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DESIGN FOR PEOPLE'S AUTONOMY. RIGHTS TO INDEPENDENT LIVING

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EDITORIAL

Design for People Autonomy

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In the last years the debate related to people autonomy has been investigated in different fields of research and experimentation, starting from the relationship between personal autonomy and well-being, the ability to make decisions freely, the affirmation of one's right of choice, (the right to political participation, access to justice or the right to have a family) for the self-determination development (i.e. legal capacity), but at the same time "autonomy" can be interpreted as a complex result of human relationships, strengthening interaction and opportunity. This is valid for everyone, regardless of their health condition or functional limitations; in fact, no human being can be considered completely "autonomous" since everyone acts in a condition of interdependence with others to varying degrees.[1] This last aspect is particularly significant for people with disabilities, because it affects their active involvement in the life of the

1 Ruth Northway, "Ethical Issues," in *Learning Disabilities-E-Book: Towards Inclusion*, ed. Helen Atherton and Debbie Crickmore (Churchill Livingstone: Elsevier Health Sciences, 2011), 75–88.

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community in which they live, and their ability to lead an independent life. The concept of independent living was introduced in the Article 19 of the Convention on the Rights of Persons with Disabilities (CRPD) and it is therefore closely connected to the citizen's rights of disabled persons.[2,3] The World Bank (WB) and the World Health Organization (WHO) estimate that a billion disabled people in the world face some barriers in the inclusion in many vital sectors, such as mobility, job, education, or simply in being socially or politically involved during their everyday life. However, the right to actively participate in the public life and reduce disparities are core elements of a stable democracy. Accessibility is intended as empowerment, meaning the individual and collective awareness of the right to access goods or services within one's own community.

Some important milestones have been reached: in the 2006 with the United Nations *Convention on the Rights of Persons with Disabilities*, the adoption of *The European Disability strategy 2010-2020*; the 2011 biopsychosocial model of disability principles by WHO & WB; the adoption in 2019 of the Agenda 2030 by European Union in which "people with disabilities" are specifically mentioned 11 times, especially in the parts related to education, growth and employment, inequality, accessibility of human settlements, as well as data collection and monitoring of SDGs.[4] This progressive process towards the recognition of the rights of people with disabilities helps a paradigm shift necessary to ensure independent living.

Two main concepts emerged and offered new perspective of innovation and development of strategies and measures for the Design for People Autonomy: the deconstruction of the concept of disability as a social category, considering also that the limit between ability and disability is subject to temporal and environmental variables: the increasing incidence of people with disabilities, also as a consequence of diagnostic and therapeutic progress in the medical field, the relationships between chronic diseases and disabilities, the increase in risk factors related to unexpected and sudden phenomena (e.g. climatic disasters, COVID 19) and that can affect the entire population; the need to apply instead of special policies, universal policies,[5] in all areas of society.

Accessibility, autonomy and inclusion are such cross-cutting societal issues that the biggest impact is achieved if they can be mainstreamed and implemented in programmes such as youth, gender, education,

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2 Raffaello Belli, *Vivere eguali. Disabili e compartecipazione al costo delle prestazioni* (FrancoAngeli, 2014).

3 ENIL (European Network on Independent Living), CIL (Centre for Independent Living) Sofia and Rusihak, *Independent Living Manual*, December 2015. http://www.enil.eu/wp-content/uploads/2012/06/Independent-Living-Manual- FINAL.pdf

4 United Nations and Department of Economic and Social Affairs, *Disability and Development Report: Realizing the Sustainable Development Goals by, for and with Persons with Disabilities: 2018*, 2019.

5 Irving Kenneth Zola, "Toward the Necessary Universalizing of a Disability Policy," *The Milbank Quarterly* 83, no. 4 (2005). https://doi.org/10.1111/j.1468-0009.2005.00436.x

employment, education and public and private service, thus safeguarding the "no one is left behind" principle.

Re-reading the principle: "Disability is part of the human condition because almost everyone, at some point in their lives will experience temporary or permanent disabilities"[6] in the light of the COVID 19 Pandemic experiences and the post-pandemic perspectives, highlights how overcoming cognitive, communication and physical isolation barriers is a necessity for the whole population. The opportunity to intercept needs related to large segments of the population then becomes a boost to the definition of responsible measures to counter the effects of the epidemic on a social and economic scale. For example, work-from-home policies to ensure that all workers (with disabilities and not) have appropriate adjustments at home; the need to provide the non-expert public with tools for their reading and interpretation of information and data, possibly free from prejudices and stereotypes; the physical distancing in public spaces that adopts new lengths to facilitate movements and flows also for people with disabilities, the digitalization of services and the use of enabling technologies to foster the fruition of health, culture, education contents remotely, etc.

An enlarged definition of "universal accessibility" implies the adoption of an integrated design approach involving the public realm of the city avoiding a use strictly linked with population groups while supporting a more inclusive mixed-use strategy.

The researches and the practices presented in this issue of CPCL describe accessibility and autonomy topics through the lens of fields of investigation and experiences in different environments, giving examples of theoretical and practical work. The contributes explores the concept of accessibility as a design tool, capable of translating individual and collective instances, needs and topics into design elements for new services, products, use of the spaces.[7] An approach that goes beyond the logic of a simple cause-and-effect sequence to take into account the complexity, leaving precise metrics to accept a development by successive approximations placing the user (the citizen) at the core of social life and public realm definition.

Some contributes narrate the progressive implementation of accessible community-based services (transport, healthcare, culture, leisure), adequate for the needs of the disabled but also for the needs of all

6 World Health Organization, *World Report on Disability* (Geneva: World Health Organization, 2011).

7 Marilys Christofi, "Trade Union Education Management Disability Movement: Accessibility and Disability," (Athens: 2013). Available at: Http://Www. Esamea. Gr/Publications/Books-Studies/496-Ekpaideytiko-Egxeiridio-No-4-Prosbasimotita-Kai-Anapiria-Tis-Marilys-Xristofi.

citizens,[8,9,10,11] removing in many cases "dedicated" structures and segregated services, for a barrier-free environment suitable for satisfying the citizen's well-being in an equitable manner and in mainstream settings.

Part of the academic papers focus on social and physical factors that influence the independent living of vulnerable people (autistic adults, elderly). In the first case, the contribution of KU Leuven research group investigates the role of the housing environment in the life setting and real experiences of people on the autism spectrum and the design of possible solutions.

The integration of enabling technologies, digital devices and automation, and the relation between the autonomy goal and the rethinking of private houses, are presented both in the paper written by the contribution of Adolfo Baratta, Antonio Magarò and Fabrizio Finucci which presents an integrated house device system low cost and open source to support elderly in their daily practices, and also in the contribution of the University of Ferrara research group. In this case the paper describes the potential of IoT application in commonly used objects, not only to facilitate their usage, but also for monitoring elderly movements, preventing domestic accidents or difficulties in use.

Enabling technologies' role in the improvement of vulnerable people's life experiences is also the object of the Information Technologies Institute in Greece research group: in this case the integration of AI powered systems especially in the identification of people and objects facilitate the use of spaces and facilities by visually impaired people.

The "Practices" area of this CPCL edition is a collection of research-actions' results in which the processes designed have the same importance of the achieved results. All these cases are designed and realized in collaboration with different vulnerable groups of people, but they have an accessibility impact on the whole target groups of museums, historic city's areas, marginalized neighborhoods, cultural facilities at urban scale. All these practices offer the opportunity to explore, with a prototyping approach, the translation of needs, requirements, individual and collective arguments, experiences, gathered in any case adopting collaborative approaches with the communities, into new services, products and new uses related to the city, to Cultural Heritage, to cultural contents, etc.

For example, the experiences in Bologna and Barcelona represent the opportunity to extend the "right to the city" and to its contents to all citizens,

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8 Adolf Ratzka, "Independent Living for People with Disabilities: From Patient to Citizen and Customer," *GLADNET Collection*, 2007.

9 Antonio Lauria, *I piani per l'accessibilità. Una sfida per promuovere l'autonomia dei cittadini e valorizzare i luoghi dell'abitare*. (Roma: Gangemi, 2012).

10 ENIL (European Network on Independent Living), *Myth buster. Independent living*, December 2015.

11 ENIL (European Network on Independent Living), CIL (Centre for Independent Living) Sofia and Rusihak, *Independent Living Manual*, December 2015.

starting from fragile people inclusive design, putting in evidence the necessity to foster culture democracy, autonomy and self-determination.

In the case of Bologna, the practice described by Foundation of Urban Innovation group focuses on the development path started as pilot collaborative labs and service prototyping that led to the candidacy of Bologna to the Access City Award 2020. While in the case of Barcelona the accessibility design promoted by in a marginalized neighborhood is the occasion to remove physical and social barriers among the local communities.

The Architect Fornasari in his paper renders the paradigm shift from the disability of the person to the disability of the environment, highlighting how favorable contexts and responsible solutions can mitigate the social exclusion of fragile people to the fruition of museums and cultural spaces.

The necessity to consider culture intellectually, culturally and socially accessible is the core theme of Cecile Houpert and Anthony Colclough article. The specific focus is on the relevance of cultural offer for the culturally diverse groups that coexist within a city, through the adoption of multiple languages, different forms of communication and dissemination, adjusting the offer itself, enriching for instance the museum experiences for every visitor.

Furthermore, cultural accessibility and the importance to promote an accessibility training for art and culture sectors are the main topics of CRT Foundation of Turin, which narrates the building of a training program for museum operators promoted adopting peer-coaching, learning labs, born as an initiative under the European Year of Cultural Heritage of 2018 and currently applied in the whole museum system of the city. The training program supports the transition from the right to cultural enjoyment to the right of cultural production.

In all the issue the concept of accessibility as a design tool has been explored, transforming specific instances in universal services and solutions to foster a collective fruition of common goods, to reaffirm the right to an independent life by vulnerable groups of people, and to experiment new tools (technologies, digital devices) as enabling elements of life setting and self-experiences.

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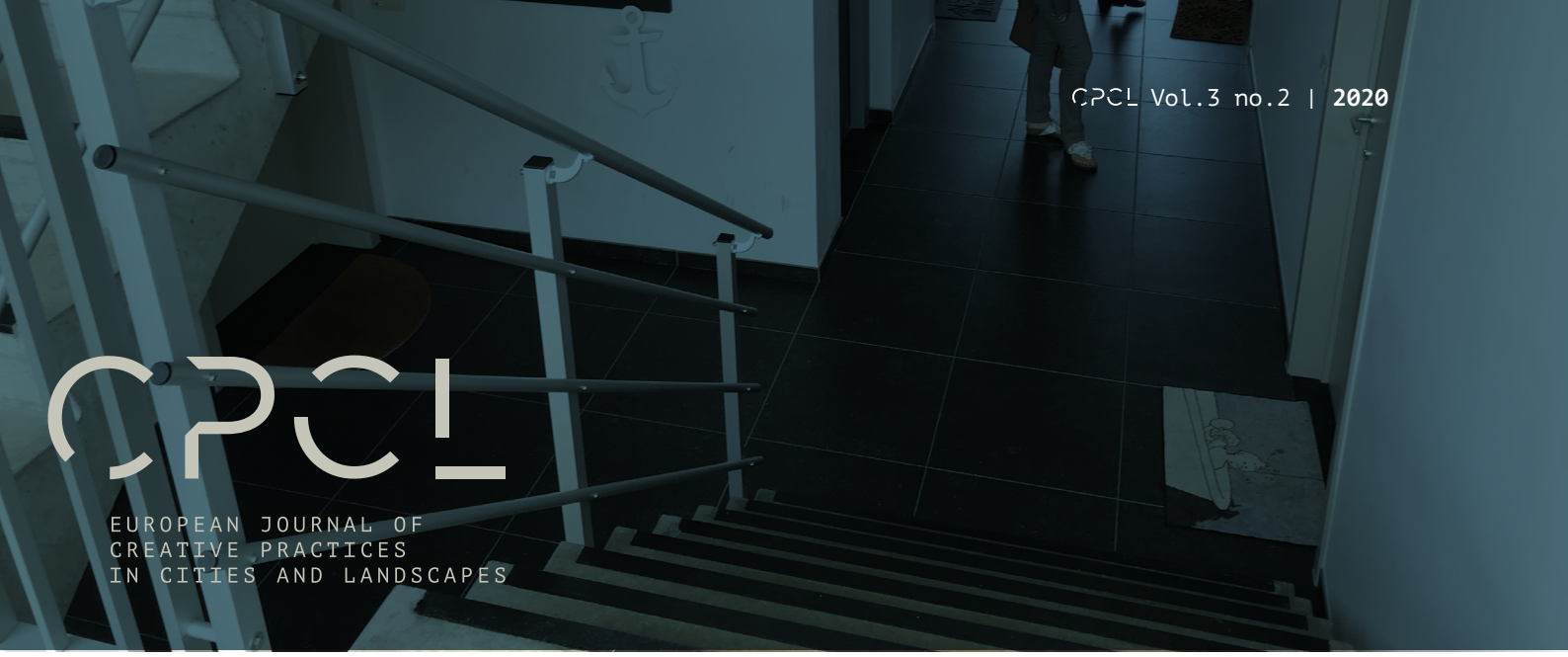

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MAIN SECTION

Understanding Independent Living with Autism: The Role of the Housing Environment in the Experiences of Two Autistic Men

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ABSTRACT

Many autistic adults continue living with their parents rather than living independently, regardless of their IQ levels. In studies about adaptive housing, their perspective is still lacking. To address this gap, our research aims to offer insight into, first, autistic adults' experiences of living independently, and second, what role the housing environment plays in these experiences. A qualitative study was conducted to investigate what living independently means to two autistic men. The findings suggest that living independently for them means (1) living in proximity of public facilities, retail stores and family, (2) self-determining their apartment arrangement, daily living activities, and (3) having nearby social contacts to cope with regular domestic stress and anxiety. Comparing their experiences suggests that social and physical factors of the housing environment are not detached, but could strengthen each other in supporting their independent living. The combination of social and physical factors facilitates living independently for these men, which resonates with the paradigm of independent living. A better understanding of autistic people's lived experiences is crucial to develop housing options which enable them to live independently.

KEYWORDS

Autism; Housing Environment; Independent Living; Lived Experience

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Introduction

"The autism spectrum" refers to a range of conditions characterized by challenges regarding social behavior, communication and language, and a narrow range of interests and activities unique to the individual and carried out repetitively.[1] Autistic people[2] share certain difficulties, but being autistic affects individuals in different ways, some need much help in daily life, others less.

Different studies report that many autistic adults live either with their family or in some form of supervised residential setting.[3] In the US, an estimated 80% of them (younger than 30, but having finished high school) remain in their family home, often being cared for by aging parents who, in most cases, will not outlive their children.[4] In the UK, a study following 68 autistic people from childhood until adulthood found that, within the "normal" IQ range, 4% of autistic adults live separate from their parents, although some of those living with their parents have a high level of independence. The majority, however, remain highly dependent on their families or require some form of residential support.[5,6] Furthermore, the rate of autistic adults living independently is lower than that of their peers. Compared to persons with other types of impairment, autistic adults are more likely to live with their parents and less likely to live independently after leaving high school.[7]

The observation that most autistic adults, regardless of their IQ level, are behind their peers regarding independent living raises questions as to what living independently means to them and the role of their housing environment therein.

Autistic adults and independent living

Autistic people face considerable challenges throughout adulthood.[8]

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1 World Health Organization, "Autism Spectrum Disorders," Fact sheets, April 2, 2018, https://www.who.int/news-room/fact-sheets/detail/autism-spectrum-disorders.

2 The term "autistic people" tends to be preferred by autistic adults, whereas professionals rather prefer "person with autism". Lorcan Kenny et al., "Which Terms Should Be Used to Describe Autism? Perspectives from the UK Autism Community," *Autism* 20, no. 4 (May 2016): 442–62, https://doi.org/10.1177/1362361315588200.

3 Kim Steele and Sherry Ahrentzen, *At Home with Autism: Designing Housing for the Spectrum* (Bristol: Policy Press, 2016).

4 Sherry Ahrentzen and Kimberly Steele, "Advancing Full Spectrum Housing: Design for Adults with Autism Spectrum Disorders," *ASU Stardust Center* (Arizona: ASU Stardust Center, 2009), https://sustainability.asu.edu/stardust/project-archive/advancing-full-spectrum-housing/.

5 Patricia Howlin et al., "Adult Outcome for Children with Autism," *Journal of Child Psychology and Psychiatry* 45, no. 2 (2004): 212–29, https://doi.org/10.1111/j.1469-7610.2004.00215.x.

6 Kristy A. Anderson et al., "Prevalence and Correlates of Postsecondary Residential Status among Young Adults with an Autism Spectrum Disorder:," *Autism*, August 30, 2013, https://doi.org/10.1177/1362361313481860.

7 Ibid.

8 Patricia Howlin and Iliana Magiati, "Autism Spectrum Disorder: Outcomes in Adulthood," *Current Opinion in Psychiatry* 30, no. 2 (March 2017): 69–76, https://doi.org/10.1097/YCO.0000000000000308.

Many of them, including those with a "normal" IQ, are significantly deprived regarding social relationships, physical and mental health, and are at risk of isolation.[9] As a result, the majority remains dependent on parents or caregivers for support in daily life when grown up.[10,11,12]

Autistic people's well-being seems to relate not to the characteristics of autism itself, but to their supportive services. A self-report study on satisfaction, competency, independence and community integration in 58 high-functioning autistic adults in Belgium, found these factors to relate to the characteristics of supportive services.[13]

Within this support, social factors play an important role: autistic adults' well-being correlates significantly with social functioning, among other elements like age, intellectual levels, or autism severity.[14] Based on a meta regression analysis of 17 studies which involved 1721 autistic adults, Kim et al. (2019) conclude that improvements in social functioning may enhance their well-being. However, autistic people have difficulty in social interaction – not only with non-autistic people, but also within autistic communities.[15] Common complaints about non-autistic people are that they seem pushy and demanding, and waste conversational energy on meaningless small talk.[16]

Living separately from their parents shows numerous benefits for autistic adults, according to their mothers' assessment,[17] while living with their parents may negatively affect skills development.[18] Moreover, autistic people who live separately from their parents, have an impressive amount of continued contact with their families.[19] Researchers suggest

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9 Patricia Howlin and Philippa Moss, "Adults with Autism Spectrum Disorders," *Canadian Journal of Psychiatry* 57, no. 5 (05 2012): 275–83.

10 Howlin et al., "Adult Outcome for Children with Autism."

11 Eva Billstedt, I. Carina Gillberg, and Christopher Gillberg, "Aspects of Quality of Life in Adults Diagnosed with Autism in Childhood: A Population-Based Study," *Autism* 15, no. 1 (January 2011): 7–20, https://doi.org/10.1177/1362361309346066.

12 Patricia Howlin et al., "Cognitive and Language Skills in Adults with Autism: A 40-Year Follow-Up," *Journal of Child Psychology and Psychiatry* 55, no. 1 (January 2014): 49–58, https://doi.org/10.1111/jcpp.12115.

13 J. O. Renty and Herbert Roeyers, "Quality of Life in High-Functioning Adults with Autism Spectrum Disorder: The Predictive Value of Disability and Support Characteristics," *Autism* 10, no. 5 (September 1, 2006): 511–24, https://doi.org/10.1177/1362361306066604.

14 So Yoon Kim and Kristen Bottema-Beutel, "A Meta Regression Analysis of Quality of Life Correlates in Adults with ASD," *Research in Autism Spectrum Disorders*, Growing older with autism, 63 (July 1, 2019): 23–33, https://doi.org/10.1016/j.rasd.2018.11.004.

15 Jim Sinclair, "Being Autistic Together," *Disability Studies Quarterly* 30, no. 1 (February 22, 2010), https://doi.org/10.18061/dsq.v30i1.1075.

16 Ibid.

17 M. W. Krauss, M. M. Seltzer, and H. T. Jacobson, "Adults with Autism Living at Home or in Non-Family Settings: Positive and Negative Aspects of Residential Status," *Journal of Intellectual Disability Research* 49, no. 2 (February 2005): 111–24, https://doi.org/10.1111/j.1365-2788.2004.00599.x.

18 Karola Dillenburger and Lynne McKerr, "Echoes of the Future: Adults with Disabilities Living at Home with Their Parents," *Journal of Neurology and Clinical Neuroscience* 1, no. 2 (2014): 10.

19 Krauss, Seltzer, and Jacobson, "Adults with Autism Living at Home or in Non-Family Settings."

the need to identify the individual, family or environmental factors that enhance autistic adults' well-being[20] and therefore facilitate independent living for them.

In disability studies, the independent living paradigm situates problems of impairment not primarily in the individual, but in the supportive structures offering solutions.[21,22] To our knowledge, however, this paradigm has hardly been recognized yet in autism research. Supportive programs to facilitate autistic people's inclusion are frequently lacking, and little research exists into ways of developing more effective programs for their independent living.[23] Some psychiatrists and researchers do not even understand the role of the environment in causing disability.[24]

Housing environment and user experiences

Autism research from the perspective of autistic adults is still limited.[25,26] Moreover, most recent studies adopt medical models of autism, primarily relying on parental, sibling or healthcare provider reports.[27] Such third-person accounts provide limited insight into what autism means and how it feels to autistic people.[28] Their voice is lacking.[29] Without opportunities to discuss their experiences, autism research risks missing important aspects of their self-concept.[30]

In summary, autistic adults' well-being is at risk, but is shown to correlate with support, in which social factors play an important role. Other factors, such as physical factors, have received limited attention. Our study therefore aims to offer insight into independent living from autistic adults' perspective: (1) what does living independently mean for them? (2) And what is the role of the housing environment therein?

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20 Howlin and Magiati, "Autism Spectrum Disorder."

21 Gerben Dejong, "Independent Living: From Social Movement to Analytic Paradigm," *Archives of Physical Medicine and Rehabilitation* 60 (1979): 435–46.

22 Ingolf Osterwitz, "The Concept of Independent Living - a New Perspective in Rehabilitation" (HELIOS European workshop, Venice, 1994), www.independentliving.org/docs5/Osterwitz.html.

23 Howlin and Moss, "Adults with Autism Spectrum Disorders."

24 Sven Bölte, "Hey Autism Researcher, What's on Your Mind Today about Inclusion?," *Autism* 23, no. 7 (October 1, 2019): 1611–13, https://doi.org/10.1177/1362361319870994.

25 Michelle Teti et al., "Reframing Autism: Young Adults With Autism Share Their Strengths Through Photo-Stories," *Journal of Pediatric Nursing* 31, no. 6 (November 2016): 619–29, https://doi.org/10.1016/j.pedn.2016.07.002.

26 Marijke Kinnaer, Stijn Baumers, and Ann Heylighen, "Autism-Friendly Architecture from the Outside in and the inside out: An Explorative Study Based on Autobiographies of Autistic People," *Journal of Housing and the Built Environment* 31, no. 2 (June 2016): 179–95, https://doi.org/10.1007/s10901-015-9451-8.

27 So Yoon Kim, "The Experiences of Adults with Autism Spectrum Disorder: Self-Determination and Quality of Life," *Research in Autism Spectrum Disorders* 60 (April 1, 2019): 1–15, https://doi.org/10.1016/j.rasd.2018.12.002.

28 Ibid.

29 Bölte, "Hey Autism Researcher, What's on Your Mind Today about Inclusion?"

30 Teti et al., "Reframing Autism."

Methods and materials

We report on two case studies with two autistic men who live independently in two different housing projects in Belgium that adopt an inclusive residential model. In this model residents with an impairment are part of a community, have a fully-equipped apartment in a neighborhood or in a house on the street. The housing projects do not provide common living spaces and no professional caregivers are living in the building. Instead, volunteers/"good neighbors" who live in the same building are the contact persons in case residents need urgent support. The "good neighbors" are residents who have contracts with a coaching center that supports residents, and in return pay a lower rent. Both housing projects are rented by social housing agencies, and residents receive personalized support from the coaching center according to their requirements; e.g., meeting monthly with their psychologist(s) and coach(es), learning how to cook, or doing weekly outdoor activities with their coach(es).

These cases were chosen because they fit with our aim to study independent living from autistic adults' perspective. We contacted the coordinator of the housing projects through the information given in a publication about the projects. The coordinator found two autistic men, living in two different settings willing to share their lived experience of living independently. Steve,[31] 32 years old, has been living independently for three years after moving out of his parents' house. Leo, 28 years old, has been living independently for more than one year after moving out of his mother's house.

The first author – henceforth the researcher – conducted a group interview with the coordinator, a coach and Steve for 1,5 hours. Semi-structured interviews were then conducted individually with each resident in their apartment for two hours. During the interviews, Steve and Leo were asked to draw their apartments and neighborhoods. After that, a walk-along-interview with each resident was conducted during a 2-hour outside promenade in the neighborhood and to the city center. Participants decided the trajectory of the walk according to their needs and daily routines. Steve wanted to activate his new bank card, then find a new book, and finally buy some food. Leo wanted to visit the park in the city center, as usually in the afternoon, yet decided to extend the walk. Along the way, he introduced the researcher to the city's landmarks (library, cinema, casino, sport centers, shopping centers, square, beach, parks, well-known houses), his regular route to the coaching center, his secondary school, and his regular barber shop. Both Steve and Leo asked the researcher to accompany them as a friend rather than as a researcher, which meant they had spontaneous conversations along the way, and did things together like buying food and

31 To omit details that might allow participants' identification, their names and those of their settings were pseudonymized. However, the illustrations may allow people familiar with the setting to recognize it.

looking at books in the book store. Sometime during the walk, Leo was playing Pokémon on his mobile phone while the researcher walked next to him. As he explained, he always keeps himself busy by playing Pokémon while going for a walk. Immediately after the walk, the researcher made thick descriptive field notes, including her impressions about the participants' feelings and actions and their meanings.[32]

Data collected included drawings made by the residents, photos taken by the researcher, interview transcriptions, field notes, architectural drawings of two projects provided by the coordinator, and project descriptions from the internet. Analysis was conducted by roughly following the QUAGOL guide:[33] reading and rereading transcripts and field notes, identifying themes, coding, and analyzing coded citations.

Insight into living independently

Based on our analysis, the meaning of living independently for Steve and Leo can be apprehended by considering three themes: proximity, self-determination, and social contacts [Fig.1]. In their living practices, living independently does not mean living by themselves. Steve and Leo need support from their physical and social environments, which facilitates their daily activities and helps them to cope with challenges in their daily life. Both experience beneficial effects from their housing location. Also, both determined (many aspects of) their living activities. Both identified the need for social contacts, yet how they experience contact with their neighbors differs.

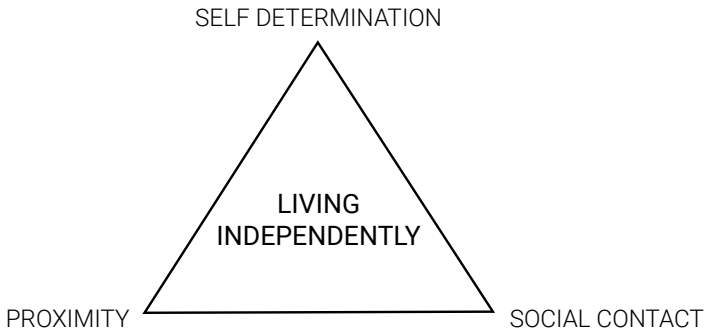

FIG. 1 Components of living independently for two autistic men

32 Claire Howell Major and Maggi Savin-Baden, *Qualitative Research: The Essential Guide to Theory and Practice* (London: Routledge, 2013).

33 Bernadette Dierckx de Casterlé et al., "QUAGOL: A Guide for Qualitative Data Analysis," *International Journal of Nursing Studies* 49, no. 3 (March 2012): 360–71, https://doi.org/10.1016/j.ijnurstu.2011.09.012.

Proximity

The housing location's proximity to public facilities and their parents' house plays an important role in the lives of both men. Their apartments are located in residential areas, close to their parents' house, the coaching center, public facilities and retail stores, e.g. a bus stop **[Fig. 2]**, a hospital, a bank, parks, supermarkets, book stores, a barber shop, restaurants **[Fig. 3]**. They remarked:

> I think living in the city where you're close to everything, I don't have a car, I have to do everything with public transport. But I like to be [here], as [it's] quiet, eh, you can get, come to rest in the evening, there's no voice from the street. In the evening you can really come to rest, that's [what] I like … It's more living alone nearby my parents (interview Steve).

> There's a lot of shops like, on the other side of the road … if you need to go to a supermarket for anything, you get everything a pretty close … You get actually everything you need here, like the drug stores if you need medicines or anything (interview Leo).

Since Steve uses public transport, the housing location is important for him. He remarked that he would prefer his apartment near the railway station. Within 10 minutes, he walks to the bus stop to go to work twice per week **[Fig. 2]**. Doing a small amount of shopping is easier

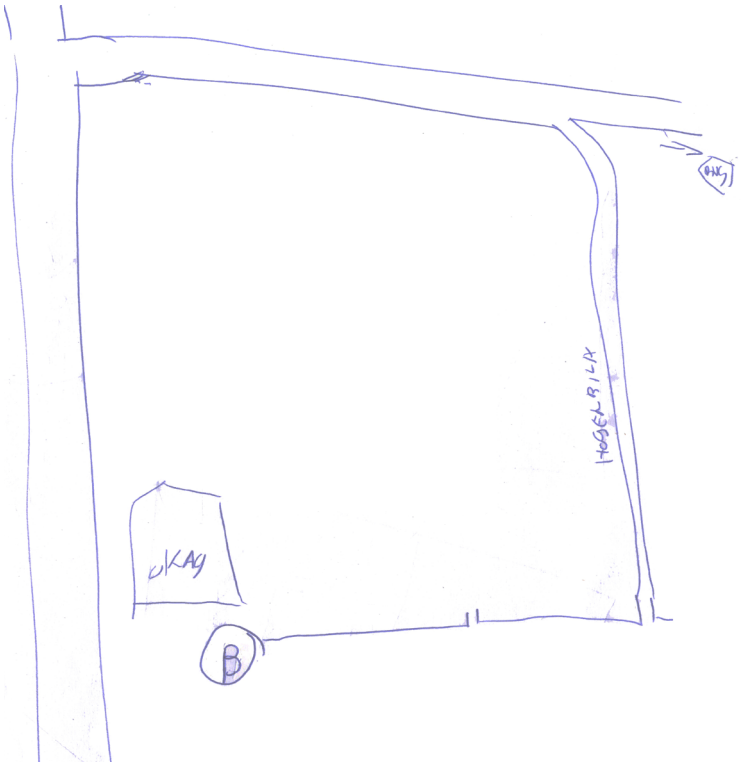

FIG. 2 Steve's drawing highlights a big supermarket next-door and a bus stop nearby

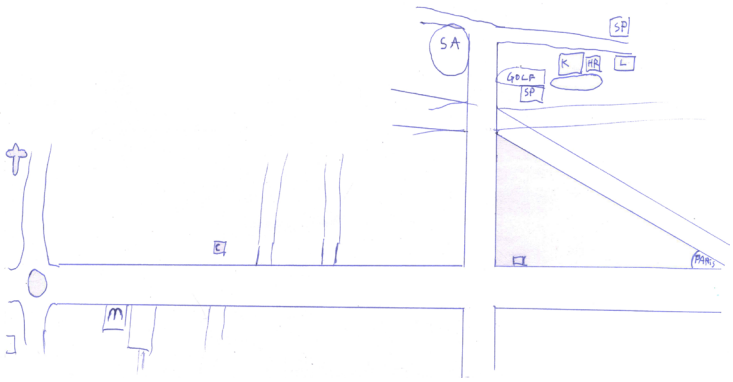

FIG. 3 Leo's drawing highlights public facilities near his apartment: different kinds of stores, supermarkets, park, and library

for Steve than buying many things at the same time. Living next to the supermarket [Fig. 2], he goes there every two days, sometimes every day.

Both Steve and Leo have intensive contacts with their parents even though they live independently. Steve's father visits him weekly, sometimes daily, and drives him to the railway station each time he needs to go to the airport. He lives at 20-minute driving distance to Steve's apartment. Leo uses a car. It takes him 15 minutes to drive to his mother's house for dinner every Monday and Thursday. His mother does his laundry weekly, cooks for him twice per week and cleans the windows in his apartment regularly.

Self-determination

Self-determination was identified as a significant theme in the lived experiences of these two men: it was one of the reasons for Steve and Leo to move out of their parents' house. Steve remarked "Living alone is doing what you want. It's your style. That's very important for me" and Leo mentioned "I want to live alone, to have my own space, and like independence myself". Living alone enables them to make decisions in several aspects of their lives: following their passions, having a sense of purpose, and having control over their daily activities.

Steve and Leo were very self-determined in what they wanted to do. They tried to have a paid job before. They are now both doing volunteer jobs which are directly related to their passions. Steve's passion relates to computers and travelling. His activities and trips are well-planned in a schedule on his computer, which he sticks to. Steve is developing an application for autistic people and designed a website for the coaching center. Leo is passionate about Star Wars and fictional heroes. He volunteers as a cosplayer in events and for children (at birthday parties or in hospitals). His volunteer work is more random as his cosplays depend on people's requests.

Both Steve and Leo were asked where they wanted to live in the building. Steve chose to live in a two-bedroom apartment [Fig. 4] on the first floor

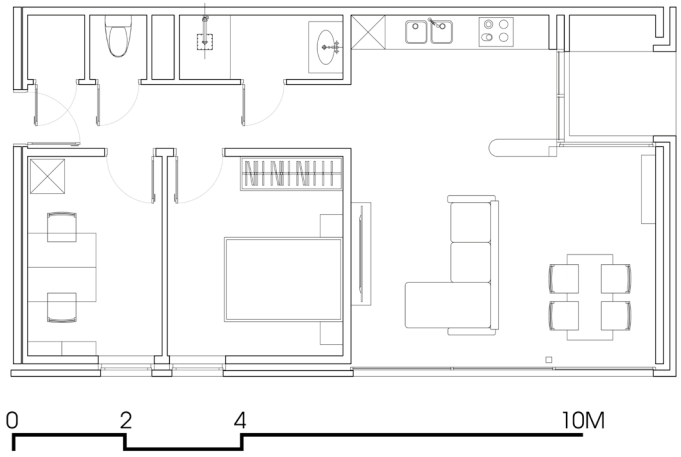

FIG. 4 Steve chose a two-bedroom apartment to have an extra room for his home-office

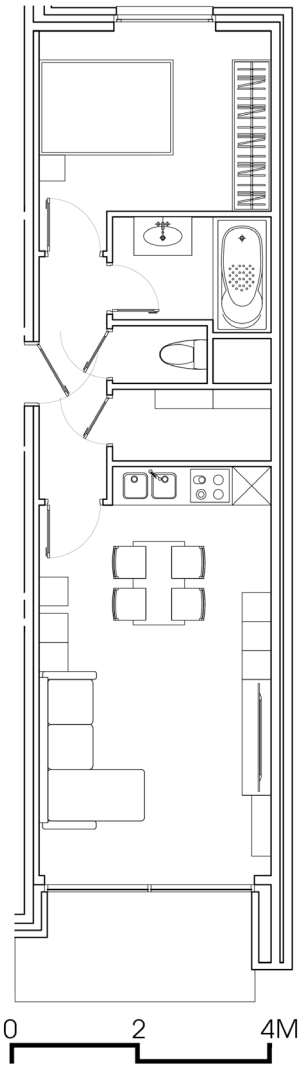

FIG. 5 Leo chose a one-bedroom apartment on the fifth floor so he could see his car on the back deck from the window of the bedroom

FIG. 6 Flashy colors for toilet and bathroom in Steve's apartment.

FIG. 7 Large desk with three screens and dark red color for home-office in Steve's apartment.

FIG. 8 Marvel and Star Wars collections and a home cinema in Leo's apartment

because he absolutely needed to have an extra room for his home-office. Leo chose to live in a one-bedroom apartment **[Fig. 5]** on the fifth floor because from his bedroom window he could see his car parked on the building's back deck.

> I think, if there is a place that you like it, but you can't make decision … because I was thinking, where my parents live, I don't want to go back, because of the home … For me, it is also important that I could chose the furniture myself. That's all my style, mine. I like modern style. Like I knew what I want (interview Steve).

Making decisions was very important for both Steve and Leo in adapting the apartment to their needs and expressing their passions, decorating it the way that they wanted, contributing to their sense of self. Steve wanted to paint his apartment in multiple colors **[Figs. 6-7]**.

> I like mixture of flashy colors, it's my personal style, mixture of shiny colors. The toilet and the bathroom as flashy as me, my desk is in *bordeaux*, dark red. And my living room is in blue. Blue. My sleeping room, my bedroom is in blue. I like that. Some people say it's ugly. But I like the flashy, the idea of flashy. I like it. It's funny, It's flashy, it's optimistic of flashy color. The vision of my flashy (laughing) like me (interview Steve).

Having spaces for their passions in their apartment was essential. Leo needed place for glass boxes containing his Marvel and Star War collections **[Fig. 8]**: "I started to live here and designing all the stuff, like, I love Marvel, like Spider Man and Star Wars, because it's like the power of me". Steve needs a large desk with three screens in his home-office **[Fig. 7]**, which is why he wanted an extra room. Having space for a "home cinema"

[Fig. 8] was important for Leo. That his apartment is small has the advantage that he finds it easy to clean.

Social contacts and different experiences

In Steve and Leo's lived experience, social contacts were identified as important to cope with many challenges throughout their living practices. In their daily life, they identified regular sources of stress. For example, Leo mentioned regular domestic stress like a light in the building's communal space that remained defective for a long time, calculating payments for electricity and water consumption, unwanted conversations with the next-door neighbor or noise from the upper neighbor in the evening, the disappearance of his neighbor's bike accessories in the bike storage, and his neighbors putting waste in the wrong place. Since some of the regular sources of stress could not be handled by Steve and Leo, they needed help through their social contacts.

> Independence, but not that independence that they don't need anything. They need a little bit support, like, it's social, they need also neighbors, for example … The concept of good neighbors is for us, eh, so, for a job, you could call it a job, small things are practical things like electricity issue, the heating whenever it went wrong, something like that. But the more important thing is the social thing, having talk with everyone here: How's about your feeling? How's about your day? How's your work? That's the most important thing that they do here (interview coach - Sarah)

The role of good neighbors is to facilitate small talk with residents with special needs and help them in case of emergency. One of Steve's good neighbors helped him when his electricity was shut off last year. They meet and talk sometimes. Leo knows he can count on his good neighbors in case of emergency, although he has not asked for help yet.

Both Steve and Leo meet the psychologist once per month, mostly related to anxiety and stress issues. Apart from that, their coaches help them as go-between with the social housing agencies and energy suppliers for electricity bills, broken lights, and other technical or garbage-related issues. The coaches also facilitate meetings between residents, especially when they moved in. Both Leo and Steve referred to friends who share the same interests. For Leo, it is hard to meet his friend because he lives far away: a 1,5-hour drive without traffic. For Steve, it is rather easy and his friend sleeps over sometimes.

Not all social contacts are appreciated, however. Social contacts they want to avoid seemed to relate to the concept of self-determination. For example, Steve does not always appreciate contact with a neighbor who used to come to him in the evening and asked questions he could not understand. This led him to make a "do not disturb" sign for his door. Leo

stated his interest in having social contacts with his neighbors, however at the same time his interest is very specific.

Room for social interactions

Steve and Leo have different experiences in social contacts with their neighbors. Differences seem to relate to the buildings' physical characteristics, the number of neighbors on the same floor, and where the good neighbors live. While Steve appreciates small talk with his good neighbors, Leo communicates with his good neighbor by sending messages without meeting. Steve is satisfied that he lives among nine other residents, while Leo feels isolated from the other 13 residents living in the same block in his building.

> A good neighbor also *motivates* each other. It's not about therapy, it's about the first step to help me to feel better. It's motivating "Tomorrow everything will be okay, tomorrow you have to go to Peace of Mind and everything will be *okay*" [laughing] okay (interview Steve).

Steve lives in a small three-floor residential building accommodating ten residents **[Fig. 9]**. The shared outdoor space **[Fig. 10]** and the large welcoming entrance, and the 1.8 m wide, light-filled and spacious staircase **[Fig. 12]** offer residents opportunities for encounter. During the walk-along-interview Steve met one of his neighbors on a pathway (a shared space) outside the building. Two good neighbors live on the upper floor, which allows for spontaneous encounters with Steve. Steve has three other neighbors on the same floor **[Fig. 11]**.

The building where Leo lives offers residents few opportunities for encounter. It is a middle-sized residential building with 52 residents divided over four blocks **[Fig. 13]**. Leo lives in a block of seven floors with 13 residents. He is the only resident in his block who has a car and parks it on the back deck of the building **[Fig. 14]**. Leo has only one neighbor on the same floor **[Fig. 15]**. He remarked that his neighbor tended to talk with him about suicide, a topic Leo wanted to avoid. This is the reason why Leo did not want to talk to this neighbor. There are two good neighbors living in this building but different blocks. In the block where Leo lives, one good neighbor lives on the ground floor. The entrance of the building is relatively dark and narrow, 1.2 m wide **[Fig. 16]**. Leo does not use the shared bike storage because of his feeling of insecurity there. He commented on his lack of social contact with neighbors in the building:

> Well, only [when] I have a building meeting … That's the only chance where we meet each other or on the street when we walk to the surrounded. So, we're actually pretty isolated from each other. I know my neighbors, the one below me, his girlfriend lives

FIG. 9 There are ten residents living in the building where Steve lives. He lives on the first floor. Two good neighbors live on the second (top) floor.

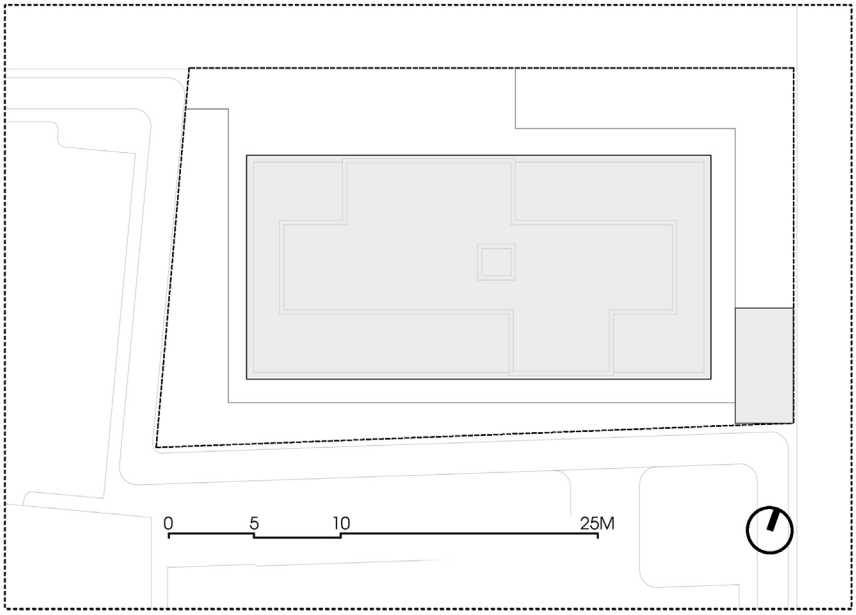

FIG. 10 The building where Steve lives, is located in the center of the site/plot. The residents share outdoor lawn, pathway around the building and bike storage.

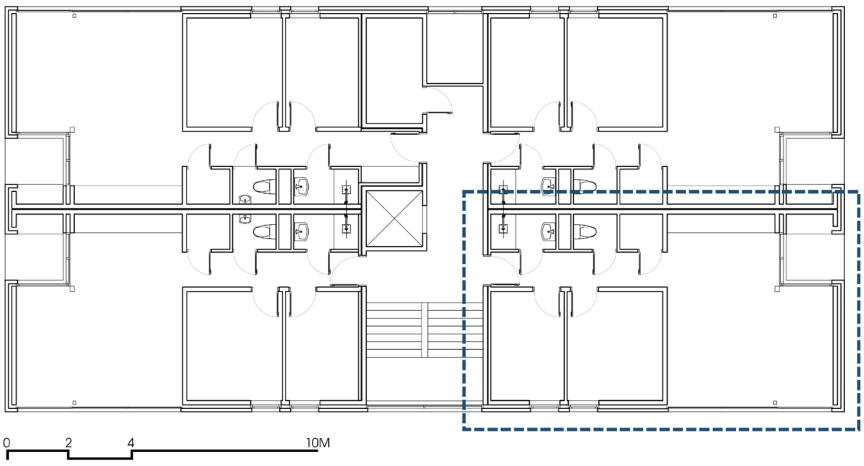

FIG. 11 The layout of the first floor, where Steve has three neighbors. Residents use the staircase.

in just below him, and below his girlfriend is actually his brother. So, it's pretty handy for him. And on the other side, there are also two friends living above each other. So, it's handy for them. I know like my below neighbor, he's gonna meet his brother everyday like for breakfast or stuff. And with his girlfriend they are

FIG. 12 The entrance of the building, where Steve lives, is filled with natural light.

> doing a lot of stuff together and with his brother. *But I don't see much people* (interview Leo).

Leo feels isolated and seeks informal "interaction" with the pizza seller on the street instead. Waving or smiling to him and/or asking "how are you today?" became a part of his walking routine. He appreciates the small talk with people on the street.:

> One of the first times I passed here, they said like "Hi, how are you?". I was like "okay he is talking to me, so I have to talk back". Because it's like a [commitment] to join. Actually, it's pretty nice, most of people just say "Hi", and ask how you are is a good thing. Not everyone did it but- if one person did it, it, likes, makes your day easier (interview Leo).

FIG. 13 The building where Leo lives is a high-rise building on the street. The building is split into four blocks. The block, where Leo lives, accommodates 14 residents, among them one out of two good neighbors lives on the ground floor.

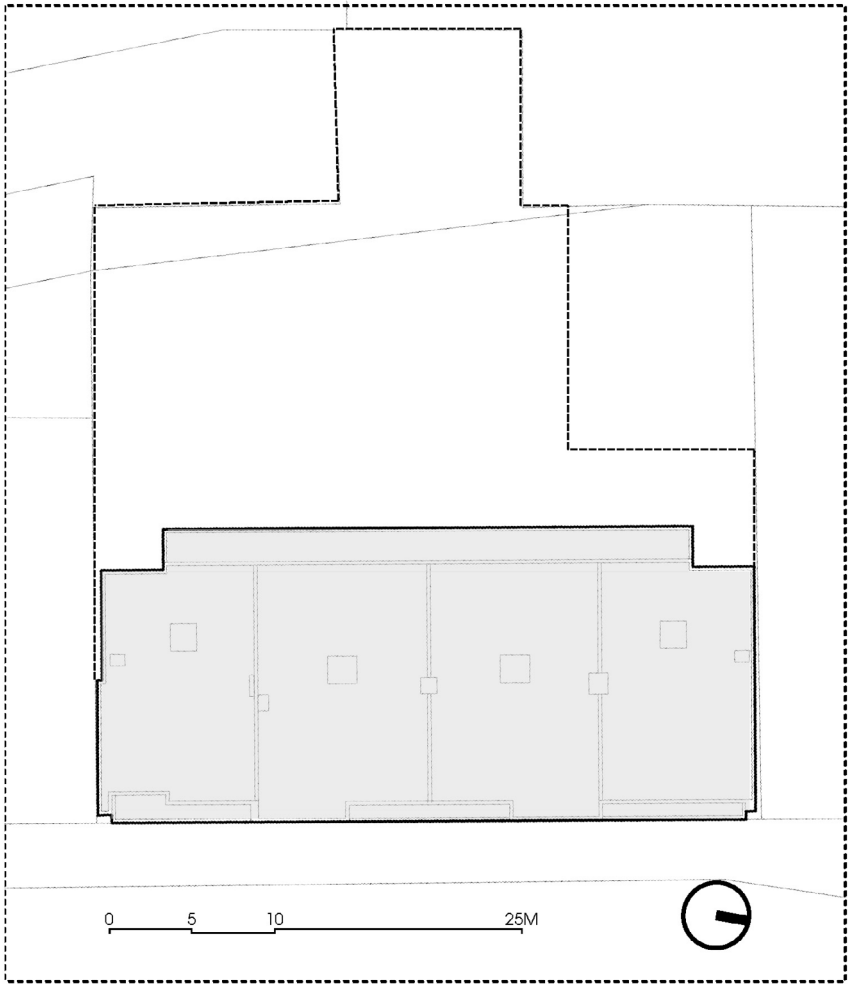

FIG. 14 The building where Leo lives, is located on the street. The residents have their parking lots at the back of the building

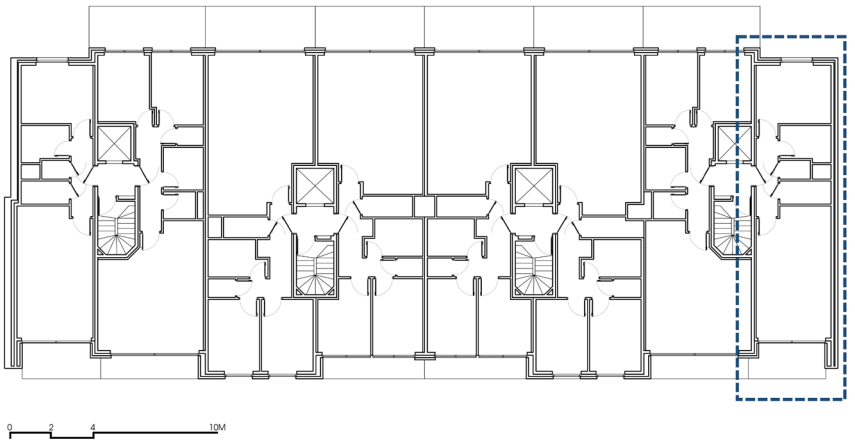

FIG. 15 The layout of the building, split into four blocks. The fifth floor where Leo has one neighbor. Leo uses the elevator only.

FIG. 16 The entrance of the building, where Leo lives, is narrow and relatively dark.

Discussion

Living independently for these two men means

1. living in proximity of public facilities, retail stores, and family;
2. self-determining their apartment arrangement and daily activities; and
3. having nearby social contacts to cope with regular domestic stress and anxiety.

Through the paradigm of independent living, their lived experiences are better understood: these two men would not live independently without their supportive housing environments, which involve social and physical factors.

Firstly, social factors support them in dealing with regular domestic stress issues. The nearby social contacts are important in supporting them practically and emotionally, providing a secure feeling of knowing a nearby and available person, good neighbors in this case, to count on in case of

emergency. Both Steve and Leo also rely on their parents, who live nearby, for weekly activities. This aligns with Krauss et al.'s (2005) finding that even when living independently, autistic adults may have an impressive amount of continued contact with their families.[34] Both men rely on support from their coach for domestic issues, technical problems, and housing maintenance. They also need monthly psychological counseling. Their living in proximity of social contacts is one physical factor which allows them to obtain support.

The finding regarding the role of social factors in the housing environment confirms previous research. As Venter et al. (1992) suggested, the availability of a supportive social network or local support may significantly affect the well-being of autistic people.[35] Access to specialist and appropriate support to develop social relationships,[36] and minimize psychological distress,[37] provides them with more opportunities to live independently.

Among the social factors, small talk was identified by both Steve and Leo as being important. This contrasts with Sinclair's (2010) finding that small talk is meaningless. In our study, small talk with the good neighbors emotionally encourages Steve when he is stressed and small talk with the pizza sellers makes Leo feel less isolated.

Secondly, for these two men, the physical factors identified are not only directly contributing to the success of living independently, but also indirectly facilitating access to social contact. Their housing location's proximity to their parents' houses, the coaches and the psychologist play an indirect role in facilitating access to social contacts. Its proximity to daily living facilities like public facilities, retail stores, and work-related and leisure activities makes living independently possible.

The housing type could facilitate residents' access to social contacts. Leo might be at risk of being lonely because he lives in a building on a street with little room for social interaction between residents. He has only one neighbor who lives next door, but wants to avoid him. Leo rarely meets his friend who lives far away, whereas Steve's friend comes over sometimes and stays with him. The housing type where Steve lives differs from the housing type where Leo lives. In Steve's situation, there is room for social interaction between residents. Room for social interaction consists of shared, common spaces for example, an outside lawn and pathway around the building, an outside bike storage, and a large light-filled entrance and staircases.

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34 Krauss, Seltzer, and Jacobson, "Adults with Autism Living at Home or in Non-Family Settings."

35 A. Venter, C. Lord, and E. Schopler, "A Follow-up Study of High-Functioning Autistic Children," *Journal of Child Psychology and Psychiatry, and Allied Disciplines* 33, no. 3 (March 1992): 489–507, https://doi.org/10.1111/j.1469-7610.1992.tb00887.x.

36 Patricia Howlin and Pamela Yates, "The Potential Effectiveness of Social Skills Groups for Adults with Autism:," *Autism*, June 29, 2016, https://doi.org/10.1177/1362361399003003007.

37 Digby Tantam, "Psychological Disorder in Adolescents and Adults with Asperger Syndrome:," *Autism*, June 30, 2016, https://doi.org/10.1177/1362361300004001004.

The number of units per floor is a physical factor which could increase the spontaneous contacts between residents on the same floor. Leo lives on a floor where he has only one neighbor. Living on a floor with more people would offer options to meet other neighbors. Additionally, the good neighbors' location in the building also plays a role in increasing the spontaneous contacts between them and other residents. That Steve's good neighbors live on the top floor, may increase his spontaneous meeting with them. The housing environment's physical factors facilitate neighborly contact for Steve while they make Leo feel isolated.

Lastly, self-determining physical factors – making decisions in choosing the apartment size, and finishing their apartments in response to their needs – were essential for both. Leo found his apartment small but at the same time enabling him to manage his homecare, while Steve decided for a two-bedroom apartment to have a home-office. Both Steve and Leo have a strong sense of self-determination and want to express their personal identity and interests in finishing and decorating their home environments. Self-determining their apartment arrangement built up their personal identity and self-esteem. As we suspect that autistic adults may vary in this respect, housing design should allow different degrees of self-determination for independent living of autistic people.

The paradigm of independent living[38,39] helps to better understand how the housing environment supports these two autistic men in living independently. Neither of them would live independently without support from their nearby family, good neighbors, coaches and other social contacts. This support is affected by the location and type of housing, the apartment's position within the building, its relation to the good neighbors' apartments and the number of neighbors per floor. Our findings suggest that their independent living is enabled by the combination of social and physical factors of the housing environment.

Limitations

Firstly, the English used for communication during the interviews was not the first language of either the researcher or the participants, which can be considered posing a challenge. At the same time, this challenge in verbal communication created opportunities to slow down the conversation. Participants had time to reflect and the researcher had opportunities to observe non-verbal communication, which added to and confirmed the meaning of the spoken words. Secondly, this research studied the cases of two autistic men with a "normal" IQ, who are not representative of the diversity on the autism spectrum.

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38 Dejong, "Independent Living: From Social Movement to Analytic Paradigm."

39 Osterwitz, "The Concept of Independent Living - a New Perspective in Rehabilitation."

Conclusion

In conclusion, this research aimed firstly, to offer insight into autistic adults' experiences in and about living independently, and secondly, to understand the role of housing environments in their independent living practices. Analysis showed that these two men need supports from their housing environments to live on their own. For them, living independently means (1) living in proximity to public facilities, retail stores and family, (2) self-determining their apartment arrangements, daily activities and many aspects of their life, and (3) having social contacts assisting in living alone. We identified the importance of the supportive role of the housing environment, which includes social and physical factors. Those social and physical factors are not detached from each other, they could indeed strengthen each other to make independent living feasible for these two men. In line with the paradigm of independent living, the housing models of these two men may inform an effective long-term program for living independently with autism. A better understanding of autistic people's lived experiences is crucial to develop housing options which enable them to live independently.

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Ann Heylighen is a design researcher with a background in architectural engineering. As a professor of design studies at the KU Leuven, she co-chairs Research[x]Design, a research team at the interface of design research and social sciences/humanities. She studies design practices in architecture and related design domains, and explores how the experience of people of various abilities, ages and perspectives may expand prevailing ways of understanding and designing space. Ann teaches design theory, professional ethics, and inclusive design. She is a Fellow of the Design Research Society, Associate Editor of Design Studies, and Editorial Board Member of Codesign and of Building Research and Information.

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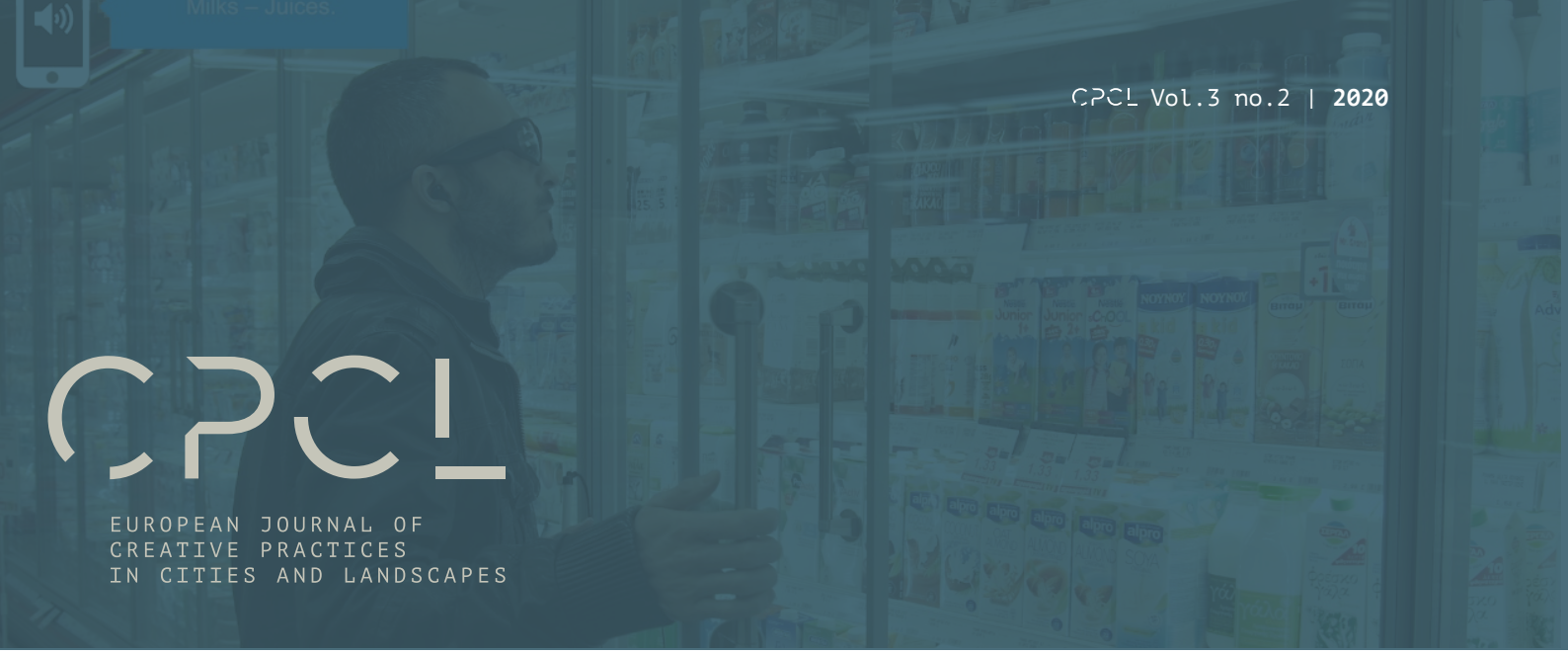

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MAIN SECTION

e-Vision: An AI-powered System for Promoting the Autonomy of Visually Impaired

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ABSTRACT
Computer vision-based assistive technology for the visually impaired is still a field of ongoing research. Its fundamental scope is to extend the frontiers of visually impaired by means of providing a greater degree of independence and autonomy in their daily living activities. Towards this direction, we present "e-Vision", a hybrid system that couples the convenience and the inherently seamless adoption of an external camera embedded within a pair of eyeglasses with the processing power of modern smartphone devices. The system consists of a pair of eyeglasses integrating a camera and a mobile application that encapsulates computer vision algorithms capable of enhancing several daily living tasks for the visually impaired. The proposed system is a context-aware solution and builds upon three important day-to-day activities: visiting a super-market, going an outdoor walk, and carrying out a work at a public administration building. Going one step further, "e-Vision" also caters for social inclusion by providing social context and enhances overall experience by adopting soundscapes that allow users to perceive selected points of interest in an immersive acoustic way.

KEYWORDS
Computer Vision; Assistive Technologies; Blind

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Introduction

Computer vision (CV) is an inextricably connected component, and one of most prominent subfields of Artificial Intelligence (AI), that describes the ability of machines to process and understand visual data. The key concept of CV is to automate the type of tasks the brain's visual processing system, supported by the visual organs (i.e. eyes), typically does. Since its infancy, CV has grown, particularly in the last decade, mainly due to increased data availability and computational power either offered by cloud technologies or by developing dedicated hardware. This has given rise to a number of assistive applications that can replace the human visual system, opting to help the visually impaired in perceiving the world in a similar way to the seeing ones.

The CV-based assistive technology for the blind and visually impaired is still an area under development. It mainly concerns the analysis of images and videos captured by a wearable camera, typically mounted on the chest or head, and provides an egocentric perspective of the world. This point of view is naturally suited to gathering visual information about day-to-day observations and interactions, which in turn can uncover the attention, behavioral structures, and goals of its wielder. The principal objectives of CV-based assistive technology evolve around providing independence and autonomy by enhancing everyday activities of visually impaired. Even though a wide variety of assistive technologies is currently available for the blind, most of them are limited to recognizing obstacles and generic objects without taking into account the context of the activities performed by the user. This context is capable of significantly shaping the functional requirements and consequently enhancing the capabilities of an assistive device.

One of the most notable efforts towards the creation of assistive technologies for the totally blind is the vOICe system[1] which offers the experience of live camera views through image-to-sound renderings and is based on the concept of sensory substitution. With a left to right scanning procedure, images are converted into sound where elevation is associated with pitch while brightness with loudness. From a theoretical neuroscience perspective, this could lead to synthetic vision with actual visual sensations, by taking advantage of the neural plasticity that governs the human brain, through training. Another notable effort concerns the Tyflos system.[2] The Tyflos system consists of camera and Global Positioning System (GPS) sensors, microphones, an audio recording device and

1 Malika Auvray, Sylvain Hanneton, and J Kevin O'Regan, "Learning to Perceive with a Visuo — Auditory Substitution System: Localisation and Object Recognition with 'The Voice,'" *Perception* 36, no. 3 (March 2007): 416–30, https://doi.org/10.1068/p5631.

2 Nikolaos Bourbakis et al., "A Multimodal Interaction Scheme between a Blind User and the Tyflos Assistive Prototype," in *2008 20th IEEE International Conference on Tools with Artificial Intelligence* (2008 20th IEEE International Conference on Tools with Artificial Intelligence (ICTAI), Dayton, OH, USA: IEEE, 2008), 487–94, https://doi.org/10.1109/ICTAI.2008.52.

a 2D vibrating vest. A portable computer is used for the purposes of text-to-speech and language processing as well as image analysis. The Tyflos system incorporates a stereoscopic vision module, which is attached to a conventional pair of eyeglasses and is capable of creating a depth map from the surrounding environment. The acquired depth map is converted to a tactile vocabulary that allows the user to perceive his surroundings through a vibratory vest.

More recently, several commercial solutions have been introduced for assisting the visually impaired by exploiting recent advances of computer-vision. These solutions can be categorized into two different types of systems. The first category concerns the smartphone-based systems with the most indicative being seeingAI,[3] Envision[4] and eye-D.[5] These applications take advantage of smartphones' built-in sensors (e.g. camera, accelerometer, etc.) and have recognizing capabilities. More specifically, they allow the user to select from generic categories for recognition, such as reading text, barcodes scanning, detecting people, etc. Then, the recognized instances are narrated to the user though speakers. Besides the smartphone-based category, the second approach concerns systems based on glasses. Prominent examples of this category are OrCam MyEye 2,[6] eSight,[7] NuEyes[8] and Eyesynth.[9] OrCam MyEye 2 is a mobile device with an integrated camera that can be attached to the users' glasses and is capable of recognizing up to 100 custom objects according to user's input (e.g. selected products, people), read text and recognize barcodes. On the other hand, eSight and NuEyes are glass-based devices that work as digital magnifiers, and therefore are only suitable for people with partial visual loss. Finally, Eyesynth is a pair of glasses accompanied by a portable microcomputer that converts the user's 3D surroundings into intuitive sounds that are communicated through cochlear audio and can be used mainly for avoiding obstacles.

In contrast with the aforementioned solutions, the proposed system, namely "e-Vision", is a hybrid approach that couples the natural and seamless adoption provided by an external camera embedded on a pair of glasses with the processing power and the penetration rate of modern smartphone devices. In addition to the system design, e-Vision's main novelty lies in the context-aware design of the application. The structure of the application is built upon specific concepts (i.e. daily-life activities) so as to take advantage of each context accordingly. Consequently, the communication of the system with the user is hassle-free, providing a

3 https://www.microsoft.com/en-us/ai/seeing-ai, accessed 28 December 2020.

4 https://www.letsenvision.com/, accessed 28 December 2020.

5 https://eye-d.in/, accessed 28 December 2020.

6 https://www.orcam.com/en/myeye2/, accessed 28 December 2020.

7 https://esighteyewear.com/, accessed 28 December 2020.

8 https://nueyes.com/, accessed 28 December 2020.

9 https://eyesynth.com/, accessed 28 December 2020.

pleasant context-aware experience. We should note that the scope of the proposed system is twofold. Apart from increasing the autonomy and independence of the visually impaired, the e-Vision system caters for their social inclusion and aims to promote their overall experience. This is achieved by means of providing social-related information (e.g. emotion analysis of people) and through thoroughly molded soundscapes that allow the user to perceive selected points of interest in a culture-oriented manner.

A survey on the needs of visually impaired people has shown that most of them concern access to information and movement.[10] This is why existing solutions mostly focus on the identification of obstacles. Navigation is indeed a vital need, but only a rudimentary one. This is supported by the fact that the most common questions that they pose to their sighted peers concern the identification and description of objects around them.[11]

The need to identify objects serves practical purposes, since, in the aforementioned survey, the majority of the visually impaired (60%) mentioned shopping as the everyday activity in which they require the most help. This is one of the key activities that e-Vision is supporting. A great part of e-Vision's -and the present study's- originality is that the system is designed to cover such needs that are not addressed by existing systems.

1. e-Vision overview

The principal objective of e-Vision is to promote the autonomy and independence of people with visual impairment. A crucial component to achieve this objective concerns the creation of a mobile application capable of enhancing their daily activities to an optimal level. In order to achieve this ultimate goal, the aforementioned mobile application passes inevitably through the employment of recent technological advancements in the fields of CV and computational intelligence. Considering not only the capabilities, but also the limitations, of the existing technological reality it becomes evident that the development of a universal application suitable to cover all the needs of visually impaired is utopic. Therefore, the development of e-Vision is based on the following assumption; the application should take into account the contextual information of an activity. Therefore, the development of e-Vision is tailored to support three major daily life activities: a) shopping in super-markets, b) going an outdoor walk and c) visiting a public administration building to carry out some bureaucratic task.

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10 D. Gold and H. Simson, "Identifying the Needs of People in Canada Who Are Blind or Visually Impaired: Preliminary Results of a Nation-Wide Study," *International Congress Series* 1282 (September 2005): 139–42, https://doi.org/10.1016/j.ics.2005.05.055.

11 Erin Brady et al., "Visual Challenges in the Everyday Lives of Blind People," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '13: CHI Conference on Human Factors in Computing Systems, Paris France: ACM, 2013), 2117–26, https://doi.org/10.1145/2470654.2481291.

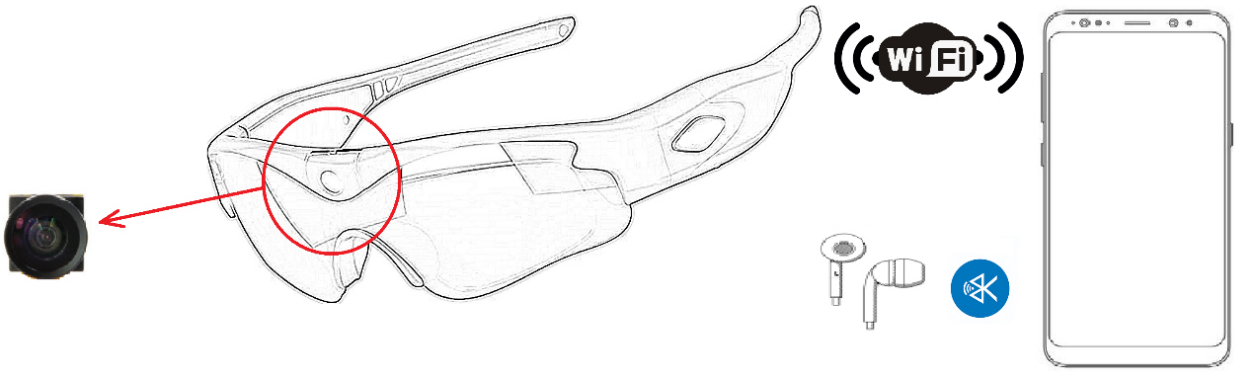

FIG. 1 The main hardware components of the e-Vision system. A pair of glasses with an integrated camera, a smartphone and a pair of earphones. The bidirectional communication between the camera and the smartphone is performed through Wi-Fi.

To achieve efficiency and effectively support the visually impaired, the e-Vision system consists of two hardware components. The first component is a pair of Wi-Fi enabled camera-glasses. More specifically, a wireless camera is integrated in a typical pair of glasses that can wirelessly transmit captured images or video in real-time through Wi-Fi protocol. The second component is a smartphone device, running either iOS or Android operating system, which hosts the e-Vision application and consequently realizes the CV components. The system's feedback is provided to the user by means of narration though the auditory pathway using conventional earphones, a crucial component capable of ensuring the essential seclusion of the feedback. The combination of the aforementioned hardware components ensures both freedom in movement and sufficient computational power in order to realize the essential computer-vision functionalities [Fig. 1].

The e-Vision mobile application[12] has been developed with respect to the SOLID object-oriented programming principles.[13] In this context, we have developed an application that is more understandable, flexible and maintainable. The modular nature of e-Vision allows third-party programmers to replace existing software modules and hardware components, with more suitable options, according to their individual needs. In this way, the e-Vision system will be able to adapt, as the computer-vision technology evolves, in a seamless manner.

1.1 Blind-friendly user interface

The design of an application for the fully and partially blind is a demanding process that remains challenging for both the users and the designers since most of the conventional mobile applications are not addressed to the visually impaired. The literature is characterized by a variety of efforts

12 The code is available at https://github.com/e-vision-project/vision-API, accessed 28 December 2020.

13 Robert C. Martin, "Design Principles and Design Patterns," *Object Mentor* 1, no. 34 (2000).

that aim to establish a common framework for designing applications that target the visually impaired. Alonso et al., introduced a set of rules that should overrule applications targeting the visually impaired and suggested a variety of prototypical user models.[14] In 2012, Sierra & De Togores revised structural tools and design elements specifically tailored to satisfy the needs of the visually impaired.[15] More recently, Olofsson studied the design process of applications for the visually impaired by conducting interviews with field experts and visually impaired people. The outcome of her research[16] indicated that the visually impaired prefer multimodal designs that combine graphical, auditory and tactile elements.

By taking into account the existing literature and in close collaboration with the "Center for Education and Rehabilitation for the Blind – CERB"[17] a preliminary research was conducted that uncovered the structural design elements and the essential principles that should be followed in order to develop a blind-friendly user interface (UI) for the e-Vision system. This research included not only questionnaires but also actual interaction with design mockups. With respect to the outcome of the aforementioned research, the developed interface abides to the following rules: a) only essential feedback should be provided to user, b) simplified design elements and patterns should be followed, c) exploitation of special gestures for providing feedback (such as the shake gesture), d) employment of light and high contrast colors, e) avoidance of auditory information overload and f) parameterization of the system's narrative feedback (e.g. text-to-speech narration speed and verbosity).

To this end, the e-Vision system employs a blind-friendly gesture control that emphasizes on simplicity and efficiency. Since e-Vision is addressed to the visually impaired, who typically use a white cane for navigation, the UI is oriented towards one-hand usage. Moreover, the UI has been tailored accordingly in an effort to enable onscreen location invariant interaction. Therefore, the employed gestures could be used without taking into account the location of the screen where gestures take place, without any loss of control precision. Finally, in order to avoid unintended interactions, the smartphone's screen is isolated during the e-Vision usage allowing control only over the introduced system's elements. We note that the assistive technologies of modern smartphone-based operating systems played a crucial role for the design process of e-Vision's UI. By employing

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14 Fernando Alonso et al., "User-Interface Modelling for Blind Users," in *Computers Helping People with Special Needs*, ed. Klaus Miesenberger et al., vol. 5105, Lecture Notes in Computer Science (Berlin, Heidelberg: Springer Berlin Heidelberg, 2008), 789–96, https://doi.org/10.1007/978-3-540-70540-6_117.

15 Javier Sánchez Sierra and Joaquín Selva Roca de Togores, "Designing Mobile Apps for Visually Impaired and Blind Users: Using Touch Screen Based Mobile Devices: IPhone/IPad," *ACHI 2012: The Fifth International Conference on Advances in Computer-Human Interactions*, 2012, 47–52.

16 Stina Olofsson, "Designing Interfaces for the Visually Impaired : Contextual Information and Analysis of User Needs" (Umeå University, 2018).

17 http://www.keat.gr/index.php/en/, accessed 28 December 2020.

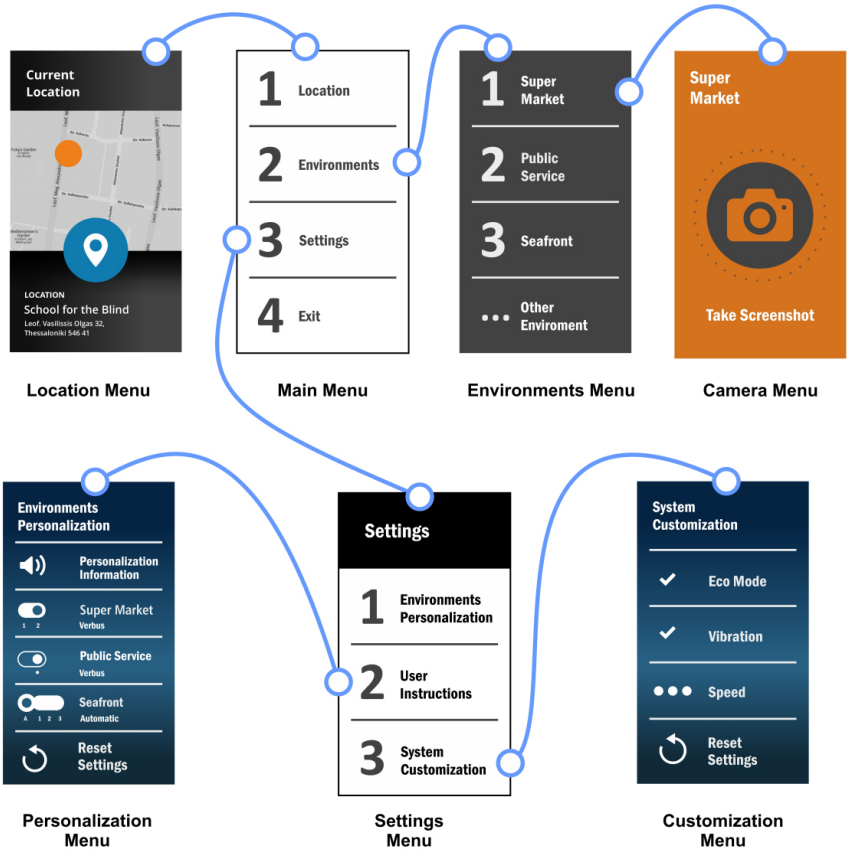

FIG. 2 Illustration of the user interface of the e-Vision application. Blue lines indicate the interface interconnections and transitions

common gestures of widespread assistive technologies, e-Vision ensures familiarity and a steep learning curve. More specifically, is it the following gestures that realize e-Vision's gesture control:

- *Double tap/ Swipe right (one finger)*: Option selection.
- *Swipe down (one finger)*: Move to the next option of the current menu screen.
- *Swipe up (one finger)*: Move to the previous option of the current menu screen.
- *Swipe left (one finger)*: Move to the previous menu screen.
- *Swipe left (two fingers)*: Move to the initial menu screen.
- *Swipe up (two fingers)*: Narrating all the options of the current menu screen.
- Touch and hold: Narrating the current option.

Having in mind the target group of the e-Vision system, the UI design process is inspired by the Voice User Interface paradigm. Therefore, the application narrates each design element, one at a time, in a sequential manner. The followed design approach differs from typical Graphical User Interfaces where users are able to scan the whole interface design and instantly develop a universal understanding, even on the invisible aspects, of the UI's structure. The visually impaired users have the possibility to

navigate in a top-to-bottom approach and get auditory feedback both on the targeted option and the corresponding type of element (e.g. button, slider, etc.). Each auditory feedback consists of a) narration that describes the targeted option, b) a distinctive alert sound that provides information regarding the success or failure of an action and c) a distinctive vibration pattern that provides tactile feedback for specific actions. Figure 2, demonstrates a detailed diagram of e-vision's UI and the interconnections between its various parts [Fig. 2].

2. Computer-vision modules

The scientific area of Deep Learning (DL) has recently entered the picture of CV. Although DL's fundamentals have been formulated several decades ago, its rapid growth has been observed only recently mainly due to the abundance of available data nowadays, a prerequisite for any DL model in order to achieve sufficiently high performance. The increased availability of training data can be attributed to the continuous digitization of our society (e.g. mobile phones, social media, etc). The CV modules of e-Vision are built on top of modern DL technologies specifically selected to operate on mobile devices.

The mobile application of e-Vision is developed in a modular manner that allows its seamless modification and extension. Although each module operates independently from the others it is only their combination that can efficiently support the targeted daily activities. The employed modules (image classification, object recognition, facial landmarks and emotion recognition, and optical character recognition) were selected so that each one can complement another towards a common goal, an assistive system for the visually impaired.

2.1 Image classification

Image classification is the process of taking an image as input and classifying it according to its visual content. As an example, an image classification algorithm may be designed to distinguish if an image contains a human figure, a car or something else. The output of such an algorithm is either a class (e.g. "car") or a probability that the input is of a particular class ("there's a 90% chance that this input is a car"). While such a task is trivial for human beings, robust image classification is still an ongoing research topic in CV applications. However, the DL field has significantly shaped the field of CV since it is able to uncover complicated structures in high-dimensional data.

In the context of e-Vision, we employ DL architectures that are specifically tailored to operate in mobile devices. More specifically, we take advantage

of MobileNetV2,[18] an architecture which has limited requirements in terms of computational power without significantly sacrificing classification performance. The employed architecture was trained on Imagenet,[19] an image database with a total of one million images and one thousand visual categories. In order to transfer to new concepts, the MobileNetV2 pre-trained model was used in order to extract high-level features and structures from images, while the final classification was performed by linear Support Vector Machines (SVMs), which are sophisticated machine learning algorithms capable of achieving high performance without requiring an excessive amount of data.

2.2 Object recognition

Object detection is a computer technology related to CV and image processing that deals with detecting instances of semantic objects of a certain class (such as humans, buildings, or cars) in digital images and videos. In contrast to image classification, object detection outputs multiple classes for an input image as well as a set of boxes which bound the detected objects and provide information about their position within the image.

With the advent of DL and its takeover of the CV field, the object detection algorithms have managed to achieve, in specific tasks, superhuman performance. Current object detectors can be divided into two categories: a) Networks that separately perform the tasks of determining the location of objects and their classification and b) networks which predict bounding boxes and class scores jointly in a single step. The second category is characterized by simplicity, making it an appropriate choice for deployment in mobile devices. Tiny YOLO[20] is among the most notable architectures of this category and was the one that was employed in the e-Vision case. More specifically, it is a single-stage architecture that goes straight from image pixels to bounding box coordinates and class probabilities and runs in real-time as it can achieve more than 10 fps on modern smartphone devices. The model that was used for the need of e-Vision was trained on the Open Images Dataset[21] which contains a total of 16M bounding boxes for 600 object classes on 1.9M images, making it the

18 Zheng Qin et al., "FD-MobileNet: Improved MobileNet with a Fast Downsampling Strategy," in *2018 25th IEEE International Conference on Image Processing (ICIP)* (IEEE, 2018), 1363–67.

19 Jia Deng et al., "ImageNet: A Large-Scale Hierarchical Image Database," in *2009 IEEE Conference on Computer Vision and Pattern Recognition* (2009 IEEE Computer Society Conference on Computer Vision and Pattern Recognition Workshops (CVPR Workshops), Miami, FL: IEEE, 2009), 248–55, https://doi.org/10.1109/CVPR.2009.5206848.

20 Joseph Redmon et al., "You Only Look Once: Unified, Real-Time Object Detection," in *2016 IEEE Conference on Computer Vision and Pattern Recognition* (CVPR) (2016 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Las Vegas, NV, USA: IEEE, 2016), 779–88, https://doi.org/10.1109/CVPR.2016.91.

21 Alina Kuznetsova et al., "The Open Images Dataset V4: Unified Image Classification, Object Detection, and Visual Relationship Detection at Scale," *International Journal of Computer Vision* 128, no. 7 (July 2020): 1956–81, https://doi.org/10.1007/s11263-020-01316-z.

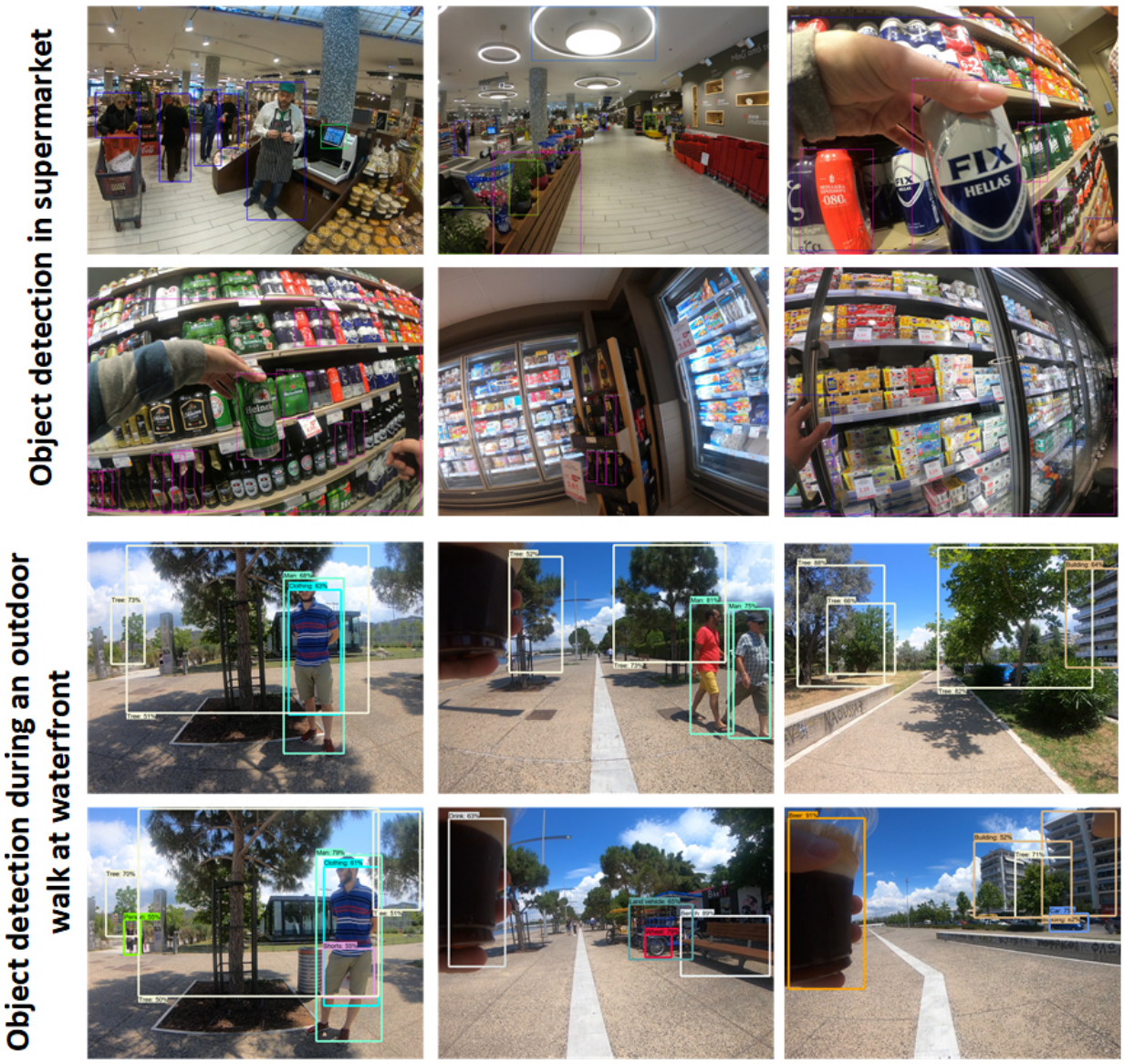

FIG. 3 Object recognition in exemplar images (egocentric viewpoint) during a visit in supermarket and an outdoor walk.

largest existing dataset with object location annotations. Figure 3 demonstrates the employed object detection model in photos from a visit to the supermarket and an actual outdoor walk [Fig. 3].

2.3 Facial landmarks and emotion recognition

One of the most integral parts of the face recognition pipeline is the verification of the existence of a face in a provided image. This can be achieved through a series of steps, referred to as face detection process, that map facial landmarks (i.e. parts of faces, like eyes or mouth), with their combination providing the prediction. e-Vision exploits the recent advances in one shot learning models, where the training process requires a limited number of faces (a few or even one –in contrast to the typical DNN models–) [Fig. 4].

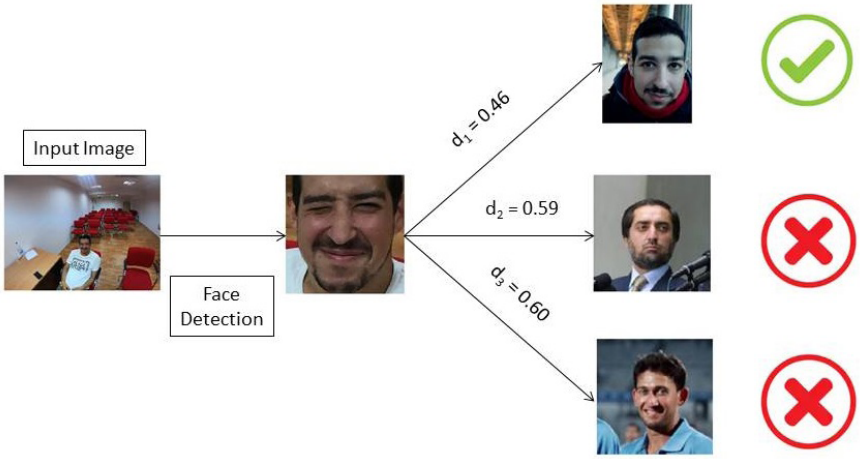

FIG. 4 Example usage of the employed face-recognition algorithm.

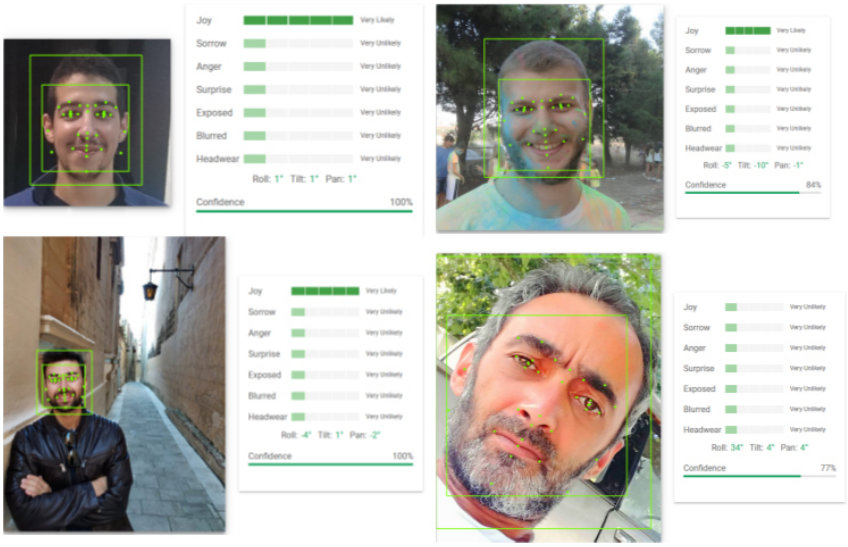

FIG. 5 Illustrating facial landmark detection and emotion recognition by the employed CV model

In this scenario, the model requires three face images that are provided to three identical CNNs that formulate the corresponding embeddings. Then the corresponding pairwise Euclidean distances calculated using a triplet loss function. Figure 4 illustrates an example where the employed tool detects the face in the image and then returns three matching images, the correct photo (the individual's original photo) and two false positive images from the dataset. It is evident that the minimum distance is reached when the correct image is identified, with a significant difference compared to the two false positive cases **[Fig. 5]**.

More recently, DL models and more specifically CNNs have been employed for the detection of facial landmarks towards emotion recognition with remarkable success. The majority of the models can be categorized as

pure-learning[22] or hybrid-learning methods,[23] with the former providing a prompt identification of the facial landmarks while the latter combine DL techniques with projection models to cast a prediction that have proven to perform better to a larger variety of expressions. Therefore, for the purposes of this work where higher degrees of freedom are crucial, we employ hybrid-learning methods[24]. An example use of the selected approach is depicted in Figure 5, where at first the facial landmarks of four individuals are identified and then a prediction regarding their emotional state is provided.

2.4 Optical Character Recognition

Optical Character Recognition (OCR) is the mechanism that converts images that contain text (handwritten or printed) to text that can be interpreted by a computer. Recent approaches in the domain of OCR employ DL models and more specifically Recurrent Neural Networks (RNNs) or CNNs with the most prominent paradigms being the ones that also encapsulate feedback connections like the long short-term memory (LSTM) architectures.[25]

The employment of DL architectures can be readily identified in the field's pioneers like Tessaract,[26] where the system's software is built upon LSTM architectures. OCR systems are classified into the ones that perform OCR when a document is scanned and the ones applied on images. In the first case OCR is applied upon scanning a document in order to convert it to a digital file[27] (e.g. PDF) while in the latter the OCR mechanism is enabled when an image is captured. The needs of the developed tool, where users will provide photos to the system, impose the use of software of the second category [Fig. 6].

Considering the functional requirements of e-Vision, the selected software is Google's Vision API, a CNN based OCR software that outperforms other competitors, providing the lowest false detection rate per character.[28] Besides its superiority against competitors, API Vision provides online features of extreme importance for the developed system. Example uses

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22 Yi Sun, Xiaogang Wang, and Xiaoou Tang, "Deep Convolutional Network Cascade for Facial Point Detection," *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, 2013, 3476–83.

23 Amin Jourabloo and Xiaoming Liu, "Pose-Invariant Face Alignment via CNN-Based Dense 3D Model Fitting," *International Journal of Computer Vision* 124, no. 2 (September 2017): 187–203, https://doi.org/10.1007/s11263-017-1012-z.

24 https://cloud.google.com/vision, accessed 28 December 2020.

25 Christian Bartz, Haojin Yang, and Christoph Meinel, "STN-OCR: A Single Neural Network for Text Detection and Text Recognition," *ArXiv*, 2017.

26 https://github.com/tesseract-ocr, accessed 28 December 2020.

27 https://www.abbyy.com/en-ee/finereader/, accessed 28 December 2020.

28 Jake Walker, Yasuhisa Fujii, and Ashok C. Popat, "A Web-Based OCR Service for Documents," in *Proceedings of the 13th IAPR International Workshop on Document Analysis Systems* (DAS), vol. 1 (Vienna, Austria, 2018).

FIG. 6 Example usage of the OCR module on actual images (egocentric viewpoint) from a supermarket (bottom image) and a public administration building. Input images on the left and the identified text on the right (mostly Greek characters).

of the selected OCR model applied to various images containing text can be seen in Figure 6. It is evident that in most cases the system recognizes the entirety of the provided text.

3. Supported activities

e-Vision is structured towards supporting three distinct daily activities for the visually impaired. Each one of the supported activities has its own functional requirements and therefore, the e-Vision system is designed to take into account the particular context that accompanies each activity. For each supported activity (i.e. supermarket visit, public administration visit and outdoor walk), several CV modules are employed in a complementary manner. We note that each of these modules is used for different reasons in each supported case. As an indicative example, we present the case of optical character recognition which is either used for document reading in the public administration case or for product identification in the case of the supermarket. In the following sections, we present the operation of the e-Vision system for each of the supported daily activities.

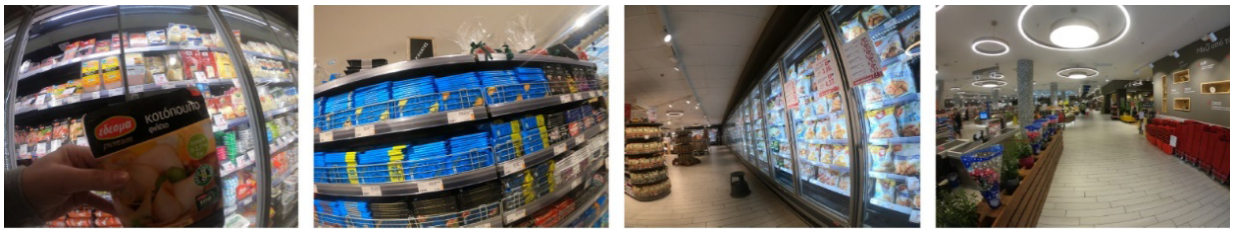

FIG. 7 Egocentric images depicting the classes in the supermarket activity namely (left to right): a) product, b) shelf, c) trail and d) other, from an actual visit to a supermarket by a visually impaired person.

3.1 Supermarket

The first use case scenario provides the visually impaired with the ability to visit a supermarket and complete a session of grocery shopping. Users are able to operate the system simply by (double) tapping the screen of their cell phone whenever they require information. Tapping the screen triggers the Wi-Fi camera to capture a first-person shot and enables a series of actions that will be completed with the system providing relevant information to the users in two levels of abstraction. The first level consists of a general description of what is in front of the user while the second overlays a more elaborate description.

The first level will facilitate navigation in the supermarket, an issue of paramount importance for the visually impaired, providing only essential information to the user while ensuring low levels of frustration. In this direction, the proposed system will classify any given image in one of the four basic concepts/categories: a) product, b) shelf, c) trail and d) other/unrecognized. In order for the system to provide accurate predictions, a combination of DL architectures and SVMs were opted, with the first being opted as feature extractors, while the latter for casting a prediction as described in section 3.1. Example uses for this case scenario, where a visually impaired person visited a supermarket, can be seen in the following figure [Fig. 7].

The second level will exploit the information provided by the first and will in turn identify the specific product, shelf or trail. As a result, users will have access to detailed descriptions about the product they are holding or the trail/shelf they are looking at. This will help the users to semantically navigate in a supermarket and allow them to easily and accurately do their grocery shopping in an autonomous way. The steps required to reach to the aforementioned descriptions, include OCR mechanisms followed by a matching mechanism on a product database provided by Masoutis,[29] one of the largest Greek supermarket corporations. More specifically, OCR extracts text, arising from the product packages (e.g. brand, product description) from the provided image. A search for the identified word(s) is then performed in Masoutis database in order to determine the exact

29 www.masoutis.gr, accessed 28 December 2020.

FIG. 8 Usage of the e-Vision application during an actual supermarket visit by a visually impaired person. The blue textbox contains the message being communicated to the user.

product, self or trail category. A more detailed technical description of the supermarket case is available by Kostas Georgiadis et al.[30] **[Fig. 8]**

3.2 Public administration

Carrying out a task in a public administration building (e.g. getting a birth certificate) is extremely demanding for visually impaired people. Although people with all kinds of impairments are given priority and help by employees in such places, this causes them unease. Therefore, the increase of their autonomy and independence has a positive effect on their mental health.[31] Towards this direction, e-Vision supports several features specially tailored for the public administration case. By taking advantage of the object detection module, the e-Vision system is capable of notifying the user about the existence of a ticket dispenser (e.g. take-a-number system) as well as other useful objects including chairs, desks and people. To increase the social aspect of this activity, by exploiting the face and emotion recognition module, the e-Vision system provides social context during a conversation or a transaction (e.g. "You are facing a happy man"). Finally, the most important feature of this case is realized by the optical character recognition module where the system can read documents and signs to users. All the feedback is provided to the user by means of narration through the auditory pathway **[Fig. 9]**.

30 Kostas Georgiadis et al., "A Computer Vision System Supporting Blind People - The Supermarket Case," in *Computer Vision Systems*, ed. Dimitrios Tzovaras et al., vol. 11754, Lecture Notes in Computer Science (Cham: Springer International Publishing, 2019), 305–15, https://doi.org/10.1007/978-3-030-34995-0_28.

31 Daniela Mirandola et al., "Psychological Well-Being and Quality of Life in Visually Impaired Baseball Players: An Italian National Survey," ed. Stefano Federici, *PLoS One* 14, no. 6 (2019): e0218124, https://doi.org/10.1371/journal.pone.0218124.

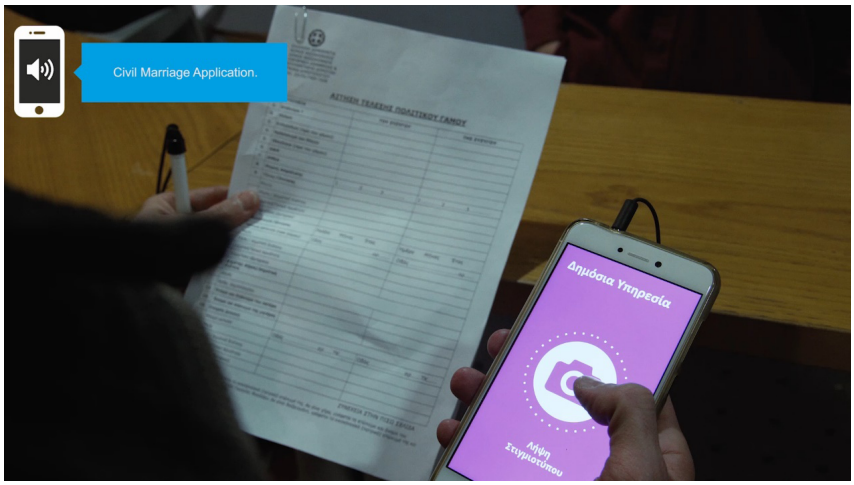

FIG. 9 Usage of the e-Vision application during an actual visit at a public administration by a visually impaired person. The blue textbox contains the message being communicated to the user.

3.3 Outdoor walk

The third of the targeted activities of e-Vision is an outdoor walk. Here the system serves a variety of purposes ranging from an immersive cultural experience through specifically designed soundscapes to user's friends identification and auditory portraiture of the user's surrounding. By exploiting the face recognition advances in CV, the system will be able to identify detected faces and whether they belong to the user's social environment. To enable this feature, each user must provide portraits of his friends, though a specifically designed interface, that will serve as the baseline for the face recognition module. The identified faces are communicated to the user through the auditory pathway (i.e. "Your friend John is approaching."). Moreover, in an effort to provide an auditory depiction of the surroundings, we take advantage of the object detection module. The user's surroundings are processed in order to extract the depicted set of identified objects. Then the identified objects are converted into an elegant narration (e.g. "A bench on your right.") that is provided to the user using text-to-speech technologies. In an effort to avoid auditory -and consequently cognitive- overload, only the essential feedback is provided according to the user's individual preferences, by means of narration verbosity and feedback frequency, through the settings menu of the e-Vision application. To further enhance the system's parameterization and personalization, an on-demand feedback option is also provided where the user requests feedback if desired.

3.3.1 Soundscapes

During an outdoor walk, visually impaired people use their hearing to perceive the surroundings and get information concerning a wide variety of events (e.g. task-related sounds such as running or bike riding and

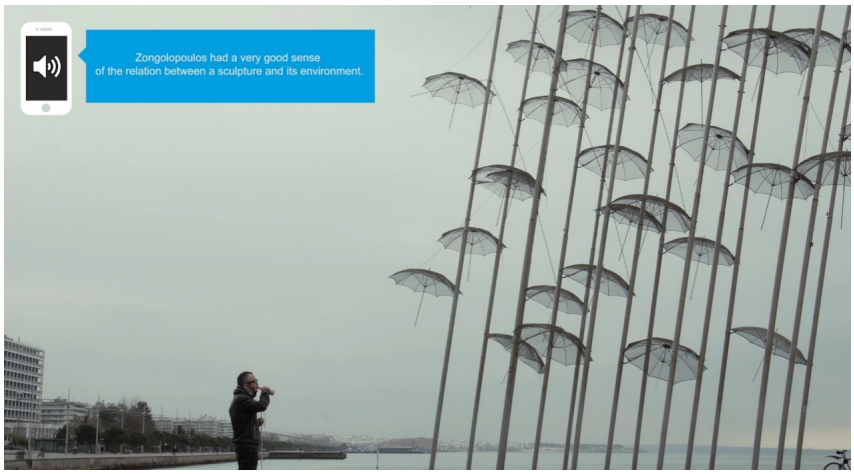

FIG. 10 Usage of the e-Vision application (soundscape case), during an outdoor walk, near the "Zongolopoulos' umbrellas" monument, by a visually impaired person. The blue textbox contains a sample of the message that is communicated to the user.

natural sounds such as a dog barking, birds tweeting wind blowing etc). Using the e-Vision system, the visually impaired should be able to receive -again through the auditory pathway and in the form of sounds- information about their surroundings, but this should be aligned with the aforementioned natural sounds and should not interfere with their perceptual processes.

In the case of e-Vision, the concept of soundscape is not confined to recording and describing the sounds that shape users' environment since these sounds will, naturally and in real-time, end up in the users' ears as they walk. In the case of e-Vision, the concept of soundscape refers to a set of high-quality and edited audio clips that correspond to selected points of cultural interest such as monuments, museums etc. When users approach a selected point of interest (identified by the smartphone's GPS sensor), they will be alerted with a brief and distinctive tone. If they like, they will be able to hear one or more sound clips that will constitute the corresponding soundscape. Moreover, the users will be able to switch to another audio clip (if one exists) as well as stop the process at any time. By employing such practices, the users will not be isolated from their surroundings, but will be able to also monitor the natural sounds of their environment [Fig. 10].

Conclusion

Despite the recent advances in the field of assistive technologies for visually impaired people, existing practices are limited to providing generic information regarding objects and identifying obstacles. In this study, we introduced the e-Vision system which aims to provide information regarding objects, faces and obstacles in contextualized manner amenable to semantic interpretation. The scope of e-Vision is to take advantage of recent advances in the field of CV in order to assist people with visual impairment and provide them the ability to identify objects and persons at a semantic level. Indeed, developments in CV have brought them closer to the efficiency levels of human vision even without the need for high computational power, enabling their operation on even less sophisticated devices, such as smartphones. The development of CV algorithms complements the wide availability of visual content that is essential for their training, as the ever-expanding streamlining of society is accompanied by large-scale digital content production and sharing. The described functionalities are framed within an interface tailored to visually impaired people that allows the control of parameters such as the sampling frequency of optical identification and the transmission rate for audio communication.

Finally, it should be noted that although e-Vision, with the capabilities offered by CV, is oriented towards addressing practical needs of the visually impaired, as explained above, there is another, equally important benefit that the system provides to the visually impaired. While visually impaired people can often rely on the help of family members, friends or members of staff to accomplish the activities covered by e-Vision or other CV solutions, their deeper needs concern much more than the accomplishment of a task.

The autonomy of the visually impaired, expressed by their ability to accomplish everyday tasks on their own even when help by others is available, is extremely important. The ultimate benefit which e-Vision aspires to bring to the visually impaired is greater autonomy, and the increased wellbeing, which can be accomplished through it. To this end and in an effort to examine the actual benefits that e-Vision brings to the visually impaired community, a pilot-study was performed where ten visually impaired participants tried the introduced system in the three described scenarios (i.e. shopping at a grocery store, outdoor walking and visiting a public administration building). At the end of this, day-long study, the participants evaluated the system by means of answering corresponding questionnaires. All participants stated that e-Vision has the potential to benefit their everyday lives greatly once it reaches its release-ready version.

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MAIN SECTION

Habitat Project: Proposals for an Autonomous, Independent and Inclusive Life for Self-sufficient and Non-self-sufficient Elderly People

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ABSTRACT
Growth in the global elderly population necessitates a review and redesigning of the social care system in order to reduce operating costs while maintaining a high quality of life for individuals. On this basis, an academic/industrial research pool has developed the Habitat project (Home Assistance based on the Internet of Things for the Autonomy of All), a research project funded under the POR FESR 2014-2020 initiative of the Emilia Romagna regional authority. The main goal of Habitat is to develop a digital, open, inclusive and flexible platform, utilising advanced technologies—such as the Internet of Things, radio-frequency identification, wearable devices, sensor networks and artificial intelligence—and embedding them into commonly-used objects, such as an armchair, a belt, a radio or an *applique* lamp. The interface of these smart objects is totally transparent and non-invasive. This allows customizable configurations for domestic or community spaces (RSA – residential care facilities, day-care centres, etc.) giving the elderly more autonomy and independence, while monitoring their movements, checking their posture or warning them of health-related events. These activities are fully personalized as each smart object can recognize the individual and thus conform to their specific needs. The project lasted two years and ended in July 2018.

KEYWORDS
elderly; user-centred design; HABITAT; co-design; Internet of Things

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Introduction

Over the last decade, global life expectancy has increased significantly due to several factors, including developments in the fields of medicine and diagnostic technology, greater awareness of health and a healthy lifestyle and greater attention to healthy nutrition.[1-2-3] However, the concept of life expectancy must be distinguished from the concept of quality of life because it would be undesirable to increase the former by drastically reducing the latter.

According to the World Health Organization (WHO), by 2050, the population aged over 65 years will exceed the number of children under the age of 14.[4]

We are therefore facing—and increasingly so in the years to come—an epochal demographic transformation that will necessarily have great repercussions on the economic, social and cultural structures of our society.[5]

In order to deal with this, the WHO has introduced the concept of active aging[6]. Possible strategies to promote healthy aging include fostering healthy lifestyles and disease prevention, trying to make people as autonomous as possible, increasing their self-esteem and independence.

To date, many dependent seniors, and those who are self-sufficient but with mild cognitive or physical impairments, rely on health facilities for their selfcare. Others seek to remain and live in their domestic settings, where professional caregivers are required. However, both solutions present obvious disadvantages and, unfortunately, the former cannot continue in the long term. If the current population growth trend continues, either there will not be room for everyone in healthcare facilities or social and healthcare costs will not be feasible for the economy. In addition, seniors who are cared for in nursing homes have been shown to suffer more frequently from loneliness, depression, and social isolation.[7]

As for assistance provided by caregivers (or family members who apply

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1 Vince Thomas et al., "Estimating the Prevalence of Dementia in Elderly People: A Comparison of the Canadian Study of Health and Aging and National Population Health Survey Approaches," *International Psychogeriatrics / IPA* 13 Supp 1 (February 1, 2001): 169–75, https://doi.org/10.1017/S1041610202008116.

2 Carol T. Kulik et al., "Aging Populations and Management," *Academy of Management Journal* 57, no. 4 (August 2014): 929–35, https://doi.org/10.5465/amj.2014.4004.

3 WHO Are you ready? What you need to know about ageing. Accessed July 07, 2020, https://www.who.int/world-health-day/2012/toolkit/background/en/

4 Elena Borelli et al., "HABITAT: An IoT Solution for Independent Elderly," Sensors19, no. 5 (12 March 2019): 1258, https://doi.org/10.3390/s19051258

5 Reports and data Available online. Accessed July 07, 2020, https://www.aihw.gov.au/reports-data

6 Rocío Fernández-Ballesteros, *Active Aging: The Contribution of Psychology* (Hogrefe Publishing, 2008).

7 Thomas J. Mattimore et al., "Surrogate and Physician Understanding of Patients' Preferences for Living Permanently in a Nursing Home," *Journal of the American Geriatrics Society* 45, no. 7 (July 1997): 823, https://doi.org/10.1111/j.1532-5415.1997.tb01508.x.

for continued work leave to try to look after their loved ones), it must be noted that this carries an important cost for the families, which not everyone can afford.

Therefore, from a quality-of-life perspective for seniors, trying to age in place,[8] while limiting further expenses, would be more efficient.

On this basis, the paper aimed to find solutions that increase people's independence in their own homes by enhancing inclusiveness and accessibility of services, without altering or lowering quality of life. Specifically, the paper describes a precise methodological process that led to the conception and realization of an IoT platform and several interoperable smart objects with the aim of fostering safe, healthy and inclusive aging for both self-sufficient and dependent people in their domestic settings or day-care centres.

HABITAT project presentation and objectives

A multidisciplinary research group, established by many universities and companies, worked to discover new strategies to develop inclusive solutions for the elderly and their families. This was the purpose behind the HABITAT project (Home Assistance Based on the Internet of Things for the Autonomy of All).[4] The project was funded under the POR FESR 2014-2020 initiative of the Emilia Romagna regional authority (Italy) and aimed to develop and test an Internet of Things platform that could allow creation of assistive and reconfigurable environments by implementing, improving or redesigning certain everyday objects. The two-year project ended in July 2018.

The project began by considering many complex and varied objectives. Thus, right from the start, a strategic partnership was established to foster solutions across technical fields by sharing multidisciplinary knowledge and a multitude of strategic tools[9]. Specifically, the authors of the paper are a member group of the Tecnopolo of Ferrara - TekneHub Laboratory accredited by the Rete Alta Tecnologia network, and are specialized in human centred design. The authors' project task was threefold: the group had to design the smart objects and interface of the HABITAT platform, test all prototypes of the assistive environment, and define the final technology readiness level as required by the initial proposal.

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8 Hardison D. Wood, *The Pros and Cons of Nursing Homes* Hardison Wood Legal Blog. Accessed July 07, 2020, https://www.hardisonwood.com/blog/the-pros-and-cons-of-nursing-homes/

9 Elena Borelli et al., "HABITAT: An IoT Solution for Independent Elderly," *Sensors*19, no. 5 (12 March 2019): 1258, https://doi.org/10.3390/s19051258.

Project partners[10] collaborated with companies in Emilia Romagna from various sectors, which offered their design know-how and technical resources for creation of some of the prototypes.

The primary users considered by the HABITAT project were the elderly. The project focused on designing smart-home solutions for seniors starting to face aging-related issues but who are still able to live in their homes without constant professional care, living with their partner or with a relative or alone. The quality of life of these individuals can be significantly improved by enhancing their level of autonomy, prolonging independent living in their own homes and postponing the need for hospitalization.[11] The majority of people in this category of users are not actually confident with the use of smart devices because of differences from more traditional products and difficulties interacting with smart interfaces that are not always truly intuitive in practice. The secondary users considered in the HABITAT project were those people who provide formal or informal care to the main users, such as medical staff, family members, relatives, friends, and so on. Considering this, while the system was not primarily conceived for them, their needs were included in research to facilitate their tasks. The stakeholders considered for the project were people or institutions that do not have direct interaction with the system or with the primary users but were involved in its development or were of particular interest to it.

Based on the above considerations, the aim of HABITAT was to produce many flexible and accessible solutions to promote active and healthy aging of the target audience. In particular, the choice of developing an interoperable IoT platform was due to new and increasingly effective technologies that enable users to personalize and customize the system according to their preferences.

Furthermore, the project produced several interconnected smart objects. According to the purposeful vision of the partners, HABITAT's initial proposal outlined the development of a set of smart devices—such as an indoor localization system equipped with indoor locators, smartwatches and wearable tags, an armchair, and an intelligent multipurpose radio—which were conceived to fulfil the objectives of the entire project.

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10 The other partners of the project are: CIRI-ICT of the University of Bologna, Interdepartmental Center for Industrial Research in Information and Communication Technologies, which cooperated for the definition and the design of the ICT infrastructure for HABITAT life scenarios; CIRI-SDV of the University of Bologna, Interdepartmental Center for Industrial Research, Health Sciences and Technologies, which cooperated for the selection and engineering of sensors and actuators part of the various smart objects; ASC-Insieme, Azienda Servizi per la Cittadinanza - Azienda speciale Interventi Sociali Valli del Reno, Lavino e Samoggia, which cooperated for the definition of requirements, specifications and application scenarios of HABITAT by providing its great expertise gained in the home care sector, specifically managing several Day Care Centers; and lastly Romagna Tech, a member of the Emilia Romagna Rete Alta Tecnologia, which cooperated for the dissemination of project results.

11 Taha Zahari and Ruhaizin Sulaiman, "Ergonomics Consideration in the Design of Products for the Elderly Population", in *Proceedings of the 9th Asia Pacific Industrial Engineering & Management Systems Conference* (APIEMS2008), 2008, 309.

However, during the process, the design strategy changed following direct involvement of the users, which provided new research insights, explained in the next section.

Ten similar devices, available on the market, were compared to each other through a competitive benchmarking.[12]

The results highlighted both advantages and disadvantages of each device relative to users' needs as expressed during previous focus groups with the target audience. The emerging considerations are highlighted by the following points:

- the smart objects must target the real needs of the users;
- the smart objects must be conceived as interoperable elements that can communicate with users through a simple and comprehensible language;
- the final solutions must match users' needs not only in terms of quantitative requirements but also qualitative and emotional needs.

As an example, the wearable devices were criticized by the users involved in the co-design workshops. Consequently, some operating strategies or functionality embedded into the smart objects were confirmed as proposed while others were completely changed.

Methodology

The HABITAT project was developed through user centred design (UCD).[13] The UCD approach was considered perfectly suited for design research related to the Internet of Things because it places great importance on the users' specific characteristics and personal requirements[14]. This allows the design team to develop products, services and systems based on the specific needs of a certain niche category—such as the elderly in the HABITAT project—who have specific abilities and often struggle with usability of some products widely used by the majority of the population.[15]

Regarding the methodological approach, the early stages of the project involved a user analysis to collect as much information as possible on the different users. The multidisciplinary project team conducted surveys, direct interviews and questionnaires with users to collect data on their

12 Giuseppe Mincolelli et al, "Internet of Things and Elderly: Quantitative and Qualitative Benchmarking of Smart Objects,", in *Advances in Design for Inclusion*, ed. Giuseppe Di Bucchianico, vol. 776, (Cham: Springer International Publishing, 2019), 335–45 https://doi.org/10.1007/978-3-319-94622-1_32.

13 Giuseppe Mincolelli, *Customer/User Centered Design. Analisi di un caso applicativo* (Santarcangelo di Romagna: Maggioli Editore, 2008), 115.

14 see ISO 9241-210:2019 Ergonomics of Human-System Interaction — Part 210: Human-Centred Design for Interactive Systems.

15 Giuseppe Mincolelli et al, "Design for the Active ageing and Autonomy: the Role of Industrial Design in the Development of the 'Habitat' IOT project," *International Conference on Applied Human Factors and Ergonomics* (Springer, 2017), 88.

QUALITY FUNCTION DEPLOYMENT	RELEVANCE OF NEEDS	% RELEVANCE OF NEEDS	1. PROCUT SPECIFICATION	2. PROCUT SPECIFICATION	3. PROCUT SPECIFICATION	4. PROCUT SPECIFICATION	5. PROCUT SPECIFICATION	6. PROCUT SPECIFICATION	7. PROCUT SPECIFICATION	8. PROCUT SPECIFICATION	9. PROCUT SPECIFICATION	10. PROCUT SPECIFICATION	1. COMPETITOR	2. COMPETITOR	3. COMPETITOR	4. COMPETITOR	5. COMPETITOR
1. COSTUMER NEED	4	6%	0	9	0	0	0	3	1	0	0	3	2	1	3	3	3
2. COSTUMER NEED	1	1%	0	3	0	0	0	3	0	3	0	0	2	1	1	2	3
3. COSTUMER NEED	5	7%	0	3	3	0	1	3	1	3	3	1	5	3	4	2	4
4. COSTUMER NEED	3	4%	0	3	0	1	0	3	0	1	0	1	2	1	1	3	4
5. COSTUMER NEED	3	4%	0	3	0	9	0	3	0	1	1	3	2	3	3	3	4
6. COSTUMER NEED	2	3%	9	3	3	3	3	1	3	3	3	1	1	1	2	1	2
7. COSTUMER NEED	1	1%	0	3	3	1	1	3	1	3	3	1	1	2	2	3	1
8. COSTUMER NEED	2	3%	0	1	1	1	1	1	0	1	0	1	2	2	3	3	3
9. COSTUMER NEED	4	6%	3	3	3	3	3	1	3	3	3	1	3	3	2	4	5
10. COSTUMER NEED	5	7%	0	9	0	0	0	9	0	1	0	1	3	2	3	4	5
ABSOLUTE TECHNICAL IMPORTANCE			65	280	188	142	68	216	72	164	129	87					
% TECHNICAL IMPORTANCE			5%	20%	13%	10%	5%	15%	5%	12%	9%	6%					

FIG. 1 An example of a QFD matrix. Source: S. Imbesi, 2019.

daily habits and the goals or frustrations they perceived in their routines. Each requirement identified was then sorted by user type and rated by recurrence and importance, in specific cells.

Next, this information was used for the Quality Function Deployment[16] matrices **[Fig. 1]**, completing one for each smart device. In order to facilitate management of the QFD outcomes for the multidisciplinary team project, each QFD matrix was filled in with 20-25 user needs linked to a specific smart object and 20 measurable technical characteristics linked to the same device. Within the QFD matrices, user needs and technical characteristics were matched to evaluate their degree of correlation by using the 0, 1, 3, 9 rating scale, derived from the QFD algorithm, to obtain the classification of the most impactful characteristics that could satisfy the most important needs.

After the stages described, the project team had enough information and data to prepare a project brief for each smart object. From the prepared documentation, some common requirements emerged for all smart objects:

- a clear and simple interface that would allow the elderly to easily use technology instead of being overwhelmed by it;
- interoperability and capacity to operate autonomously on the basis of data gathered from the domestic environment;

16 Yoji Akao, *Quality Function Deployment: Integrating Customer Requirements into Product Design* (Taylor & Francis, 1991).

- return of such information in an intelligible form that can be undestood by a self-sufficient senior rather than a caregiver or an operator.[17]

The smart objects were designed, prototyped and tested through an iterative UCD process, as described hereinafter.[18]

The first object is a sort of physical 'frame' containing a monitor and a free space usable as a notice board. The shape of the object was chosen to improve usability by avoiding the perception of something too technological and complicated but rather fostering the idea of very intuitive and accessible use.

The second HABITAT smart object is a smart armchair, which has been designed for both self-sufficient and non-self-sufficient seniors, and can even be used as an alternative to the wheelchair. The smart armchair is comfortable for various seated activities, and it offers different configurations to ensure the best sitting posture according to the physical abilities or disabilities of a particular person.

The third smart object is a wearable device enhanced with inertial and gyroscope sensors, capable of constantly monitoring body motion for movement analysis in both indoor and outdoor spaces.

The fourth smart object is another wearable device, conceived as a tag for an indoor locator. It is associated with an RFID reader that locates the tag. The wearable tag has different fixing options and it should be worn on the upper body. The reader should be installed on the wall at a specific height in all rooms of the home according to a modular and scalable layout that allows coverage of the areas where the seniors spend their day. The fourth smart object was conceived to be perceived as a lamp rather than a medical device in order to be more appropriate for a domestic environment.

In order to develop an inclusive solution that could improve accessibility for individuals and their autonomy in domestic environments, the research adopted a co-design approach. This allowed the research to include the main users throughout the decision-making and concept-generation processes, which was fundamental in defining the technical and morphological aspects of the smart objects. The users played the role of experts during idea generation and concept development, while the researchers acted as facilitators by supporting people in giving form to their ideas, providing prototyping tools for ideation and expression.[19]

The participatory activities were structured into two main co-design workshops, both involving the same people as in the first phase of the user

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17 Giuseppe Mincolelli et al, "Inclusive Design for Ageing People and the Internet of Things: Understanding Needs," in *Advances in Design for Inclusion*, ed. Giuseppe Di Bucchianico and Pete F Kercher, vol. 587, (Cham: Springer International Publishing, 2018), 98–108, https://doi.org/10.1007/978-3-319-60597-5_9.

18 Mincolelli et al, "UCD, Ergonomics and Inclusive Design: The HABITAT Project," 824.

19 Elizabeth B.-N. Sanders and Pieter Jan Stapper, "Co-creation and the New Landscapes of Design," *Co-Design4*, no. 1 (2008): 5–18.

FIG. 2 First workshop setting. Source: GA. Giacobone, 2017.

analysis and both organized with the contribution of the public elderly day-care organization ASC Insieme. All the participatory activities were held at the ASC Insieme's headquarters in Casalecchio di Reno (Bologna), Italy. The workshops involved 12 elderly families over 65 years old, including self-sufficient and non-self-sufficient seniors. Each family included either an informal caregiver (a relative) or a formal caregiver (a professional health operator). The scope of the two workshops was to contribute to generation of the final prototypes of the smart objects through co-design. This collaboration supported the co-design process in gathering numerous insights from the perspective of elderly people, as fundamental insights to properly define specific solutions focused primarily on specific needs of the elderly people.[20]

The first workshop was used to develop the initial project concepts, specifically defining their expected functionality and appearance [Fig. 2]. In order to facilitate the idea-generation process, the workshop was divided into three participative round tables—with both users and facilitators—each associated with one of the smart objects resulting from the research. The activities analysed the needs of older people through their everyday living experiences, which were thoroughly explored by using a brainstorming section and by creating several user-journey maps. Furthermore, the use of an empathy map collected the emotional aspects of all members of the families—such as conditions of fear, frustration, satisfaction and pleasure—which in turn became specific insights to improve the quality of the overall project. Subsequently, all of the user data was utilised to design the functions and morphological aspects of the smart objects in the form of raw prototypes, focusing particularly on the level of acceptance of the inertial sensor and the usability of the interface.

20 Karin Slegers, Pieter Duysburgh, and Niels Hendriks, *CoDesign with People Living with Cognitive and Sensory Impairments* (Taylor & Francis, 2015), 11

Following the first workshop, the early concepts were refined and improved with the most important considerations drawn from users' expectations. After this, the second co-design workshop was organized to evaluate correspondence of the updated prototypes with the expectations of the seniors. The activities involved observing the elderly while interacting with the smart objects and the interface to improve their usability, accessibility and desirability. This method allowed some needs to be elicited from their behaviour.[21] At the end of the second workshop, any friction encountered during interaction between the elderly users and the artefacts was reviewed and resolved by developing a working version of the overall project. In order to estimate the technological maturity of HABITAT, another conclusive usability test was conducted by an external expert in a simulated environment and with real users, in order to assess and formally validate the technology readiness level of the smart objects.

Results achieved

The outcomes of the overall research generated a multidisciplinary project that promoted development of solutions across technical fields to support 'aging in place'. The synergic collaboration among all partners produced an assistive domestic environment through a modular and scalable IoT-based platform, which provides a customizable and adaptable healthcare service to residents.[22] The overall HABITAT platform is composed of a family of four interoperable smart objects that can support elderly people's everyday activities and simultaneously monitor their health, improving their quality of life. This is done through predictive analysis of their daily behaviours or biological parameters. The smart system is meant to fade into the domestic background and act only when required by the needs of the seniors. To achieve this, the four smart devices are everyday objects equipped with digital capabilities (sensors, actuators, wireless connection and information computing), that can detect, record, and react to data streams produced by the elderly people in the domestic environment. Three smart objects (a smart chair, an indoor localization system and an inertial sensor) repeatedly collect data from the indoor environment. The information gathered is processed by the IoT cloud system and displayed through a digital interface. This takes operative decisions based on both health status and indoor position of the users. HABITAT not only has medical purposes for healthcare but also aims to provide psychological stimulation for the elderly through an entertaining and enjoyable experience[23], to preserve their social identity, sense of

21 Tim Brown and Barry Katz, *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation*, vol. 20091 (HarperBusiness: New York, NY, 2019).

22 Giuseppe Mincolelli et al., "New Domestic Healthcare. Co-Designing Assistive Technologies for Autonomous Ageing at Home", *The Design Journal* 22, no. sup1 (2019): 504

23 Angelika Dohr et al. "The Internet of Things for Ambient Assisted Living," in 2010 *Seventh International Conference on Information Technology: New Generations*, Las Vegas, NV, USA: IEEE, 2010), 804–9, https://doi.org/10.1109/ITNG.2010.104.

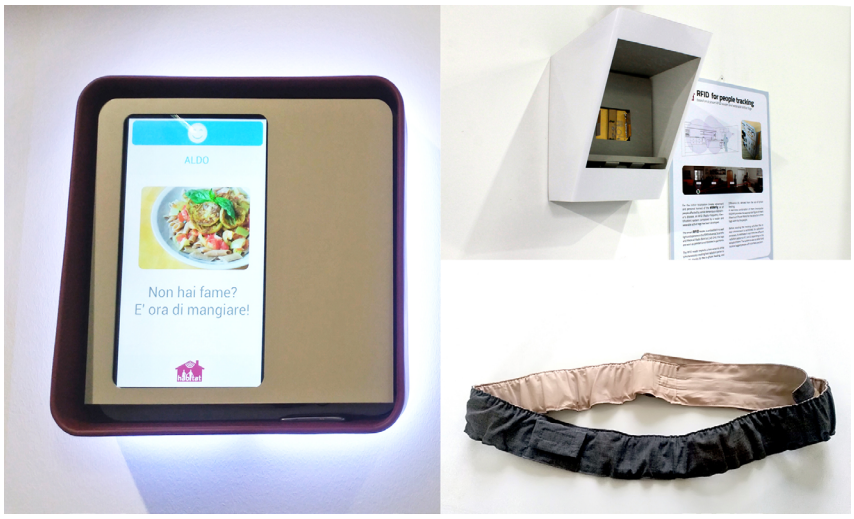

FIG. 3 The digital interface (left); the reader lamp of the indoor localization system (top-right); the wearable inertial sensor for tracking elderly people's movements (bottom-right). Source: M. Marchi, 2018

personality and a level of independence while aging in the home[24] The system also provides remote support to families and health operators to ensure monitoring of their parents/patients through the IoT network. In addition, the beta version of HABITAT was developed to configure each smart object to operate either as a stand-alone device or together as a full assistive ecosystem. This means that the artifacts can adapt to different stages of aging, underlined during the testing phase under three specific categories: self-sufficient senior, partially self-sufficient senior, and non-self-sufficient senior.

The first smart device is the digital interface, which is designed in the form of a picture frame that fades into the domestic background as an element of home furnishing **[Fig. 3]**. The physical prototype features a communication system to connect the device to the other smart objects and a wide touch-screen to interact with the caregivers through visual notifications. Meanwhile, the software monitors and improves the daily activities of seniors through integrated analysis of data collected by other smart objects. During the analysis of the elderly person's state of living, the communication of either suggestions or advice about particular health conditions is displayed through simple instant messages designed to be readable and intelligible for all. Specifically, the layout of every message is structured in three parts: on the top, a coloured bar identifies the message category; in the centre, a large image refers to the figurative meaning of the communication; and at the bottom and below the image, a simple phrase indicates the specific purpose of the notification. Blue and green divide the notifications into two categories. Blue indicates temporary advice, which encourages the elderly person to do an action such as drinking, eating, walking, changing posture or sleeping. Green identifies interactive

24 L. N. Gitlin, "Conducting Research on Home Environments: Lessons Learned and New Directions", *The Gerontologist* 43, no. 5 (1 October 2003): 43,. https://doi.org/10.1093/geront/43.5.628.

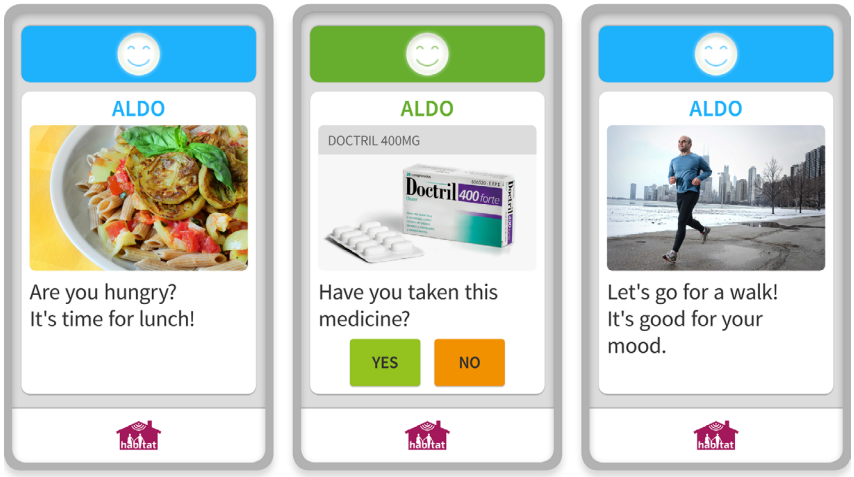

FIG. 4 Some screens of the HABITAT interface. Source: GA. Giacobone, 2018

messages, which are used to gather information about the elderly person's daily routines, such as whether they have already taken medicines at certain times **[Fig. 4]**. In particular, green indicates a specific activity requested at the end of the day, which prompts the elderly people to rate the quality of their everyday lives on a level from one to five, according to five specific parameters: nutrition, mood, health, rest time and interpersonal relationships. The digital interface also provides a mobile version, which extends the service outside the domestic environment in order to help caregivers to remotely monitor the elderly person everywhere and in real-time. More specifically, the mobile version displays health parameters of each senior monitored by the IoT system and it supports caregivers with specific warning messages (in red) in the event of critical issues involving one of their patients.

The second smart object is a conventional armchair with several load cells embedded in different locations—under the feet, the seat frame and the backrest—which provide real-time monitoring of sitting posture and the amount of time seniors spend seated. A computational board collects the data and sends it to the cloud system. Here it is processed to offer strategic decisions for the elderly people to improve their health in the form of personal advice. Information is visible on the digital interface, which displays recommendations for physical activities (e.g. walking), achieving proper back posture while seniors are sitting in the armchair.[25]

The third smart object is a wearable device equipped with an inertial sensor that monitors **[Fig. 3]** dynamic motion of seniors inside and outside the domestic environment. Like the smart chair, the inertial sensor analyses both active and passive time of the elderly people to monitor their daily activities. Furthermore, if there are critical events, such as falls, the wearable device is also able to warn the caregiver in real-time by working with the indoor localization system. The smart object is developed to be

25 Ergotek, which is the industrial partner specialized in ergonomic seats for older people, provided its know-how to develop the physical prototype.

FIG. 5 The image shows the functioning prototypes of the HABITAT system: the digital 'frame' interface (top-left); smart chair; and indoor localization system inside the lamp (top-right). Source: M. Marchi, 2019

worn on the back at waist level, at the height of the L5 vertebra, in order to perform correct motion tracking.

The fourth smart object is the indoor localization system **[Fig. 3]**, which is based on Radio-Frequency IDentification (RFID) technology and has two components: localization readers and recognition tags.[26] The localization readers are embedded into wall lamps or shelves to conceal technology in the surroundings and they monitor the position of the tags in the domestic environment. The tags are integrated into the other smart objects or worn by the elderly people on the upper body to facilitate identification. The indoor localization system is developed to prevent undesirable access of the elderly people into areas declared unsafe (for example the bathroom) and when a problem occurs, the system can warn caregivers in real-time with alerts.

Finally, specific desirability and usability tests were conducted for all smart objects and for the whole HABITAT system regarding the technological readiness level (TRL). To do this, the project team selected an external consultant. The study on usability and desirability of the HABITAT project lasted about one month and was carried out in two different locations:

- the first, was the ExpoSanità International Fair (BO). This is an international exhibition for the healthcare and assistance sector. On this occasion, the HABITAT project had the opportunity to exhibit the smart

26 Paolini et al, "Human-Centered Design of a Smart 'Wireless Sensor Network Environment' Enhanced with Movement Analysis System and Indoor Positioning Qualifications," in *2017 IEEE MTT-S International Microwave Workshop Series on Advanced Materials and Processes for RF and THz Applications* (IMWS-AMP) IEEE MTT-S, Pavia: IEEE, 2017, 3, https://doi.org/10.1109/IMWS-AMP.2017.8247434.

objects in a dedicated pavilion. The Fair allowed practical demonstrations to gather considerations on usability and interaction between people and the devices [Fig. 5];

• the second was at a day-care centre managed by the partner ASC Insieme. Nineteen participants were involved, including self-sufficient and non-self-sufficient elderly people and caregivers to whom the HABITAT system was explained for the first time, including the objects and the smartphone applications. Specifically, tests involved:

7 self-sufficient elderly people

2 caregivers of semi-self-sufficient elderly people

2 semi-self-sufficient elderly people

4 caregivers of non-self-sufficient elderly people

4 non-self-sufficient elderly people.

The goal was to quantitatively evaluate usability and desirability of the HABITAT system and its individual components: the wall lamp, necklace and identification pin, wall screen, smartphone application for self-sufficient elderly people, smartphone application for caregivers, armchair and belt. At the end of this cognitive process, the external consultant positively evaluated the project and assigned it a technological readiness level of 5. All users were able to conclude their test session without interruptions. Furthermore, the consultant drafted a technical report in which some suggestions for improving device-user interaction and the graphical interface of some applications were highlighted. These suggestions arose from the many interviews and tests that were performed with users.

Critical discussion of results

On the basis of the experimentation performed within the HABITAT project, several observations can be made. Firstly, it is crucial to work in synergy with the research and development team in order to structure and implement complex projects, both for user involvement and for high-level technology. The fields of investigation are distinct from one another (in terms of language, skills and design repercussions), therefore, assuming and developing a common inclusive methodology can drastically reduce the margins of final error in terms of time and quality. Specifically, the HABITAT project has followed human-centred design approaches that have led the entire research project to significant outcomes based on the real needs of users. Adopting participatory methodologies, listening to people and planning the development process with them right from the very first project choices considerably increased the quality of the overall results.

Secondly, the lack of accessibility to spaces, services and products by

people with specific needs—such as children, the elderly or those with disabilities—will certainly be a dominant theme in coming years, as demonstrated by trends in demographic data. For this reason, it is essential to immediately start planning a different approach to social assistance, much better aligned with the reality and needs of people. The HABITAT project has tried to propose new solutions that would give people greater autonomy and independence through development of a completely open and inclusive IoT platform and the design of smart objects equipped with AI.

A final reflection on managing and mastering new technologies:

they are—and continue to be—important tools for increasing the quality of people's lives, creating inclusive urban and environmental realities. However, keeping the individual at the centre of the creative project is fundamental. New technologies must continue to be conceived as tools and not goals. Empathic and emotional aspects—together with pleasing use and aesthetics—must remain essential elements of a project. The HABITAT project has confirmed these aspects.

Conclusions

The field of design for ageing people is constantly increasing in importance in the light of the great contribution it can make from a social perspective. Satisfaction of the requirements expressed by the elderly in order to increase their quality of life can be a strong welfare tool in the reduction of public expenses related to personal assistance and health services.

Recent technological innovations are opening up scenarios that were unthinkable a few years ago, allowing multidisciplinary groups to design devices, services and processes related to IoT that can be integrated into the everyday environment of target users.

In this context, Design Research has the important role of acting as a bridge between technology and potential use of the product by users, as a tool to set the project's specifications in order to satisfy requirements regarding usability, ease of use and accessibility, which make a difference to the effectiveness and feasibility of the design project.

Integrating objects or products, encouraging different ways of socialization and proposing different daily habits, are all actions that are not easy for seniors to understand. People have different needs and it is not always easy to build discussion and change their lifestyle and habits for the sake of greater well-being and daily security. Therefore, it is necessary to adopt extreme sensitivity in order to change the lifestyle or integrate certain objects or products within daily habits. The goal is therefore to produce interconnected and smart objects with very simple, customizable and flexible interfaces based on individual user profiling. Furthermore,

it is crucial to carry out an inclusive process for knowledge and purchase of the individual devices. The elderly have to get used to new habits, being able to choose the most suitable technology for their characteristics and ability; only with these conditions can technology to encourage active ageing be usable, accepted and inclusive.

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MAIN SECTION

Intelligent Domestic Ecosystems: Innovative Housing Models for Fragile Elderly

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ABSTRACT

Fragile users represent a category in which the elderly population is included (fragile elderly). In 2017, there were 962 million people over 60—half the number expected by 2050—many of them with disabilities. During the recent health emergency, frailty was discriminating for access to therapies creating the risk, not yet evaluated, that the mortality rate of fragile users could be increased.

This is because, even when not infected, fragile elderly people were denied access to the hospital spaces they needed. The contribution would describe the state of the art and the first results of the research conducted at the Roma Tre University which aims to study innovative housing models for fragile elderly people, capable of promoting de-hospitalization avoiding the aforementioned risk and improving the quality of life through the technological transfer of the Internet of Things from the ICT sector to the architecture one. First of all, the article defines both the final user of the research—the fragile elderly—through its historical genesis, and the tools of the research—the intelligent domestic ecosystems—as new integrated and interconnected housing models. Secondly, it describes the research core aimed to design a prototype, realized with the use of open source and low-cost technologies.

KEYWORDS

Intelligent Domestic Ecosystems; Fragile Users; Housing for Elderly; Active and Assisted Living; Safe and Inclusive Housing

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Introduction

The contribution aims to summarize the progress and the first results of the research conducted in the Department of Architecture of Roma Tre University, which has been investigating the topic of Safe and Inclusive Housing for an ageing society, since 2018.[1]

Because of the social criticality determined by the significant increase in the elderly population, the research focuses on new residential models, equipped with characteristics of inclusiveness, sharing, ergonomics, and safety, intended for fragile elderly or, in a broader sense, for fragile users, i.e., people in conditions of vulnerability, latent or manifest, associated with a growing risk or with an overt permanent or temporary disability.[2]

The research aims to find design solutions capable of supporting the active ageing of the fragile elderly, coming to define innovative residential models that exploit the technology transfer from the ICT sector to the architecture one. The aim is to encourage the active inclusion of this particular category of fragile users and their social interaction at home, in the neighbourhood and city scales, by working on the founding principles of the smart city within the housing.

The research has been articulated in the following phases:

1. definition of the state of the art of the users; analysis of user profiles and drafting of the needs and requirements framework;
2. definition of the state of the art of the tools; identification of the most advanced research, by analysing systems and components to support the active and autonomous life of the fragile elderly;
3. design application, through technological transfer, to a special housing model;
4. realization of the technological prototype of an integrated house-device system, characterized by the use of open source and low-cost technologies;
5. dissemination of results.

The research—which has already produced a series of outputs—[3] has seen

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1 The research was divided into two phases: the research group of the first phase, which received departmental funding, is composed of Adolfo F. L. Baratta (scientific director), Laura Calcagnini, Milena Farina, Fabrizio Finucci, Giovanni Formica, Maurizio Gargano, Alfonso Giancotti (Sapienza University of Rome), Antonio Magarò, Sergio Martín Blas (ETSAM Madrid), Luca Montuori and Valerio Palmieri; the research group of the second phase is composed of Adolfo F. L. Baratta (scientific director), Laura Calcagnini, Fabrizio Finucci, Giovanni Formica and Antonio Magarò.

2 Antonio Magarò and Adolfo F. L. Baratta, "Machine Learning e architetture sicure e inclusive per un'utenza fragile," *Agathon. International Journal of Architecture, Art and Design 5* (2019): 109.

3 These include two International Conferences "Safe and Inclusive Housing for the Elderly", held in Rome in October 2018, and "Inclusive living, the project for an autonomous and independent life", held in Udine in December 2019.

the collaboration of six Italian universities (Roma Tre University, University of Udine, IUAV of Venice, University of Florence, Polytechnic of Milan, and Sapienza University of Rome) and a foreign university (ETSAM of Madrid).

For funding the realization of the technological prototype, the topics of the paper have recently been submitted as research project proposal at the Special Integrative Fund for FISR Research.[4]

Fragile elderly, social spending and Active and Assisted Living: a historical perspective

Although the category of fragile users and the elderly has no clear boundaries,[5] in about half a century the sub-category of the fragile elderly has proven to have a consolidated structure. From the historical point of view, the recognition of this condition originates from a series of political-institutional assumptions. Charles Fahey used for the first time the expression "frail elderly" for the first time in 1974 when he was appointed director of a task force on the subject on behalf of the Federal Council on the Ageing.[6] The first definition of "frail elderly" responds to the aim of uniquely identifying a group of subjects for whom there is a conjunction of the condition of seniority, of one or more physical disabilities, of the impairment of affects and of an unfavourable social context.[7] This definition seems too segmented for the scientific community. In fact, the condition of seniority appears to be indefinite, and moreover, the identification of the social needs of the context is uncertain.[8]

At the end of the Seventies, the term "frail elderly patient" is used, referring to some pathologies and only from a sociological point of view. Once again it was not clear whether the use refers to people over 75, or even just over 65, and it generally referred to patients or people already included in an institutional care circuit.[9] The contradictions of the early Eighties on the subject are evident: on the one hand, studies demonstrated that a specific physical characteristic is enough to define frailty in the elderly patient; on the other hand, a list of indicators capable of supporting the diagnosis

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4 Directorial decree n. 562 Covid 2020. The results of MUR evaluation have not yet been published.

5 Antonio Magarò, "Ergonomia cognitiva negli ecosistemi domestici aumentati per un'utenza fragile," in *Abitare inclusivo, il progetto per una vita autonoma e indipendente*, eds. Adolfo F. L. Baratta, Christina Conti, Valeria Tatano (Conegliano, Treviso: Anteferma, 2019), 340-49.

6 George L. Maddox, *The Encyclopedia of the Ageing* (New York: Springer Publishing Company, 1987), 21.

7 Cleonice Tavani, A *Staff Report – Public Policy and the Frail Elderly* (Washington D.C.: US Department of Health, Education and Welfare, 1978), 8.

8 FCA, Federal Council on Ageing "Federal Council on Ageing Focuses on Frail Elderly," *Geriatrics* 33 (1978): 16.

9 Olive Stevenson "The Frail Elderly – a Social Worker's Perspective," in *Healthcare of the elderly*, ed. T. Arie (Baltimore: John Hopkins University, 1981), 158-75.

of frailty was drawn up.[10]

The need to redefine the limits of the category does not come from geriatricians, but from sociologists. Until the Eighties, they had focused their studies on independent, active elderly able to express their needs, neglecting the most vulnerable ones. The frail elderly had the characteristics of an over seventy-five-year-old, more often female, usually a widower, not hospitalized, but unable to carry out daily activities independently. In addition, the definition was released from the economic availability of the subject who—even if economically self-sufficient—may not be able to provide for the purchase of the services he/she needs.[11]

At the end of the Eighties, it became clear that the fragile individual is the one who has difficulties in daily activities, regardless of the causes, but the term "elderly" was not well defined. Therefore, it appeared useful to differentiate three types of elderly, according to age:[12]

- *young-old*, to the age between 60 and 69 years;
- *old-old*, in the range between 70 and 79 years;
- *oldest-old*, when the subject is over 80 years old.

Given the increase in the average age, nowadays it is preferred to translate each of these categories by five years forward, in the awareness that they have blurred edges.

The definitions of frail elderly had always been related to a pathological framework that includes or excludes specific disabling diseases. It was becoming increasingly evident that frailty is linked to disability and not to age, a concept close to the more modern and broader idea of "fragile user". This approach expresses how fragility is linked to the lack of autonomy in carrying out daily activities, due to the loss of ability, as the result of a complex pathological picture. This generalization is independent of hospitalization, since daily activities take place within the home, and opens the door to new ways of dealing with the problem, which goes beyond the strictly clinical context.[13]

In the Nineties, the frailty of the elderly was recognized as an epidemiological condition. It started with the first alarming data of the American Medical Association, which in 1990 counted 25% of over 65 and 45%

10 In the early 1980s, the geriatric literature published a study by the Manchester Department of Geriatric Medicine which intends to demonstrate that the condition of frailty is exclusively physical and linked to skin thinning [Brocklehurst, J. C.; Robertson, D.; James-Groom, P., 1982]. At the same time, the Geriatric Division of the University of Saskatchewan, Canada, proposes the standardization of the definition of frail elderly, through the creation of a series of indicators used to assess the impairment of daily activities, cognitive faculties and health conditions [Stolee, P. and Rockwood, K., 1981].

11 Gordon F. Streib, "The Frail Elderly: Research Dilemmas and Research Opportunities," *The Gerontologist* 23, no. 1 (1983): 40–44

12 Adam J. Garfein and A. Regula Herzog, "Robust Aging among the Young-Old, Old-Old, and Oldest-Old," *The Journals of Gerontology: Series B 50B*, no. 2 (1995): S77–87

13 Antonio Magarò and Adolfo Baratta, "Machine Learning e architetture sicure e inclusive per un'utenza fragile", *Agathon. International Journal of Architecture, Art and Design 5* (2019): 110.

of over 85 as frails. In 1997 the National Center for Health data identified approximately 1.6 million guests in retirement homes as frails. The turning point for understanding the pathophysiological mechanisms of frailty is its correlation with the reduction of "physiological reserves"[14] as well its dependency on the "susceptibility to disability", a typical condition of old age. And for the first time it was imagined that fragility could be countered.[15]

Therefore, frailty and disability were distinguished: advanced age, disability and comorbidities are not enough to identify a frail person. Even if many disabled people are frail or at risk of frailty, the opposite is not always true.[16] The frail person is the one who suffers an increase in the risk of disability (or death) as a consequence of a stressful event,[17] even a minor one.[18] At the end of the last century, the definition of frailty as a condition of vulnerability associated with age was consolidated, while the following years witnessed an approach aimed at understanding the biological basis of frailty and the possibility of identifying a clinical phenotype, yet unidentified.

What has been consistent since the Eighties is the difference between the frail elderly and the frail patient: the former is not hospitalized, therefore a relatively burden on the National Health System. The condition of the fragile elderly has a significant influence on public spending. In Italy, the most expensive services for welfare are precisely those age-dependent monetary benefits, such as the provision of accompanying allowances and residential and home care. Italian expenditure for all social policies corresponds to 29.1% of GDP just above the European average which settles at 27.9%. If the expenses deriving from the pension and health systems are excluded, Italy ranks among the European countries with the lowest levels of expenditure. The Italian municipalities per capita expenditure has an annual increase in spending on services by 2.5%, while spending on services to the elderly increases by 4.5%. The spending on social services for the elderly is equal to 17.9% of total expenditure, with peaks of 23% in North-Eastern Italy.[19]

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14 The definition is the result of research by the Department of Health Services of the University of Washington in Seattle and the Center for Health Studies also in Seattle.

15 David M. Buchner and Edward H. Wagner "Preventing Frail Health" *Clinics in Geriatric Medicine* 8 (1992):4.

16 Linda P. Fried "Introduction". *Aging Clinical and Experimental Research* 4, no. 3 (September 1992): 251–52.

17 One of the biggest differences that occurred in the 1990s, in the treatment of frailty, concerns the scientific need to identify a broad physio-pathological framework, within which to carry out experiments. In addition, geriatrics has appropriated the authority on studies in this regard, since the multidimensional approach required is the identification of this medical branch and distinguishes it from traditional medicine. The multidimensional approach to frailty makes it possible to expand the pathophysiological picture by inserting elements relating to musculoskeletal functions, aerobic capacity, cognitive functions, but also nutrition, and quality of life.

18 Archibald J. Campbell and David M. Buchner "Unstable Disability and the Fluctuations of Frailty" *Age Ageing* 26 (1997): 315.

To better understand the amount of this expenditure, it is worth noting that for every euro per capita spent on poverty mitigation and adult hardship, 6.78 euro are spent on welfare to the elderly.[19]

These numbers describe a social dimension that stresses the necessity to work on inclusion, to ensure the fundamental rights of assistance to the fragile elderly within domestic, urban and special spaces. That means to enable the so-called Active and Assisted Living (AAL). In 2007, the European research program Ambient Assisted Living Joint Program (AALJP) was born, involving research organizations and companies in sectors ranging from telemedicine to information technology, from home automation to social housing. The aim is to avoid hospitalizations and admissions to assisted residences, thus improving the quality of life of the elderly, and reducing social costs. This seven-year program was followed by another similar one, expired in 2020, called "Active and Assisted Living" (AAL2), which maintains the objectives of the previous one, focusing on active aging. The overall funding was 1.4 billion euros. The projects presented are different in their field of application, but those that exploit the potential of connection of domestic environments to favour de-hospitalization and assistance, are based on the creation of a real domestic ecosystem within which automated technologies and human beings play their own role.[20] The acronym AAL identifies a system of living spaces in which there is a strong technological integration.[21]

The aim is to provide support and assistance in terms of health and quality of life, especially for frail elderly people.

Through the transfer of technology from ITC to architecture, it is possible to counteract dates in daily activities and mitigate the discomfort due to chronic diseases, dementia, and depression.[22] Using the technologies on which services dedicated to the frail elderly are based, it is possible to respond to many needs of these users. The services in question are for everyday use, such as localization or support for movement and independence.[23]

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19 ISTAT "La spesa dei comuni per i servizi sociali. Anno 2017" Accessed July 20, 2020. www.istat.it/it/files/2020/02/Report-Spesa-sociale-dei-comuni.pdf

20 Giovanni Formica and Antonio Magarò, "Abitazioni per Anziani: nuove tecnologie per la fruizione dello spazio domestico" in *Abitazioni sicure e inclusive per anziani*, eds. Adolfo F. L. Baratta, Milena Farina, Fabrizio Finucci, Giovanni Formica, Alfonso Giancotti, Luca Montuori, Valerio Palmieri (Conegliano, Treviso: Anteferma Edizioni, 2018), 347-56.

21 Rytis Maskeliunas, et al. "A Review of Internet of Things Technologies for Ambient and Assisted Living," *Future Internet* 11, no. 12 (2019):259.

22 Salifu Yusif, et al. "Older People, Assistive Technologies, and the Barriers to Adoption: a Systematic Review," *Int. J. Med. Inf.*, 94 (2016):113.

23 Rubén Mulero et al., "An AAL System Based on IoT Technologies and Linked Open Data for Elderly Monitoring in Smart Cities," in 2017 *2nd International Multidisciplinary Conference on Computer and Energy Science (SpliTech)*, 2017, 1–6..

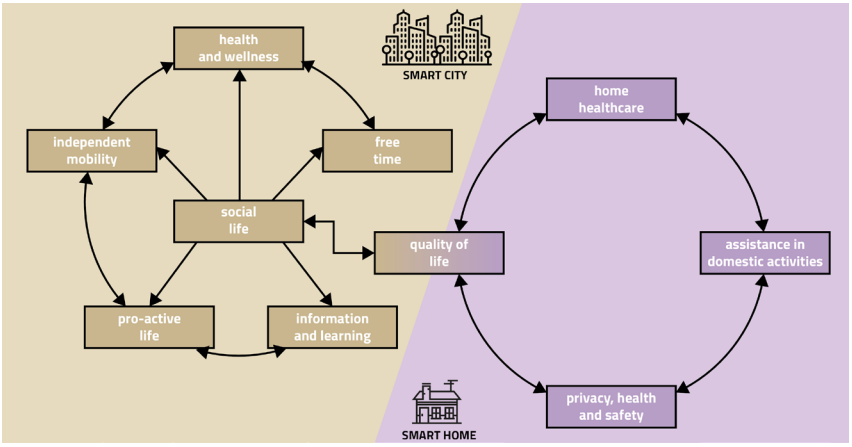

FIG. 1 Relationship between the smart city and the smart home Source: Authors.

Domestic ecosystems for fragile elderly: from smart cities to smart homes

The concept of smart city, sometimes abused, is considered the contemporary design approach to the new architectural spaces. The definition of smart city is not univocal, also because its basic assumptions are expressed in different terminologies depending on the country.[24]

The substantial differences split the concept into two categories: which elements a city must contemplate in order to be defined smart, and which resources a city must exploit according to the objectives that make it smart. Each category can generate urban and social policies, often unaware, and therefore unable to determine the transition of modern urbanizations towards smartness.

From the research point of view a city can be defined smart when investments in human and social capital, in traditional connection infrastructures and in telecommunications feed a sustainable economic development that provides for a high quality of life and careful management of resources, within participatory decision-making processes.[25] This "citizen-centered"[26] vision reflects the attention to fragile users, subjected to the physical and psychological, architectural, and social barriers that the contemporary city implies [Fig. 1].

The city that places the citizen at the centre of its development policies foresees for public and private actors to consider the needs of the different categories of citizens as a priority for any smart city project.[25] Therefore, citizens themselves become agents of change, aware of the role they play within the civic network, characterized by commitment, participation and

24 Hafedh Chourabi et al. "Modelling E-government Business Processes: New Approaches to Transparent and Efficient Performance" *Information Polity Journal* 14, no.1,2 (2009): 93.

25 Andrea Caragliu, Chiara Del Bo, and Peter Nijkamp, "Smart Cities in Europe," *Journal of Urban Technology* 18, no. 2 (2011): 65–82.

26 Pablo Sanchez Chillon, "The Thirds Rule for the Smart City Plan: Vision & Leadership, Sound Infrastructures and Civic Engagement (let's Count on Digizens)" Accessed July 20, 2020. https://urban360.me/2012/10/13/the-3-thirds-rule-for-the-smart-city-plan/

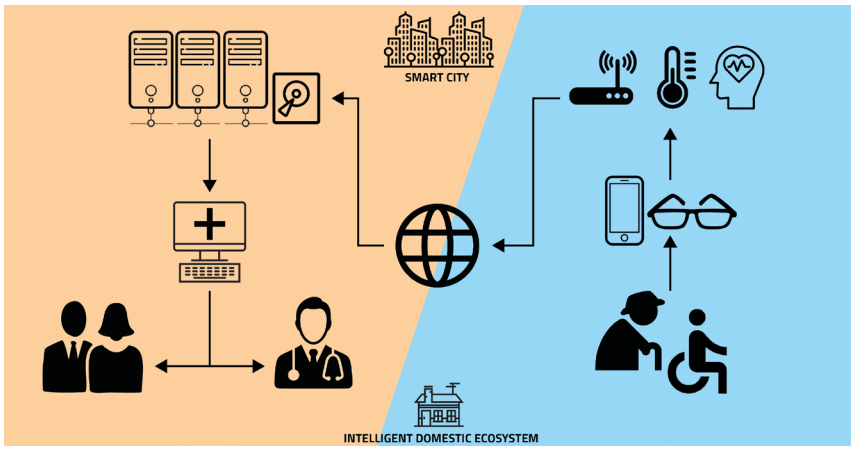

FIG. 2 How an Intelligent Home Ecosystem works Source: Authors

sharing. But citizens are not all the same: in the case of fragile elderly, the challenges are linked to overcome the barriers that aging causes, such as the limitation of mobility, of the senses, physical impairments, high susceptibility to diseases, in particular for chronic ones.

With the aim of improving the quality of life of fragile users, the founding principles of smart cities must be able to expand within homes, making them safe and inclusive. The principles underlying the design of so-called smart homes are not recent. Since the 1990s, there has been talking of a physical environment capable of interacting with users thanks to sensors and actuators connected to a local network [Fig. 2].[27]

In the same years, the Research started discussing Ubiquitous Computing to indicate the ability of objects to perform more or less complex computer processing, obtaining information from the environment and/or providing it.[28]

The transition to the so-called Internet of Things (IoT) is very short: it represents the completion of the technology transfer from the automation and ICT sectors to the world of architecture and allows to take advantage of electronic miniaturization and constant and ever-faster connection to improve the quality of life, especially for fragile users. The first definition of IoT comes from Kevin Ashton, of the Massachusetts Institute of Technology. In the late Nineties, he argued that if the internet is a network for exchanging data and information between people, the new generation of computers would work through a network for exchanging data between things.[29] Although the definition of "things" has changed along with the evolution of technology, the goal of computerizing communications between commonly used objects, without the direct intervention of a programmer, remains current. This interoperability constitutes a radical

27 Mark Weiser, "The Computer for the 21st Century" *Scientific American, Special Issue on Communications, Computers and Networks* 265, no. 3 (1991): 96.

28 Byeong Ho, "Ubiquitous Computing Environment Threats and Defensive Measures" *International Journal of Multimedia and Ubiquitous Engineering* 1 (2007): 48.

29 Kevin Ashton, "That 'Internet of Things' thing" *RFiD Journal* 12 (2009): 122.

evolution of what the internet is today, since it allows the network to collect environmental inputs in order to implement changes in the environment itself, according to the needs of one or more categories of users.

Integrate computerized and automated systems within homes, connected to each other and to the IT systems of health and care facilities, capable of interoperating to improve the conditions of comfort, safety, health, and social inclusion, based on an open platform, would allow to extend the smartness of urban systems, including architectural systems, with evident social, cultural and economic benefits.

The homes, in the broad sense of the living places, can be equipped with miniaturized sensors—even wearable—capable of constantly monitoring the environmental and health conditions of the fragile elderly. Furthermore, by managing these sensors, through a low-cost open-source microcontroller, it is possible to obtain several outputs, ranging from communication with the healthcare system or with caregivers, up to the automatic adjustment of the systems to achieve the best levels of comfort.[30] The homes for the fragile elderly conceived this way, behave like natural ecosystems, providing habitats for living species: for this reason, they can be referred to as domestic ecosystems.

The concept of a domestic ecosystem goes beyond both the concept of home automation and the concept of supply of health care machines within homes. Home automation provides complex systems for managing services within the home, not designed to be automated, customized and to provide support to the specific user.

Furthermore, the prohibitive cost of the closed source systems (to date, the most common systems on the market), devoid of any interoperability, makes them unable to communicate with each other, and not very accessible. On the other hand, the supply of specific machines for health care, in addition to the discomfort they create inside a home, complicate the life of users, already afflicted by conditions of fragility; they constitute a cost that is not always sustainable and in any case the possibility of using them only by fragile users is limited to those who live in the so-called "first world" countries.[31]

A very important part of the cognitive methods and solutions related to smart environments, smart homes and smart services, to transform elderly's houses in domestic ecosystems, are IoT-based. These include home/environment appliances control[32] or the modelling and creation of

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30 Antonio Magarò and Adolfo Baratta, "Machine Learning e architetture sicure e inclusive per un'utenza fragile,"*Agathon. International Journal of Architecture, Art and Design 5* (2019): 111.

31 Antonio Magarò, "Ergonomia cognitiva negli ecosistemi domestici aumentati per un'utenza fragile" 347.

32 Dongyu Wang, et al."AnyControl-IoT Based Home Appliances Monitoring and Controlling", in *Proceedings of the 2015 IEEE 39th Annual, Computer Software and Applications Conference* eds. Ahamed, S. I. et al. (Taichung, Taiwan, IEEE Computer Society, 2015), 487-492.

smart buildings,[33] via a cell phone or a smartphone. Another way to use IoT solutions is aimed to detect humans in smart environments, using Bluetooth Wireless Sensor Network (WSN) as a communication platform linked to unobtrusive sensors.[34] Generally, the smart AAL environments monitoring and controlling systems are based on personal mobile terminals (smartphone or tablet) and wearable devices (smartbands or smartwatch).[35] Furthermore, some researchers focus on the emotion recognition by sensors in smart homes.[36]

The IDEAs prototype (Intelligent Domestic Ecosystem for an Ageing Society)

The design and construction of a housing model integrated with a computerized system aimed at monitoring and supporting the daily life activities of the fragile elderly is among the achieved results of this research. The housing model will be interoperable with similar models, within widespread urban areas, revolutionizing the concept of neighbourhood, and promoting social relations. Thanks to the constant internet connection, the integrated housing model will be able to communicate autonomously with the network of the National Health Service and with basic health facilities, in order to facilitate assistance even in the absence of a direct request. It could be defined as an Intelligent Domestic Ecosystem aimed at supporting the daily activities of the fragile elderly.

The housing model is called IDEAs, acronym for Intelligent Domestic Ecosystem for an Aging Society **[Fig. 3]**. It is composed of a housing physical structure, integrated with a system that includes a widespread hardware infrastructure (Structure) and a centralized device, composed of a fixed unit (Core) and a wearable unit (Cell).

The Structure is composed by a series of sensors and a corresponding network of actuators. The sensors are able to acquire a series of input data with the aim of constantly monitoring the environmental comfort conditions. By way of example, the Structure is able to detect and collect, with a pre-ordered, modifiable and/or self-modifiable frequency, the data relating to the internal temperature and humidity of an environment but also the indoor air quality, the presence of harmful gases, the presence of liquids on the floor. The range of actuators, consisting of a huge variety

33 Hemant Ghayvat, et al. "WSN- and IoT-Based Smart Homes and Their Extension to Smart Buildings" *Sensors* 15, no. 5 (2015): 10350.

34 Denis Gracanin, et al. "An Approach to Modelling Internet of Things Based Smart Built Environments" in *2015 Winter Simulation Conference* eds. Ylmaz, L. et al. (Huntington Beach, California, IEEE Computer Society, 2015): 3208.

35 Tao Beibei, Lu Yi "Upgraded Application of Intelligent Environment Monitoring System in IOT Smart Home" in *Proceedings of the 2015 Sixth International Conference on Intelligent Systems Design and Engineering Applications* (Guiyang, China, IEEE Computer Society, 2015), 916-919.

36 Evdokimos I. Konstantinidis et al. "Emotion Recognition in the Wild: Results and Limitations from Active and Healthy Ageing Cases in a Living Lab" in *eHealth 360°* eds. Giokas, K. et al. (Cham, Switzerland, Springer, 2017): 181.

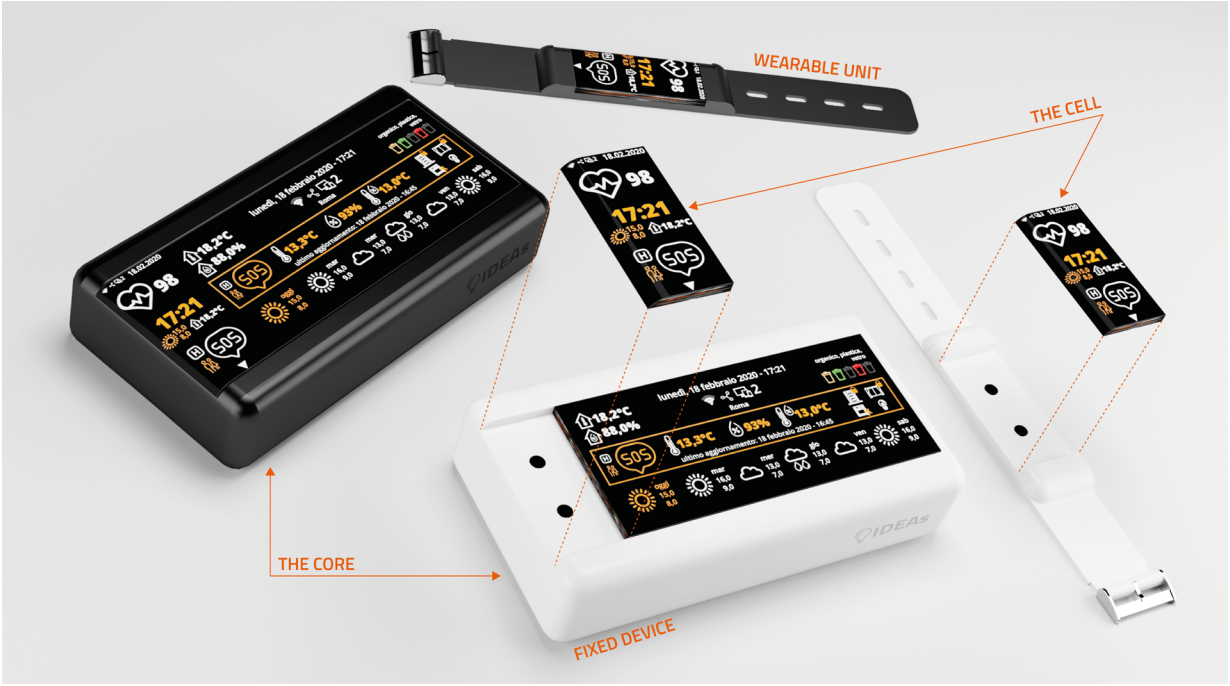

FIG. 3 Concept of the IDEAs prototype. In particular, the relationship between the CORE and the CELL that can be mounted on a wearable support is shown Source: Authors

of electronic components, is designed to create the output based on the acquired data. This function is considerably simple, in the easy visualization of data on the display, or increase its degree of complexity, from the recording of the data on a local or remote server, to the interpretation of any critical conditions, up to autonomous communication with caregivers or with the health system.

In addition, the actuators can independently regulate the movement of the windows to facilitate air changes, ventilation, and natural lighting, with the aim of re-establishing any imbalances in the indoor ecosystem.

The Core is a centralized device, easily identifiable within the home by the fragile elderly, as well as by any rescuers, in case of need. Its function is to host the microcontroller capable of interpreting the input data from the sensors and transmitting the commands to the actuators according to a series of algorithms. Designed as a communication station (reception and transmission), the Core is responsible for hosting some of those actuators, such as for displaying information.

It integrates or replaces the home router to ensure constant connection to the internet and the home network via Wi-Fi, and in the same way it connects with personal devices such as smartphones and tablets close to the user.

These devices integrate or replace the Cell, a wearable bracelet, hosting a slave microcontroller, dependent on the main one but with a certain degree of autonomy, and a series of sensors, with the purpose of monitoring the physical and health conditions of the fragile elderly person. By way of example, if the Structure acquires environmental data, the Cell

can record data on the user's temperature, sleep quality or heartbeat. In addition, because these devices are in solidarity with the user, by equipping them with an accelerometer it is possible to identify any falls, allowing to autonomously activate a communication with the rescuers.

Finally, because the Cell is in constant wireless communication with the Core, the system can acquire data relating to the user's position within the home environment via the Cell or the smartphone GPS, it is possible to trace its position outside or in the ecosystem network.

When the living places of the elderly and the homes they frequent network each other, according to the smart city approach, each Cell can interact with different Cores and related Structures, increasing the levels of health and safety.

The IDEAs system is not just an IoT application, but aims to become an IoT platform, proposing the use and dissemination of an open standard.

In fact, one of the most frequent limits to the spread of IoT applications, for which the technology is already available, is practically zero interoperability between different proprietary systems.

Someone who decides to take advantage of this technology within homes, needs to purchase a range of products from the same brand or resigns to having to manage each device (things) with a different application. In the United States, it is already possible to integrate devices that can be centrally controlled by a general user. In fact, it is sufficient to purchase the special closed-source technology made available by the four large multinationals, the so-called GAFA.[37] In Europe, the market prefers the spread of innovative, agile, and small start-ups focused on developing specific products.

Digital assistants, generally voice-activated, and similar to what the IDEAs Core should be, do not usually communicate with each other. Inevitably, all this leads to the creation of small "information islands"[38] that are impossible to systematize into a real IoT.

The strong originality of the research, which also distinguishes the IDEAs device, provides for close integration within the living spaces of the fragile elderly, bypassing the issue linked to both home automation devices and those dedicated to home care. In addition, the research used open-source hardware and software technologies, making a careful selection

37 Juan Carlos Miguel and Miguel Ángel Casado, "GAFAnomy (Google, Amazon, Facebook and Apple): The Big Four and theb-Ecosystem" in *Dynamics of Big Internet Industry Groups and Future Trends* (Berlin: Springer, 2016), 321-29.

38 Ovidiu Vermesan and Peter Friess, *Digitising the Industry Internet of Things Connecting the Physical, Digital and Virtual Worlds*, (Delft: River Publishers, 2016), 12.

among those international standards, in the process of being drafted and expanded, which are gaining ground globally.[39]

Furthermore, the simultaneous collection of data from the environment and from users could open a new efficient model of Post Occupancy Evaluation about indoor and energy efficiency of a residential building.

Conclusions

Fragile elderlies have proved particularly vulnerable during the recent health emergency: in many cases, they have not been protected in their right to health. Many studies are working on quantifying what the news have narrated: fragility has occupied a leading role in discriminating access to invasive therapies and in increasing the mortality rate. Furthermore, even when not subject to infection, the fragile elderly have been prevented from accessing the hospital spaces they needed for other diseases. This highlighted the need to rethink care models in synergy with life models linked to living spaces, with the aim of reducing hospitalizations for the fragile elderly.

Research on intelligent domestic ecosystems moves in this direction: it aims to redefine the concept of residential care for the fragile elderly, differentiating it from assisted living and hospitalization, with the aim of defining design guidelines that allow for integration of new technologies in architectural spaces.

A device such as the described one already integrated in the design phase, paves the way for a series of technological transfers with extended perspectives. In fact, the research predicts that the scenario in which intelligent domestic ecosystems must be experimented coincides with the natural one for the fragile elderly, the home space, in addition to the immediately pertinent one and the one dedicated to the socialization that facilitates the social inclusion. Therefore, a complex system is created, determined by the interoperability of these elementary cells, which can be considered as a natural ecosystem. However, to behave as such, it must be able to evolve, readjusting to the changing needs of the fragile elderly, whose conditions are variable by definition. This result can be achieved by integrating algorithms related to neuronal networks and machine learning

39 E.g.: the *Web of Things* del W3C, an international association that deals with defining and promoting standards in internet programming languages, which aims to create open ecosystems based on standards related to identification and interoperability between devices on different platforms (D. Ragget, "The Web of Things: Challenges and Opportunities" *Computer,* 48 (2015): 26), and the *Alliance for Internet of Things innovation* (AIOTI, *Alliance for Internet of Things Innovation* (Bruxelles: European Commission (2015)), *Open Platform* 3.0 (J. Swetina, G. Lu, P. Jacobs, F. Ennesser, J. Song, J. "Toward a standardized common M2M service layer platform: Introduction to oneM2M", *IEEE Wireless Communications*, 21 (2014): 20), *IEEE Internet of Thing Initiative* (R. Minerva, "Towards a Definition of the Internet of Things", IEEE Internet Initiative, 1 (2015): 3) and *International Technical Working Group on IoT-Enabled Smart City Framework*, developed by NIST, *National Institute of Standards and Technology* (S. Rhee, "Catalyzing the Internet of Things and smart cities: Global City Teams Challenge", in *Proceedings of the 1st International Workshop on Science of Smart City Operations and Platforms Engineering (SCOPE) in Partnership with Global City Teams Challenge*, Vienna (2016), 1–4).

into the system. The latter is defined as "the field of study that provides the computer with the ability to learn without being programmed."[40] When we talk about machine learning we mean a sort of "training" of the neural network, during which a quantity of data is administered to the computer from which it can derive information, and it is also possible to measure how well it succeeds.[41] In this way, the device that controls the ecosystem cell is able to improve its performance not only by operating in support of the daily activities of the fragile elderly, but by anticipating their behaviour. It will eventually be able to prevent disease states or warn the health system or caregivers before they manifest, further increasing safety.

A further development that the research aims at relates to the integration of augmented reality (AR) technologies with the aim of gradually replacing the assistance activities carried out by the general practitioner. AR consists of the superimposition of information levels, virtual and real, to increase perception and increase the use of reality. Therefore, by exploiting this model of content administration, it is possible to allow the telepresence of medical and assistance staff inside the home.

The possibilities offered by this technology transfer are also linked to the mitigation of the discomfort associated with any periods of forced solitude, both emergency and forced by the conditions of senescence.

However, some issues may arise concerning the difficulty that older people encounter in using complex computerized systems. This problem is strongly felt in the oldest-old, while the number of people over-65 who commonly use personal computing devices is showing a sharp increase. Familiarity with interactivity based on the use of network connections is one of the peculiarities of a generation of elderly people defined as YEEPIEs (Youthful Energetic Elderly Population Involved in Everything).[42] Despite this, Italy shows 25% of the elderly between 65 and 74 using smartphones or computers connected to the internet, against a European average of 45.5%. However, the aptitude for the use of these devices by the elderly in Italy is probably higher than their European peers, since smartphones and tablets are consulted at least once a day by 92% of the sample, against 72% of the European average.[43] Therefore, it will be necessary to refer to that interdisciplinary academic field that aims at looking for sustainable aging through the creation of technologically assisted environments, using the tools of inclusive design aimed at autonomous and independent living. This area is called Gerontechnology.[44]

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40 Arthur L. Samuel, "Some studies in machine learning using the game of checkers" *IBM Journal of Research and Development* 44, no. 1.2 (2000): 209.

41 Antonio Magarò and Adolfo Baratta, "Machine Learning e architetture sicure e inclusive per un'utenza fragile," *Agathon. International Journal of Architecture, Art and Design 5* (2019): 113.

42 Giovanni Formica and Antonio Magarò, "Abitazioni per Anziani: nuove tecnologie per la fruizione dello spazio domestico," 349.

43 Simone Carlo, *Invecchiare on-line. Sfide e aspettative degli anziani digitali* (Milano, Vita e Pensiero, 2018): 36.

44 Thomas Harrington, *Why and How* (Maastricht, Shaker Publishing, 2000): 45.

At present, the research is strongly oriented towards the development of applications, generally on the software side, that are "one-dimensional" and dealing with the mitigation of a specific disability or a narrow spectrum linked to the difference between physical and cognitive disabilities.[45] The prototype proposal focuses on the development of a device capable of governing the integrated house-device system, so as to be able to operate autonomously to support the daily activities of the fragile elderly, exploiting hardware and software, in an interoperable way, i.e. in constant dialogue with commonly used electronic devices, with other cells of the urban domestic ecosystem and with health care facilities.

This way, the augmented intelligent domestic ecosystems are proposed not only as a temporary post-emergency expedient, but as a housing model capable of adapting to the daily activities, transforming the fragile user into a super-able user.

45 Giovanni Formica and Antonio Magarò, "Abitazioni per Anziani: nuove tecnologie per la fruizione dello spazio domestico," 351.

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Urban Public as a Phenomenon of Communication

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ABSTRACT
The article describes the theory of German sociologist Hans-Paul Bahrdt, who characterizes a special form of communication in cities and urban places. This reflection on the phenomenon of communication in the urban public are traced from a system-theoretical perspective and further transferred on the concept of 'non-places' by Marc Augé. His comparison should provide information about which signs and communicative codes in the urban public are able to express the identity of the city and the people living in it. Finally, these considerations will be compared with contemporary approaches of architectural semiotics and urban design.

KEYWORDS
Urban Public; Communication; Representation; Urban Semiotics

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Urban public as a phenomenon of communication

The article focusses the relation between the urban public and the people in these cities that communicate via signs, texts, and images. Our nowadays cities are full of signs, billboards or screens all communicating a certain message to a passer-by: Where can I get some coffee and how much is it? Is the entrance to the subways on the left or on the right? May I enter the park in front of the palace? In this sense, the signs and texts and the social conventions associated with them are intended to organise flows or to facilitate circulation and coordination.

Furthermore, the architecture of buildings tells a message defining the character and meaning of a building: Is it a museum, a school, or a shopping-mall? We can read this character or meaning, because there is a variety of signs or symbols helping us draw a distinction between different buildings or places. On the one hand, the article tries to characterize the particular feature of (symbolic) communication in an urban public according to the theory of German sociologist Hans-Paul Bahrdt. On the other hand, Bahrdt's considerations are compared with contemporary approaches to show that present-day questions of an urban public were already problematized and theoretically discussed more than sixty years ago. Above all, however, this article aims to show one thing: Even though Bahrdt does not elaborate his theoretical considerations in depth, he nevertheless makes an exciting and promising attempt to combine a theory of communication and a theory of the urban public.

1. The open social intentionality of urban behaviour and the self-representation of communication

In his book *Die moderne Großstadt* (*The Modern Age City*) first published in 1961, German sociologist Hans-Paul Bahrdt develops a theoretical approach to give reasons for a seeming distinctiveness of urban centres and urban life. In the context of Bahrdt's considerations it is more appropriate to speak about an urban public sphere than about places of urban public,[1] because Bahrdt's concept of an urban public does not primarily describe concrete places, but rather a particular feature of communication. Following the concept of German sociologist Max Weber, Bahrdt calls the "incomplete integration" of social relationships in the city a necessary condition of the urban public. With "incomplete integration" he means that there is no – or rather: less – control to communication

1 For the differences between the terms "public sphere" and "public space", see the reflections of Setha Low, "Public Space and the Public Sphere: The Legacy of Neil Smith: Public Space and the Public Sphere," *Antipode* 49 (January 2017): 153–70, https://doi.org/10.1111/anti.12189.

and social relations by norms and structures.[2] Bahrdt states that if social relations are characterized by incomplete integration, the individual's existence becomes more and more indeterminate, because it is liberated from the mediation by personal relations, like social or family ties. The form of interaction between two people as well as the individual opportunities to act in a specific way are no longer – or better: less – controlled and determined by social norms.

Bahrdt hypothesises that the individual in a rural environment is more likely to communicate and act in a known manner.[3] In this context the main emphasis is on the known and predictable manners of individual communication and behaviour instead of on the individual him- or herself. In contrast to that the behaviour in a bourgeois city is characterized by greater openness because the subject is increasingly confronted with the unknown. Since the individual has only little and sometimes even no knowledge at all to anticipate the reaction of others, Bahrdt assumes that communicating in such an incompletely integrated situation involves higher risks than in a fully integrated environment.[4] For example, sometimes, there is a lack of reasons to communicate at all. In other cases, communication will not work because you do not know your counterpart or there is no main theme of common interest, etc. The opponent's reaction in conversation is seldom arbitrary, but also never completely predictable.

According to Bahrdt the "representation" of behaviour and communication is necessary in order to increase the likelihood of successful communication in such a situation dominated by uncertainties. The representation of communication expresses the specific characteristics of the communicating individual.[5] Since no personal connection and less social rules determine the situation, communication depends entirely on the individual him- or herself. The individual has to convey an information with his or her statement, and, at the same time, the "representation" or "stylization" of communication emphasizes the communicative character of the statement and thus seeks to establish a connection to the other person. In communication with others, therefore, individuals must always communicate information of their own choice. But this information must also be comprehensible to the other person(s) and, above all, it must be connectable for them. Thus, the conversation should always establish and at the same time explicitly address a connection between the individuals involved.

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2 Hans Paul Bahrdt, *Die moderne Großstadt: soziologische Überlegungen zum Städtebau*, ed. Ulfert Herlyn (Opladen: Leske + Budrich, 1998), 86 (translated by the author).

3 Ibid., 86–87.

4 Ibid., 88–89.

5 Ibid., 90.

2. Self-representation as a feature of urban places and communication

According to Bahrdt, in the bourgeois city these two factors – at first the incomplete integration and open intentionality of social relationships and, secondly, the self-representation and stylization of behaviour and communication – are necessary conditions of an urban public. This requires a theme of common interest, which stimulates communication and, at the same time, communication must be designed to be understood by all participants.

From the perspective of system theory, the phenomenon Bahrdt describes as the representation of communication can be understood as a self-description of the speaker, a self-reflection of his or her identity. From the level of a second-order observer a system distinguishes the border to its environment and communicates this observation.[6] This self-representation of the individual, the perception of one's own identity, can be verbalized, but also communicated through a multitude of other signals.

Accordingly, what Bahrdt calls "stylization" or "representation" of behaviour and communication is also described with other terms by Luhmann in his system theory of communication. Whereas in Bahrdt's considerations communication consists of the reference to the individual and a reference to the common of the participants, these two references are included from Luhmann's perspective already in the self-reference of communication. But – as Luhmann shows – communication always requires an external reference in addition to this self-reference.[7] And here we can find a blind spot in Bahrdt's idea of communication: Communication should not only refer to itself, but needs to speak about something else, an information outside of what is heard in the actual conversation. One must tell something new, an information that matters, in order to keep the conversation open to possible different trajectories. Otherwise, communication could end in pure self-references – which, of course, is possible, but should not necessarily be one of the goals of public communication.

With the concept of self-representation, Bahrdt primarily describes a feature of communication, but in some passages of his considerations one can find tentative attempts of Bahrdt trying to transfer this concept to the form of architecture or urban design.[8] He also concedes to buildings and certain quarters the ability of self-representation when he ascribes a "real social function" to the representative façade of bourgeois houses,

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6 Niklas Luhmann, *Social Systems*, trans. John Jr. Bednarz and Dirk Baecker (Stanford: Stanford University Press, 1995), 57; Niklas Luhmann, *Art qs a Social System*, trans. Eva M. Knodt (Stanford: Stanford University Press, 2000), 54–55.

7 Claudio Baraldi, Giancarlo Corsi, and Elena Esposito, *GLU: Glossar zu Niklas Luhmanns Theorie sozialer Systeme* (Frankfurt am Main: Suhrkamp, 1998), 89–90.

8 Bahrdt, *Die moderne Großstadt*, 163.

but he does not further elaborate on this approach.[9] Nevertheless, it must be assumed that the self-representation of buildings and urban places is shown in their structures or architecture as well as in writings, signs, and other messages that they provide to an observer. But the greatest deficit of Bahrdt's reflections remains that he does not at all address what concrete content these signs or symbols in public places convey – the buildings or urban structures only must represent themselves. This deficit can possibly be compensated by more recent considerations.

In his book *Non-Places* (1995) ethnologist Marc Augé deals with phenomena like Bahrdt's. In contrast to Bahrdt Augé does not describe a feature of communication but rather concrete spaces or sites. In his phenomenological approach he describes those sites as 'places' and distinguishes them from 'non-places'. He characterizes the place as the result of collective identity reflection and therefore in its materiality as a medium that can be used to observe this identity. Augé considers a non-place to be a place that has no identity and cannot be described as either relational or historical.[10] Places, on the other hand, are characterized by the fact that they are concerned with identity. These places have a history ascribed to them by individuals and the collective. Individuals as well as the collective refer to these places when they communicate their identity, or they use the place ritually for this purpose. For Augé, typical non-places are places of transport, such as motorways, airports, railway stations, or places of leisure consumption. These places neither disclose a (particular) identity and history nor connections for individual or collective relations. At this point, however, it must be objected, that the properties mentioned by Augé are attributed to places by individuals and are not inherent to the places themselves.[11]

By observing these places based on the description of their identity, history and relation, Augé, however, aims at precisely the same phenomenon that Bahrdt attempts to outline with his concept of representative communication: Bahrdt hypothesizes the fact, that the representative and reflected communication refers to something common as well as to one's own identity. These are precisely the qualities that Augé uses to distinguish places from non-places. Like Bahrdt and Augé, German linguist Wildgen notes that architecture is a semiotic artifact inhabited by humans.[12] But it is not a question of a building or façade being a semiotic artifact, but rather of *what* it represents. The non-places described by Augé all directly

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9 Ibid., 117 (translated by the author).

10 Marc Augé, *Non-Places: Introduction to an Anthropology of Supermodernity* (London and New York: Verso, 1995), 77–78.

11 For example, highways can be designed to provide a special landscape experience and are then perceived as such by individuals, see Peter Merriman, "Driving Places: Marc Augé, Non-Places, and the Geographies of England's M1 Motorway," *Theory, Culture & Society* 21, no. 4–5 (October 2004): 145–67, https://doi.org/10.1177/0263276404046065.

12 Wolfgang Wildgen, *Visuelle Semiotik: Die Entfaltung des Sichtbaren. Vom Höhlenbild bis zur modernen Stadt* (Bielefeld: Transcript, 2013), 243.

show "their 'instructions for use'" and the "traffic conditions" they establish. These functionalities are "transmitted by the innumerable 'supports' (signboards, screens, posters) that form an integral part of the contemporary landscape", while the actual senders of these messages are becoming more and more invisible.[13]

The non-places of the modern-age city thus do not lack illustrative signs or representations of themselves. Rather, these places lack any expression of a collective identity, any historicity and individualized connectivity. In the non-places described by Augé, it seems difficult to establish any arbitrariness for making contact, which is not determined by social norms. In the non-places, all forms of social interaction are already predetermined by economic or other principles. This seems to be exactly what Bahrdt means, when he calls the openness in terms of the content of communication an essential component of communication in urban publics. In the signs that are presented in non-places, no individual identity or historicity is conveyed, and just as little commonalities are addressed. In this aspect, these places resemble what Bahrdt describes as the direct opposite of an urban public, when communication through signs and symbols in such places addresses nothing common and unifying. Because the behaviour in such places is primarily subordinated to economic purposes, such places also do not allow for an open social intentionality in the behaviour of the individuals.

In the 1980s, German sociologist Hamm also studied the semiotics of urban public places and its effects on the actions of individuals. He states that the analysis of spatial semiotics is the theoretical key to understand the relations between the physical environment in a city and the behaviour of individuals in it.[14] But what is most important and seems perfectly obvious from the perspective of a theory of communication: Hamm points out that both the sender and the receiver of a message must be able to recognize the same meaning in a sign. Otherwise, communication will not be pragmatic. The greater the social distance, the less likely the supply of common signs.[15] While this circumstance is manageable in most cases of interactive communication, in the sphere of complex cultural and social expressions it makes the real understanding of a message increasingly difficult.

13 Augé, *Non-Places*, 96.

14 Bernd Hamm, *Einführung in die Siedlungssoziologie* (München: Beck, 1982), 165.

15 Ibid., 162 and 165.

3. Urban public as a phenomenon of communication

In contemporary approaches to a theory of urban public space, implicit references to such sociological assumptions about the semiotics of architecture and phenomenological considerations such as Augé's characterization of non-places appear frequently. These approaches confirm Bahrdt's considerations in many cases, but also partly contradict them. For example, Klamt shows that the strict differentiation used by Bahrdt between places in public ownership and private places cannot necessarily be sustained.[16] As Klamt describes, many places in today's cities can, in principle, serve the function of public urban space. The places of urban publicity must not only be in central squares, streets, or parks, but can also be created in peripheral areas of the city. Most importantly, Klamt emphasizes that an urban public space in a political sense can emerge not only in publicly owned places, but also in private places such as pubs and rooms of cultural or political associations.[17] This fact shows that the strict difference between public and private spaces used by Bahrdt is no longer necessarily true today: The main question is whether these spaces allow an open social intentionality, represent themselves and enable or support the self-representation of individuals.

A comparatively more recent approach comes from Parkinson, who, like Bahrdt, shows that the structure of a city influences the emergence of an urban public. Parkinson deals with the effects of public space on the phenomenon of democracy, describing both factors that favour the emergence of an urban public and factors that rather limit the emergence of an urban public. In his view, the assumption that the physical structure of a city determines the behaviour of its inhabitants is now generally accepted.[18] Therefore, in the following, he is interested in analysing the effects of concrete structures. Parkinson judges "that certain kinds of space encourage encounters while others do not". For example, "proximity encourages interaction and the development of community". On the other hand, there are "other city forms" that "encourage transit" and thus can hinder the development of neighbourly relations.[19] These places that encourage transit are exactly what Augé addresses when he gives examples of his distinction between places and non-places. Bahrdt also devotes large parts of his reflections to the fact that car traffic in particular has massively transformed the places of the urban public where citizens meet and communicate with each other.[20]

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16 Bahrdt, *Die moderne Großstadt*, 89 and 117.

17 Martin Klamt, "Öffentliche Räume," in *Handbuch Stadtsoziologie*, ed. Frank Eckardt (Wiesbaden: Springer VS, 2012), 777, https://doi.org/10.1007/978-3-531-94112-7_34.

18 John R. Parkinson, *Democracy and Public Space: The Physical Sites of Democratic Performance* (Oxford: Oxford University Press, 2012), 71.

19 Ibid., 73.

20 Bahrdt, *Die moderne Großstadt*, 160.

In a summary, Parkinson mentions three dimensions with regard to which urban space can promote – or rather limit – the emergence of an urban public: "it can be (a) absolute, physically preventing, or mandating certain action; (b) suggestive, encouraging certain kinds of behaviour at the expense of others; and (c) symbolic, triggering a sense of identification or recognition, which in turn impacts on such things as political efficacy".[21] Of course these three dimensions can also occur together. While the first and the second dimension seem to be what Bahrdt means, when he describes places that allow (or rather inhibit) an open social intentionality of the individual, the third dimension exactly seems to describe what Bahrdt means, when he states that not just communication in the urban public sphere must represent itself but also the architectural structures of the urban places must represent their identity. According to Parkinson, public buildings or spaces can thus represent a collective symbol of identification, which can therefore also convey common political or social contents. The symbolic dimension of a place can then be characterized with Augé's description of a place as an expression of a collective identity with a specific history and individualized connectivity. Thus, on the one hand, it is the physical structures of the city, and on the other hand, the specific symbols, messages, and meanings within it that encourage the emergence of communication in the urban public.

But the symbols and messages in a socially and culturally highly heterogeneous structure such as a city must in principle be connectable for everyone and thus always emphasize something in common. For this reason, in public places the question always arises as *which* social collective's identity the place is referring to and in which way. As systems theory shows, communication always means selection, because there is always something that has not been told.[22] Also, the symbols and sometimes subtle meanings of the semiotics in public places can rarely be seen as communication as in the case of spoken or written language. The significance that individuals ascribe to these symbols and signs in the urban public is subject to permanent change. As Jürgen Hasse puts it, these meanings are only produced or 'performed' by the subjective actions of individual persons. For this reason, 'the' meaning of the urban public and its symbols cannot be interpreted in a denotative sense, but rather results from a "deep murmur of meanings". This 'deep murmur of meanings', in Hasse's opinion, does not complicate communication, but rather favours it, because it offers a multitude of very different connectivity options.[23] This seems once again to be exactly what Bahrdt means when he demands not only that the public places in the city represent themselves,

21 Parkinson, *Democracy and Public Space*, 77.

22 Luhmann, *Social Systems*, 39.

23 Jürgen Hasse, *Die Wunden der Stadt: Für eine neue Ästhetik unserer Städte* (Wien: Passagen Verlag, 2000), 56–57 (translated by the author).

but also that they offer a certain openness to the various social or cultural intentions of different individuals.

4. Conclusion

Hans-Paul Bahrdt published his sociological considerations sixty years ago. In addition to concrete architectural, spatial theoretical and urban planning considerations, he describes in large parts the phenomenon of the city in terms of communication and the behaviour of individuals. Bahrdt emphasizes the necessity that the buildings and places in the city also represent themselves, but that the places also allow different behaviours of different individuals. This circumstance is immediately apparent in the non-places described by Augé, because although they are shaped by a multitude of information and messages, these messages serve primarily to navigate individual behaviour. The more recent approaches to urban sociology and spatial theory described above seem to support Bahrdt's fundamental considerations to a large extent.

With this in mind, urban places can also be designed as special places of publicity and communication. According to Huning, their characteristics include, for example, qualities of residence such as seating, but also a certain size and structural openness for different persons and groups who meet there, come into contact with each other, perceive each other and represent themselves to each other.[24] These considerations show that Bahrdt's approach can be translated into a design of direct physical structures of public places, which then have an effect on communication in these places. But these places must always be open for a variety of different possible uses. Places of public communication in Bahrdt's sense would be those that allow an open social intentionality of behaviour. Bahrdt assumes that if in social situations there are not so many things that two people have in common, the individual is more likely to be asked to communicate his or her own identity and refer to the identity of his or her counterpart.[25] The experience of the unknown then makes it more likely for the individuals to reflect their identity as well as their communication. For this reason, an encounter with the foreign and the unknown in places that allow communication with others is essential for the creation and future existence of an urban public. The city must offer places to communicate publicly about the community to *all* its inhabitants and, at the same time, the city itself – its structures, buildings, and their surfaces – must be a medium of communication.

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24 Sandra Huning, *Politisches Handeln in öffentlichen Räumen: die Bedeutung öffentlicher Räume für das Politische*, Originalausg, 14 (Berlin: Leue-Verl, 2006), 202.

25 Bahrdt, *Die moderne Großstadt*, 87.

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PRACTICES

Bon Pastor, a Neighbourhood with a Future. Let's Make its Remembrance Claiming the Symbolic Accessibility.

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ABSTRACT
The article discusses the on-going experience in Barcelona, Bon Pastor district. A citizen's participation experience aiming to capture the civic memory of the neighbourhood in public space. A co-management experience between neighbours, the University, the District of Sant Andreu and the MUHBA (Museum of History of the City) with the creation of a space-museum focused on popular housing.

Barcelona City Council policies for improving people's accessibility to their residence, public space and public transport are described, highlighting the new emerging rights that suggest we cannot exclusively consider "People's autonomy" from the individual dimension. Citizens, through existing participatory channels or new channels that can be opened, have the right to actively participate in the proposals and projects for transforming built environment linked to their daily life, in a "bottom-up"process of co-production and co-design.

The article calls for an extension of the concepts of accessibility to the symbolic dimensions of the public space that contributes to a better design for people. But, we recognise, that to give an answer to this claim is only possible at a time when the social structure is on the pathway to overcome the problems of physical accessibility.

The article concludes that this expansion of the concept and the tools necessary to tackle it can effectively contribute against the processes of social exclusion.

KEYWORDS
Accessibility; Social Exclusion; Civic Participation; Public Space; Bon Pastor

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Context

Bon Pastor emerged as a popular and working-class neighbourhood in the early 1920s, following the placement in the territory of large industries like La Maquinista, Sanchís or Sala. At this time, parts of the industrial settlements were located within the boundaries of Barcelona, while the former Bon Pastor's small neighbourhoods (La Mina, 1923; Estadella and Las Carolinas, 1926) were within the boundaries of Santa Coloma.

In 1929, due to pressing housing problems, the Barcelona's Municipal Housing Trust, developed a low-cost houses estate—as well as the nearby Baró de Viver estate—with more than 700 small single-family houses, the largest of the four implemented in Barcelona. Early in the 1940s, Barcelona annexed this territory and, following the Provincial Plan (1945) and the Regional Plan (1953), the territory became an area for industrial and residential developments, growing in population, with mostly emigrants. However, this growth is based on processes of spatial (bad communications, isolation), economic and social segregation (poverty, lack of facilities, stigmatization).

> "The time of the Franco regime was the time of repression. The Church called apostolic "missions" the work in the district. Social assistance (…) and almsgiving made up for much of the services to which citizens were entitled. Nevertheless, Bon Pastor remained a united neighbourhood in the face of deficits and adversities: a struggling and united neighbourhood that went out to claim the "absences" of public investment in health (a struggle for the Health Centre in the middle of 70's), education (a struggle for a professional school in recent years), transportation (a struggle for the metro and for improvement of the bus lines arriving to the area at the end of the 20th century), and public space. They also fought for a culturally active neighbourhood supportive to the less favoured"[1]

In 1968 the Regional Plan, through a *Partial Plan for remodelling the housing group*, proposed the replacement of the 1929 single-family homes with isolated blocks. It started a long process of give-and-take between different local governments and the neighbours, until 2000-2001 when, through a popular referendum, the neighbours proposed a redeveloping plan, replacing the small houses by blocks to rehouse residents. The process goes ahead into five stages and is currently under development

1 Salvador Angosto, "Mapping the History of a Territory: Bon Pastor (Barcelona) Social Remembrance and Heritage Project", Acta Universitatis Lodziensis. Folia Philsophica-Ethica-Aesthetica-Practica, 2019, 37–55.

(phase IV). The plan was called "*Bon Pastor, a neighbourhood with future*".[2] It was a strategic document allowing the development of a series of actions to conduct the physical remodelling of the neighbourhood and definitively enable the replacement of houses by new housing blocks. The principal aims of the proposal were:

• to promote the Bon Pastor as an open, plural and inclusive neighbourhood, linked to the district and city;

• to preserve its strong community personality, social activity and cohesion, and commitment to educational quality.

• to preserve an intercultural and solidary neighbourhood, maintaining a balance between urban growth and productive activity and defending its commitment to the quality of its natural environment.

The Plan for the Future foresaw a model of sustainable and balanced development for Bon Pastor.

The projects for the Barcelona Olympics (1992) had an urban impact in the area. One of the strategic projects developed during this period was the city´s beltways. The city beltways were one of the strategic projects developed during this period. These heavy mobility infrastructures were conceived for decongesting the traffic inside the city and for connecting the metropolitan areas more efficiently. In the case of Bon Pastor, a section of the city beltway designed in trench, runs parallel to the Besòs River and invade part of the neighbourhood. In contrast with other districts, the only benefit that Bon Pastor got from the Olympics public works, was the coverage of a part of this beltway with a large reinforced concrete slab, hosting sport facilities, a new pedestrian bridge to cross the Besòs river and a big solar power plant on top of a pergola built as a roof of a civic square.

Just in the turn of the century, two projects of regional dimension put more pressure on the territory. The first—with a beneficial impact—is the environmental recovery of the Besòs River (1999), which became one of the best river parks in Barcelona Metropolitan Area. The second is the "Sagrera's Plan", an ambitious project linked to the HST arrival to Barcelona—with a forecast of a 2,250M€ investment—involving the construction of a new central station, with an initial project by Frank Gehry. It entailed the coverage of the old railway yards with a new park (3,7 Km long), several housing developments and the creation of a logistics area,

2 "Bon Pastor, a neighbourhood with future" is a document emerging from a participatory process organized by the Neighbours Association. The document sets out guidelines for residential transformation of the neighbourhood. It assumes demolishing the old houses and replacing them with new block buildings. The document also includes the guidelines for the process of change, as well as the economic conditions for its realization. As mentioned, the document was approved in a neighbourhood referendum. Subsequently, the Association of Neighbours and the Housing Board of Barcelona signed an agreement setting out the conditions. The transformation process has not been exempt from social conflict, as a small part of the residents did not agree with the conditions, with a period of response and resistance to the process. (Col. Repensar el Bon Pastor, s. f.; Portelli, Stefano 2015)

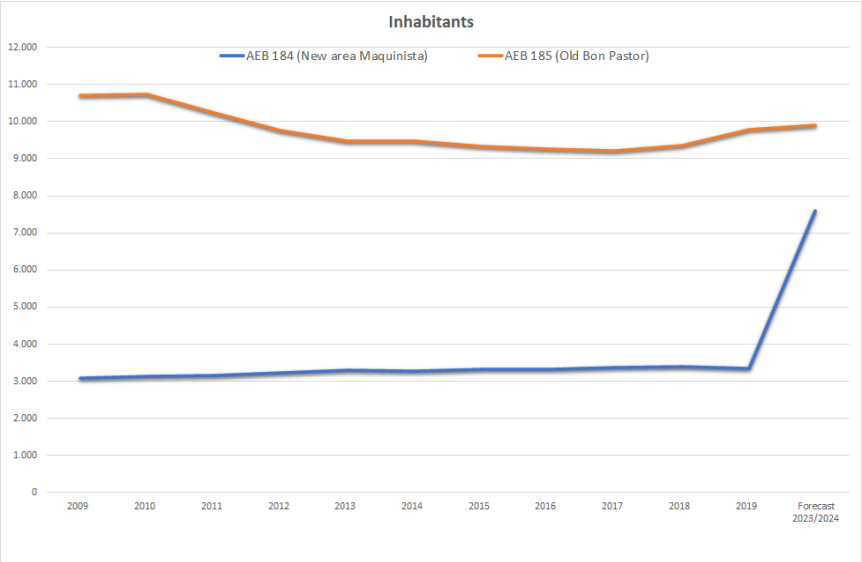

FIG. 1 Inhabitants in the two areas of the neighbourhood (Maquinista area and area of the old Bon Pastor). Own elaboration from Barcelona's City Council data.

the so-called "Railway Triangle". Today, the "Sagrera's corridor" project is only partly accomplished. It includes an important commercial and residential development, the subproject "La Maquinista", in the former industrial lands of one of the historic and largest industries in Barcelona, with the construction of a large 250,000 square metres shopping mall and of 829 homes. A first phase of the plan ended in 2000, but in 2014 the City Council of Barcelona processed a Modification of the General Plan (MPG) to increase "La Maquinista" shopping area in 36,000 square metres and, in turn, building 588 new homes, a green area and a school. However, the development of this phase is pending final municipal authorization.

Due to its morphology, the neighbourhood is divided into two very clear areas. To the north, the new buildings of the urban operation "La Maquinista", to the south, Bon Pastor, the old neighbourhood. "La Maquinista" new homes are integrated into the administrative division of the Bon Pastor neighbourhood. This means an increase of approximately 8% of residents in 2000, able to reach 22-25% if the 2014 plan is finally unblocked. The existence of this new area is important to understand some of the social dynamics in the territory, since its building typology, its public space and the social condition of its inhabitants, introduces a break with the old neighbourhood.

These new residents are socially, economically and culturally different from the former residents, coming from popular strata. In addition, an international real estate investment and asset management group purchased the old "Mercedes-Benz" industrial estate (96,000m2), very close to "La Maquinista" area.

This new urban regeneration operation will involve the construction of residential and office buildings. The specific project is not yet known, but we can estimate up to 1000 new dwellings will be built, together with an indeterminate number of offices' square meters. Hence, in the next decade,

the residents in this area can reach 40-50% of the district residents. As said, the "Sagrera's Plan" within the borders of the neighbourhood, includes the creation of a logistic "Railway Triangle". In 2001 "Acciona," a Spanish group of civil engineering, construction and infrastructure, bought a 26,000 square metres piece of land in the Bon Pastor industrial estate. Recently, the company reported it began to build 56.000 square metres in 48 modular buildings, which will be sold together or separately. This draws a scenario susceptible to a serious and foreseeable problem of social gentrification [Fig. 1].

People's accessibility

Besides its real estate fast development, Bon Pastor presents notable improvements in urban facilities (Civic Centre, Library, Old people Centre, new market, sports facilities). Since 2009, the City Council and the Generalitat (Regional Government) co-financed the installation of elevator, through the Elevator Plan of the Barcelona's Housing Consortium. The accessibility of people to the public space (crossings, ramps, paving, lighting) has been improved in the framework of putting forward Bon Pastor as a sustainable neighbourhood. The district where the neighbourhood is located has defined an Integral Plan[3] to remove architectural barriers[4] (Access to the Community Centre and the health centre; adequacy of pedestrian crossings with guidance elements for blind people, extension of sidewalks, standardization of unique platforms on the streets that include elements for blind people guidance). As in the rest of the districts in Barcelona, it is a local signage system designed for pedestrians that provides the necessary information to help people to move around. Nevertheless, it does not provide information to blind people.

Accessibility to the whole the territory of Barcelona is guaranteed by the extension of bus lines and the installation of a metro stop in the neighbourhood (2010). Improvements in transport accessibility include: braille signage of the switches and the sound information system for visually impaired people, kneeling mechanisms in the buses, retractable ramp on the central door, upgrade request pushers and child pusher warning—which cancels doors automatically—and the guiding system Navilens[5] for visually impaired people.

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3 Ajuntament de Barcelona, "Projecte d'intervenciói Integral Bon Pastor-Baro de Viver. Districte de Sant Andreu" (Barcelona, 2009).

4 The Comprehensive Neighbourhood Plan, approved for funding by the Neighbourhoods Act in 2009, sets up clear priorities for investment in personal accessibility, in public transport (underground in 2010, new buses lines), in housing (Phases II to IV of the 2000 Rehousing Plan) and public space (paving, lighting, etc). While it is true that an important part of the material achievements resulted from the financing of the Spanish Plan for the Stimulus of the Economy and Employment from the State Local Investment Fund (2009), known as the Zapatero's Plan

5 NAVILENS is a type of VISUAL TAGS, a new type of fully innovative and revolutionary visual markers that through the use of artificial vision allow, among other things, the visually impaired to be able to move independently in environments unknown to them, simply using their cell phone.

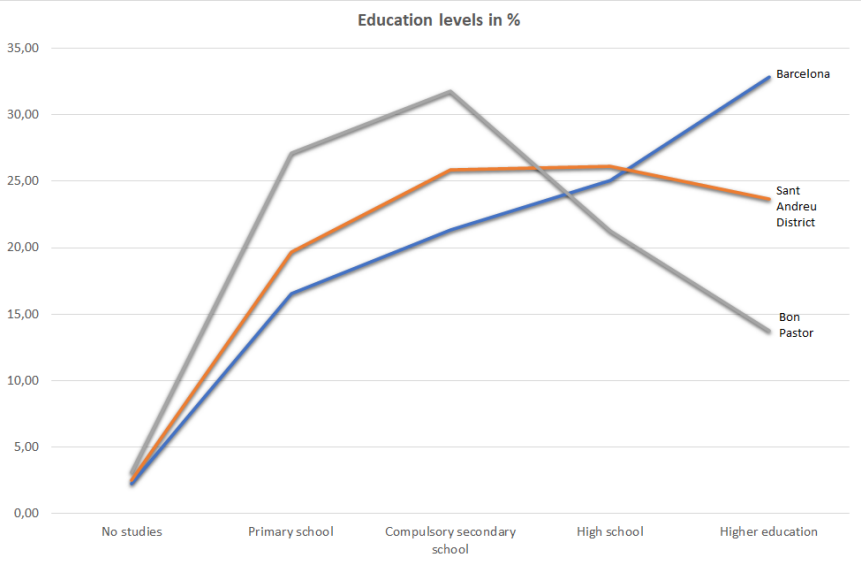

FIG. 2 Neighbourhoods such as Bon Pastor show that there is a significant decrease in study levels, when the stages of compulsory education are exceeded. Vocational and university education policies do not have the necessary mechanisms (free of charge, scholarships, etc.) to ensure universal access to all levels of education. Source: Ajuntament de Barcelona

In any case, following some of Ascher's[6] ideas we believe that universal accessibility must be understood, also from the point of view of the access to "goods" and "services" available in the city and its metropolitan area.

The decentralization policies developed in Barcelona since 1979[7], have defined a highly decentralized city which allows local universal access to goods related to health, leisure, sport, culture and basic education, goods and services to a large extent free of charge. Similarly, the policies of new central areas[8] of the 1980s have allowed a large portion of services related to local administration, trade and retail[9], and much of financial services to have a significant local accessibility. But as Borja[10] points out, this model has "lights and shadows."

The following three Images illustrate some of these shadows. According to the latest study of the Urban Vulnerability Observatory[11] (2011), El Bon Pastor is one of the 27 neighbourhoods of Barcelona with some degree of urban vulnerability and one of the 7 with a medium degree of vulnerability (the rest remain in a low degree of vulnerability) **[Figs. 2-3-4]**.

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6 François Ascher, *Los nuevos principios del urbanismo. el fin de las ciudades no está a la orden del día* (Madrid: Alianza Editorial S.A, 2004).

7 Jordi Borja, *Estado y ciudad. descentralización política y participacion* (Barcelona: Promociones y publicaciones Universitarias, S.A, 1988); Jordi Borja, Barcelona. *Un modelo de transformación urbana*, ed. Jordi Borja (Quito: Prgrama de Gestion Urbana, 1995).

8 Jaume Barnada, ed., *Arees de nova centralitat* (Ajuntament de Barcelona. Àrea d'Urbanisme i Obres Públiques. Àrea de Relacions Ciutadanes., 1987).

9 José Luis Oyón and Manuel Guàrdia i Bassol, *Hacer ciudad a través de los mercados: Europa, siglos xix y xx* (Barcelona: Museu d'Història de Barcelona, 2010).

10 Jordi Borja, *Luces y sombras del urbanismo de Barcelona*, 2nd ed. (Editorial UOC, 2010).

11 The Urban Vulnerability Observatory is a project of the Ministry of Development that is responsible for studying the situation of the neighbourhoods of the whole of the Spanish State from a multi-variable approach. https://ja.cat/Pr5tY

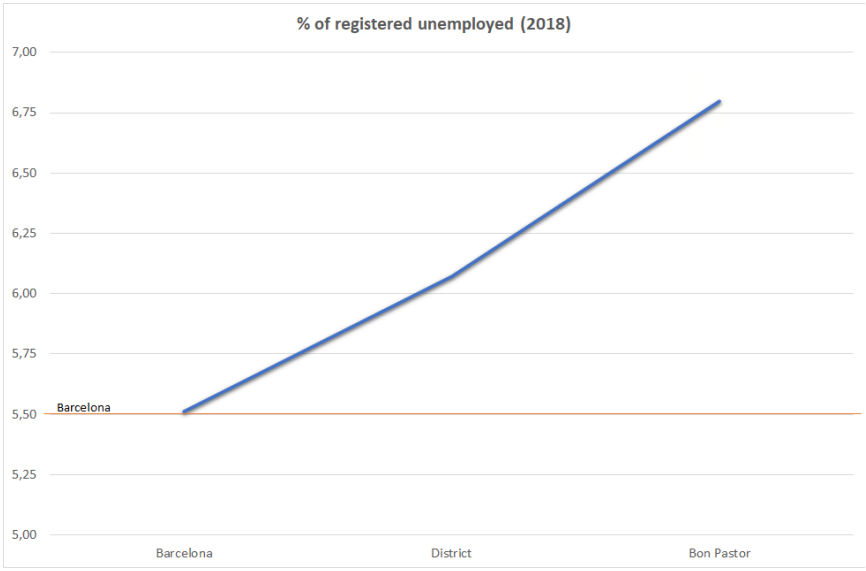

FIG. 3 % of registered unemployment. Barcelona and its metropolitan area are an eminent area of services (tertiary, quaternary and quinary), a part with high added value, and another based on "garbage" jobs. Access to education ensures better employability and therefore a reduction in the unemployment rate. (Barcelona, Sant Andreu's District, Bon Pastor) Source: Ajuntament de Barcelona

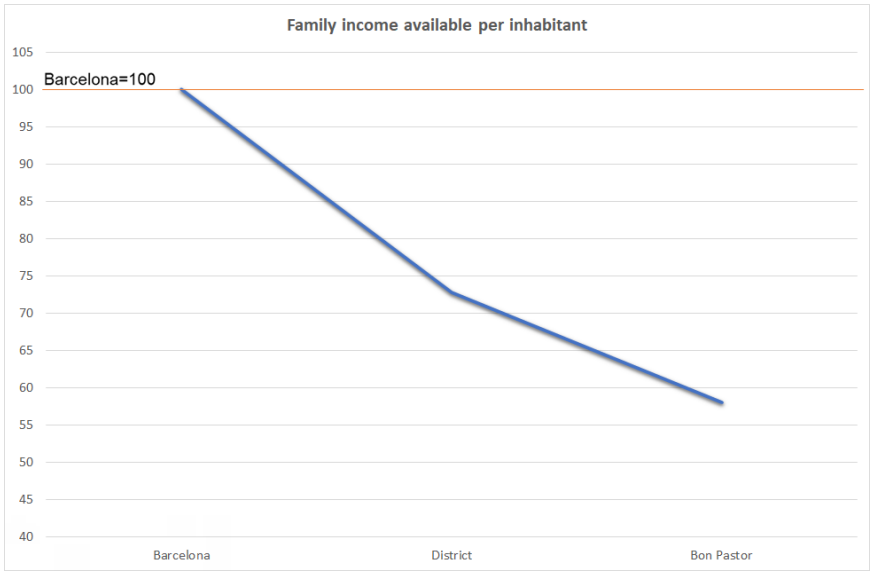

FIG. 4 Family income per inhabitant. If the level of training is related on the one hand to the risk of unemployment and on the other to the type of work and remuneration that can be achieved, it is logical that we find that the level of income is affected in this neighbourhood, almost 50 points below the 100 index for the whole city. (Barcelona, Sant Andreu's District, Bon Pastor) Source: Ajuntament de Barcelona

The employment and training policies developed by "Barcelona Activa," both in the Comprehensive Neighbourhood Plan (2009) and in the new Neighbourhood Plan (2016) of the City Council,[12] did not have a remarkable success in providing accessibility to quality employment.[13] [Fig. 5]

12 Foment de Ciutat S.A. and Ajuntament de Barcelona, "El Pla de Barris de Barcelona 2016-2020. Memòria de Seguiment" (Barcelona, 2019).

13 Nemo Remesar-Aguilar and Manuel Borja, "Promoting a Place-Based Approach in the Configuration of Local Development Policies in Spain: The Catalan Experience," *Local Economy* 29, no. 4–5 (2014): 469–85; Nemo Remesar-Aguilar, "Employment, Social Cohesion and Territory. Integrating Labour Market Policies into Urban Regeneration Processes in Catalonia: The Employment in the Neighbourhoods Case Study," in *The Art of Urban Design in Urban Regeneration*, ed. Antoni Remesar (Barcelona: Universitat de Barcelona, 2016), 27–61.

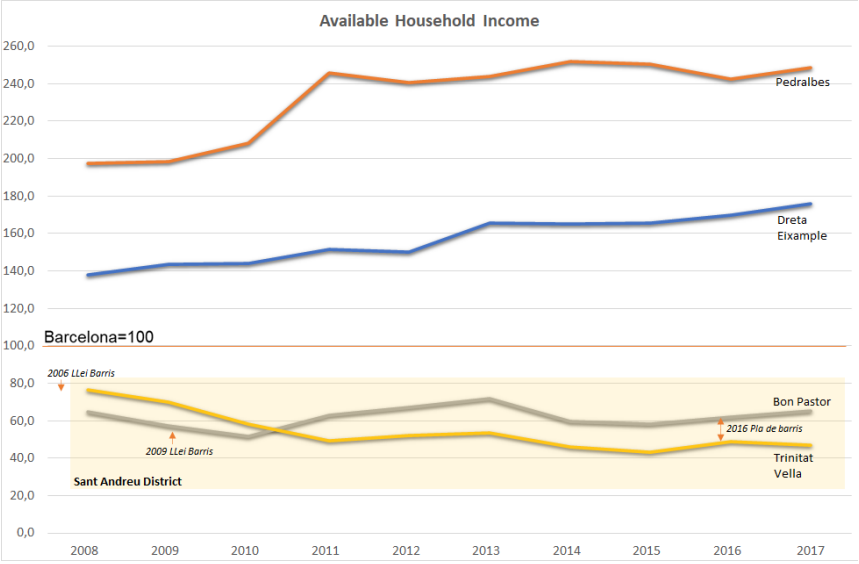

FIG. 5 It presents the evolution of disposable income in 4 neighbourhoods of Barcelona. Two in the affluent districts of the city. Two others in the District of Sant Andreu: Trinitat Vella and Bon Pastor. These two neighbourhoods hosted processes of the Neighbourhood Law and the Neighbourhood Plan. This indicator shows us two very different scenarios. While the operations of the Law and Plan seem to have an impact on the increase in disposable income in Bon Pastor, everything indicates that its impact on Trinitat has been less. The Image also indicates that since the 2008 crisis, inequalities between the different areas of Barcelona have increased dramatically. Source: Ajuntament de Barcelona

Accessibility, solidarity culture, civic remembrance

Neighbourhoods like Bon Pastor use to develop powerful self-managed networks, cultural and solidarity networks among neighbours. For example, Bon Pastor has been running for years a "*Bank of Time*", a "*Food Bank*" and a "*Sports Association*", promoted by the Association of Neighbours, along with numerous other civic association initiatives.

As mentioned above, departing from the project "*Bon Pastor a neighbourhood with future*" the City Council, through the Municipal Housing Board, begins the construction of the new buildings that replace the old houses of the 1929 estate. This construction takes place in 5 phases and today the buildings of the 4rth phase are being built. The first buildings were delivered to the neighbours in 2006, starting the staggered rehouse of residents in the old "*cheap houses*".

The Universal Forum of Cultures in Barcelona (2004) and in Monterrey in 2007, promoted the Universal declaration of Emerging Human Rights, a proposal to adapt classic Human Rights to the 21st century situation:

> "All human beings - free, equal and endowed with dignity - are entitled to more rights than just those that are recognised, protected and guaranteed. The Declaration of Emerging Human Rights arises from the global civil society at the beginning of the 21st century with the aim of contributing to the design of a new horizon of rights that will orientate the social and cultural movements of communities and peoples, and that will at the

> same time be inscribed in contemporary societies, institutions, public policies and the agendas of leaders in order to promote and favour a new relationship between the global civil society and the authorities"[14]

The statement introduces new dimensions for the concept of accessibility. It is based on the principles of "social inclusion" and the "principle of horizontality," among others. Article 5 "Recognises the right to pluralistic democracy," and in its part 3: "The right to the recognition and protection of the common cultural identity." Article 7 "Recognises The right to participatory democracy." The following articles unfolds several interesting aspects for our purpose:

- Paragrah 1. The right to the city[15]
- Paragrah 5. The right to participation[16]
- Paragrah 7. The right to public spaces, monumentality and attractive town-planning[17]
- Paragrah 9. The right to the conversion of the marginal city into the city of citizenship[18]

These new emerging rights suggest that we cannot exclusively consider "People's autonomy" from the individual dimension, but the concept must be extended to some collective dimensions. Citizens, through existing participatory channels or new channels to be opened, have the right to actively participate in the proposals and projects for the built environment linked to their daily life, from a co-production and co-design[19] perspective[20] i.e. in "bottom-up" processes.[21] Once the demands for the most basic

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14 Institut de Drets Humans de Catalunya, "Universal Declaration of Emerging Human Rights" (Barcelona: Institut de Drets Humans de Catalunya Pau, n.d.) english translation by the author.

15 *"All human beings and every community have the right to participate actively in public affairs and to enjoy a democratic administration at all levels of government."* English translation by the author.

16 *"which entails the right of all individuals and communities to participate, through effective channels, in the adoption and control of public decisions on the matters that concern them, and to challenge before the courts the decisions with respect to which they allege a right or a direct or indirect interest as grounds for their legitimation."* English translation by the author.

17 *"which entails the right to an urban setting articulated by a system of public spaces and endowed with elements of monumentality that lend them visibility and identity incorporating an aesthetic dimension and a harmonious and sustainable urbanism."* English translation by the author.

18 *"which entails the right of all individuals to inhabit quality urban areas, with a character of centrality"*

19 Claiming co-production and co-design is not something new. It is implicit in Arnstein's historic article (Arnstein 1969), the Gibson's participatory proposals in the 1970s (Gibson 1979), in the work by Sanoff (2000) or in the Latin American approach to the construction of the popular city (Takano and Tokeshi 2007)

20 Antoni Remesar, "Del arte público al post-muralismo. políticas de deocoro urbano en proceso de regeneración urbana," *On the W@terfront* 61, no. 1 (2019): 3–65; Antoni Remesar, "Co-Design of Public Spaces with Local Communities," in *The Palgrave Handbook of Co-Production in Public Services*, ed. Elke Loeffler and Tony Bovaird (Cham: Palgrave Macmillan, 2021), 335–68.

21 Tony Bovaird and Elke Loeffler, "From Engagement to Co-Production: The Contribution of Users and Communities to Outcomes and Public Value," *Voluntas* 23, no. 4 (2012): 1119–38; Tony Bovaird, "Evaluation of Public Projects and Services" (Barcelona: Universitat de Barcelona, 2010).

living conditions (housing, health, transport) are accomplished, the claim of a decent built environment and a public space for all and by all emerges as an imperative, while claiming a role for pro-active citizenship.[22]

In addition, citizens have the right to reflect on their collective past, not "writing" history, but embodying this civic remembrance in the public space as an instrument to "self-recognition" as a collective body, with the aim to empower their collective identity and facilitating the appropriation of the public space and its elements.

It is no coincidence that Barcelona, in parallel with the district's municipal archives, saw the proliferation of what we can call "civic archives," focused on preserving the social and civic memory of the neighbourhoods and their inhabitants. The existence of these "civic archives" is not at odds with the official ones. On the contrary, it would be timely and relevant to "link" both archive types, a challenge for municipal policy on "historical memory." This way the "access" to the different readings about the past would be guaranteed.

The civic remembrance project

In this context, the Bon Pastor Neighbours Association started a double working process in order to preserve their social and historical remembrance. On the one hand, the Association began to work with the City's Museum of History (MUHBA) on a project for a physical museography space devoted to popular housing. This space-museum would be located in a block of the old houses that would be preserved for this purpose.

On the other hand, the Association entered into cooperation with CR POLIS regarding the implementation of the project "Building Bon Pastor's Remembrance." The cooperation with this academic centre started with the "Remembrance Mural" experience, resulting from a citizen participation process in the neighbouring district of Baró de Viver (2005-2011) **[Fig. 6]**.

At the end of 2013, the Bon Pastor Neighbourhood Association contacted the POLIS Research Center,[23] with the intention of developing a project similar to the one carried out two years earlier in Baró de Viver. The project on "Civic Memory" of Bon Pastor started at the beginning of 2014

22 There is a widespread tendency to exclusively identify "vulnerability" with "social exclusion". It is true that vulnerability is a condition of social exclusion. In a democratic society, however, there are other ways of social exclusion. Specifically, setting aside or preventing citizens from actively participating in decision-making that affect their living environment, since as Subirats (Subirats, Joan 2006) points out social exclusion is the impossibility, or intense difficulty, of reproducing and accessing mechanisms that allow the population to develop on a personal level, we can understand that active participation in the design of the local public space , in the manifestation of identity memory in this public space, can be tools to combat social exclusion, when they also generate clear processes of social innovation(MacCallum, et alS 2009; Pradel, Marc; García Cabeza, Marisol 2018) that should place the emphasis on citizenship and the modes of participation and action to achieve these results

23 Detailed information about our research centre can be found at: http://www.ub.edu/escult/index.html and https://femlamemoriadelbonpastor.wordpress.com/

FIG. 6 Baro de Viver's Wall of Remembrance (2011). Taking advantage of the construction of an acoustic wall, we developed a participatory process so that the neighbours could capture their "memory" of the neighbourhood. The mural is 125 m linear x 4 m high and consists of the photographs provided by the neighbours in the participation process.

with some resistance from the district administration. In 2015, CR POLIS, the district of Sant Andreu and the Neighbourhood Association, signed a cooperation agreement for the development of a participatory project for implementing the Historical-Social Memory of the neighbourhood, in the public space. A long participatory process took off, based on creative workshops and neighbourhood forums, which ended in 2018 with the public presentation of a "strategy"[24] for the development of neighbourhood proposals. Participants in the creative participatory workshops, created a work program and chose 13 neighbourhood sites that had the capacity to represent the dimensions that the neighbours wanted to preserve: the neighbourhood's industrial past and present, the social movements and struggles and the most relevant aspects of the urbanization processes in the neighbourhood. The series of participatory workshops reached the conclusion that the translation into the public space of the "Remembrance" project could not reproduce the linear scheme based on images used in Baró de Viver. they rather worked on the idea of a "remembrance spatial system". The different points of the Remembrance Space System have been analysed regarding the three dimensions above mentioned (the industrial idiosyncrasy, the social movements and the urbanization processes). The spatial remembrance system would enhance certain points of the territory with socially significant value. Starting from this premise, the "laboratory of ideas" of the M.A in Urban Design, developed some

24 This working paper has suffered several vicissitudes for negotiation with the local administration. The first was the apparent collision of this project with a District and City project to implement the "City Points of Interest" (PIC), a system based on an APP and to mark the points with inserts on the pavement containing Beacons technology. As the neighbourhood project is based on a system of marks on the ground, the Administration understood that it was necessary to integrate the two projects. However, the PICs were oriented towards trade and tourism, while the neighbourhood system was geared towards "rescuing" its civic memory. The second stumbling point concerned the "sanctioning" role of the City Council's Institute of Urban Landscape and Quality of Life which, it seems to be necessary to approve (?) all projects that concern interventions on public space. Meetings with the Institute were promised, which have not been held so far. The third drawback relates to the local election cycle (2019) that involved a change of government and a reorganization of the District's organization chart. This situation led to a temporary postponement of planned meetings and a "slowdown" in activities on the "Historical Memory" of the neighbourhood - including the MUHBA project. Once the District administration was organized, initial meetings were held. And then the coronavirus pandemic arrived and all activities, meetings and discussions have been postponed because of confinement.

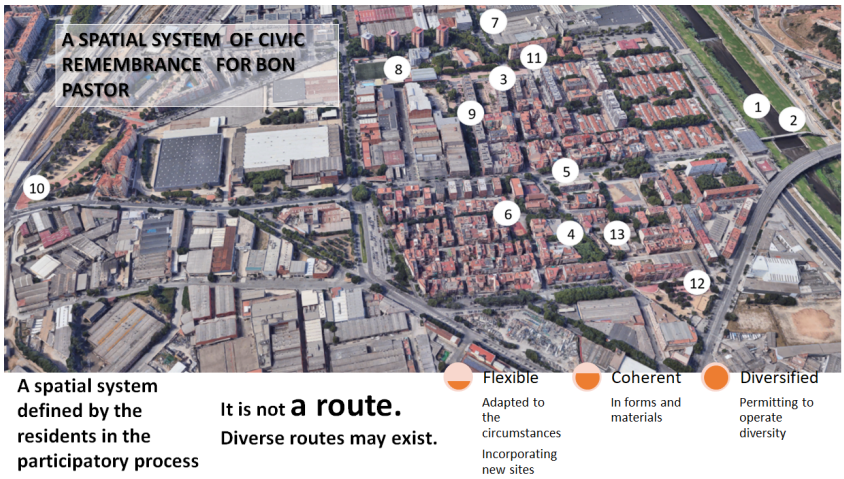

FIG. 7 Plant of the neighbourhood that summarizes the participatory process, with the 13 points of interest for the civic remembrance project. Based on Google Maps

proposals focused on the deployment of "spatial marks" on the ground, trying to avoid the multiplication of vertical signs in public space.[25] [Fig. 7]

Each of the points are marked with an intervention on the pavement, using the most widespread paving system in Barcelona[26] since the beginning of the 20th century, the so-called *panots*, pieces of 20 x 20 x 5 cm of hydraulic concrete with different forms. Several of the points also involved an intervention of public art to highlight its civic importance.

These indications on the ground were completed with the local signalling system. In addition, they could n incorporate elements such as QR code or similar, to provide augmented reality data via mobile phone. A contest among neighbourhood schools students provided an identity "marque" to incorporate into the neighbourhood signalling system. [Figs. 8-9]

In some specific places, some additional elements were incorporated such as public art works; visual improvement of the landscape and a proposal for a colour plan and welcome marks to the neighbourhood.

A particularly significant point is the location of the "museum space," in the rows of houses that will be preserved and rehabilitated, within the framework of the museography project by the MUHBA (Museum of History of Barcelona). The urbanization of the environment at the site has created a square surrounded by greenery. In the square is going to be installed a new monument, currently under study, remembering the nine victims of the bombing of Italian aircrafts in 1937 during the Spanish War.

Before the 2019 municipal elections, under the pressure of the neighbours, the District "granted"—in a gesture of "placation"[27]—the construction of

25 Javier Vergel, "Ciudad comunicación identidad participación. Hacia un programa de información urbana para el barrio del Bon Pastor" (Universitat de Barcelona, 2017).

26 Danae Esparza, *Barcelona a ras de suelo* (Barcelona: Edicions de la Universitat de Barcelona, 2017).

27 "Placation, is simply a higher level tokenism because the ground rules allow have-nots to advise, but retain for the powerholders the continued right to decide" (Arnstein, Sherry R. 1969, 217)

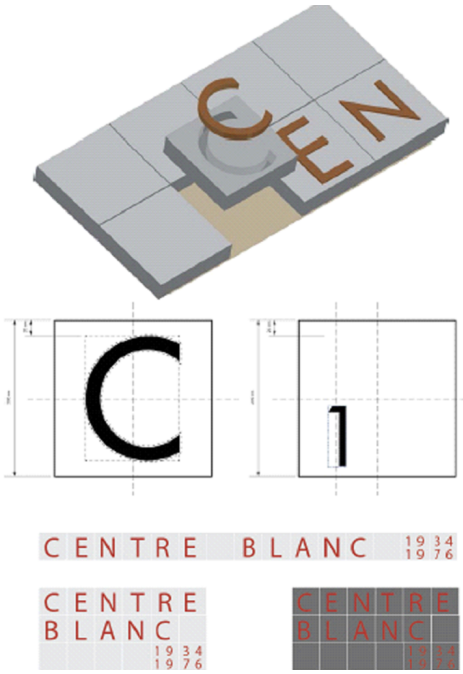

FIG. 8 Preliminary ideas regarding the use of panot as the main element to signal the points of the Space Remembrance System. Master in Urban Design (Laboratory of Ideas)

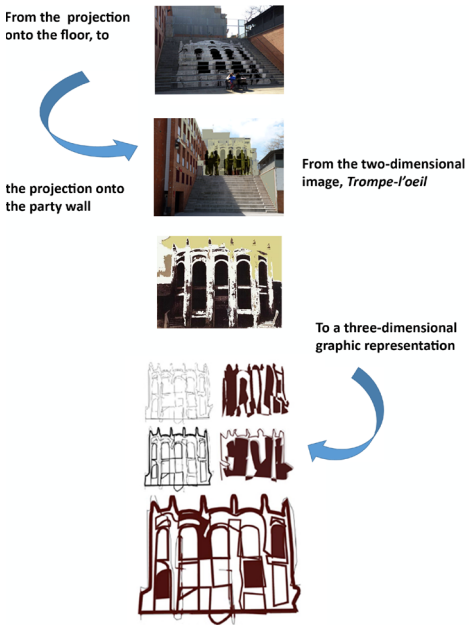

FIG. 9 The Community Centre of the neighbourhood is located in the place that for many years was the site of the so-called "White Centre", a reference for social movements. Monument preliminary study by Monica Bellido (M.A. in Urban Design)

one of the points of the system, taking advantage of the remodelling of one of the squares. The point refers to the old cultural and recreational association "La Pinya" that in the 1980s and early 1990s organized activities that today are developed by the Community Centre and the Library of Bon Pastor. [Figs. 10-11-12]

As shown in Figure 10, the point of "La Pinya" is not complete. The QR, Beacon or Visual Tag is missing, necessary to connect the physical part of the system with the Augmented Reality part.

FIG. 10 Point 12 of the system. *La Pinya*. Unveiled march 2019

Fem la Memòria del Bon Pastor

PROJECTE PARTICIPATIU

SISTEMA DE MEMÒRIA

- Riu Besòs Murs i passera
- Entorn Museu i Monument víctimes bombardejos
- Antic Centro Blanco
- Metro
- Mitgeres i Murs
- Can Sala
- Poliesportiu
- La Morera
- Ambulatori
- La Maquinista
- La Pinya
- Fàbrica Sanchís

(Fanal Cases Barates)

PROJECTE ARXIU

DOCUMENTACIÓ

HISTÒRIA DEL BON PASTOR

ALTRES PROJECTES

SORTIR

Amb el suport

Proyecto HAR2017-88672-R

Proposta d'intervenció
Nivell 1 Nivell 2

Objectiu 1
recordar l'antiga passera del riu.

Forma
fer una intervenció subtil en la barana de vidre perquè es vegin ombres en el paviment que recordin la forma de les passeres de fusta. Es planteja també la possibilitat de intervenir a mode de esgrafiat o gravat en el paviment. Possibilitat d'incloure llum led per la nit tenir una altra imatge potent.

Objectiu 2
cridar l'atenció , fer visible el barri per convidar a venir

Forma
mitjançant un perfil o relleu sobre el mur una frase poètica que faci referència al barri
(formigó o acer Corten). Es parla d'emprar el color verd o contempla la possibilitat d'un jardí vertical

Les frases recollides fins ara són:
o Bon Pastor batega il·lusió
o Bon Pastor..., atreveix-te!
o Bon Pastor està viu
o Bon Pastor és viu
o Bon Pastor acollidor
o Bon Pastor, porta de Barcelona
o Bon Pastor batega. Porta de Barcelona
o Bon Pastor és viu. Porta de Barcelona
o Somniar despert és possible a Bon Pastor
o Bon Pastor. Porta de Barcelona

Riu Besòs, Murs, Passera

Les Besossades

La Passera

fotos © Arxiu Fernando Blaya

El pont del Molinet (el dels militars)

FIG. 11

Montaje de la evolución del Bon Pastor, realizado por José A. Santamaría Concha en el Trabajo Final de Máster *"La periferia en transformación. Procesos de cualificación del espacio público. El caso del barrio del Bon Pastor"*. Universitat de Barcelona, 2018 http://hdl.handle.net/2445/122523 . Fuente: Institut Cartogràfic i Geològic de Catalunya (ICGC)

FIG. 11-12 Two screens of the web model that would be the support for augmented reality of the Remembrance System. It involves a documentation and editing activity that should be carried out from "the Fem La Memoria archive" The images come from the photo archive (more than 2,000 photos) provided by the neighbours in the early stages of the participatory process.

Fem la memòria Archive is a key part of the development of the System. In fact, signs on the ground can simply mean a change in the pavement, unless the viewer can get an extra explanation. Such explanation cannot be to add more artefacts, more elements of noise into public space. Therefore, the Strategic Plan proposes that the increase in information (AR) would be linked to a dynamic information management system (images, texts, documents, videos) using the possibilities offered by smartphones.

This archive would be sited in the space-museum of the "Cheap Houses" becoming a documentation centre about the neighbourhood and the popular housing in Barcelona. The space-museum would also facilitate the organization of exhibitions based on the documentation and studies carried out by the Archive. The first of these exhibitions has been designed but not exhibited due to the confinement during the Covid19 pandemic. [Fig. 13]

FIG. 13 Four of the 15 panels that make up the first exhibition of the *Fem la memòria* Archive. The exhibition looks at the changing aspect of the neighbourhood from the early 20th century to the 1960s.

The MUHBA's museographic policy. integrating peripheries

FIG. 14 Museography decentralized plan of the MUHBA for the North of Barcelona. The thematic axes: Water, Industry, Popular housing

For a few years now, the Museum of History of the City has initiated a policy of "decentralization" of its exhibition spaces, using, for this, the conversion of old industrial enclosures out of use. The central idea of this policy is to territorially balance the museum spaces of the city, excessively concentrated in the Central (Ciutat Vella) and Western areas of the city.

Water,[28] Industry,[29] Work and Popular Housing[30] are the axes on which the new exhibition spaces of MUHBA are based.

> "A part of the "museum" space will be devoted to reproducing the physical environment (furniture, household goods ...). Another to a permanent exhibition about popular and

28 The Northern Zone has historically been linked to the provision of a good as necessary as water. Since the time of the Romans an important part of the provision of water to the city came from the aquifers of the Besòs River. In the Middle Ages the waters of this river watered the fertile fields of the North and East of Barcelona thanks to the construction of the Comtal ditch. A ditch that would eventually be used to provide driving force to the first manufacturing and industrial facilities.

29 This area has also been the large area in which industrialization took its body in Barcelona from the nineteenth century until well into the twentieth century. Even today, Bon Pastor's neighbourhood cannot be understood without the existence of the last large industrial estates located within the city limits.

30 Since the beginning of the twentieth century this area has been a good example of the transition from the rural to the urban (Lefebvre, Henri 1970). Initially, buildings were related to the deployment of the various Economic House Laws, including the two large estates of Bon Pastor and Baró de Viver in 1929. Subsequently, new residential estates, with block building typology, have shaped the landscape since the 1950s. Buildings for workers and popular classes under the different laws developed during the Franco`s regime and Early Democracy in Spain

FIG. 15 Project for the new facility t in the cheap Houses (museum space). Ricard Mercadé -Aurora Fernández Arch. (2016-2018)

> working-class housing in Barcelona. In addition, a conference room. Neighbours, like actors of the facility, demand to manage an archive on the popular and working-class housing. This archive would produce the web content to virtually increase the information of the sites product of the participatory process. The archive, should manage the contents of an information system in the metro station hall consisting of large screens emitting different types of contents and that is intended to negotiate with TMB, the municipal public transport company of Barcelona"[31]

The archive within the museum space will be the practical link between the two neighbourhood remembrance projects: historic and civic remembrance [Fig. 15].

Conclusion

When the problems of physical accessibility to general facilities are relatively well solved; when demands about public services are met (according to the current Welfare State), then, the neighbours of a territory begin to worry about other dimensions of accessibility. The neighbours challenge these dimensions, eminently symbolic, to be able to wield their right to understand and express "where they come from and where they are going", their right to write and capture their memory, to organize, manage and disseminate the documents that underpin this journey to civic memory. They also claim access to the design of the space where their daily life is deployed, not as "actors," but "agents" in the production of this space

31 Angosto, "Mapping the History of a Territory: Bon Pastor (Barcelona) Social Remembrance and Heritage Project."

and a clear opposition to be considered mere “users” of space, goods and city services.

Co-design and co-production means articulating new ways to citizen participation, a way that exceeds the levels of the consultation to enter the dimensions of the “creation” of public spaces and organizational routes that allow a satisfactory level of self-management of the symbolic dimension by the citizens. A new attitude on the part of the local administration is needed, understanding that this “accessibility to the symbolic” is a part of the set of actions against social exclusion.

The project at Bon Pastor has not been completed due to various reasons expressed in the text, but it marks a path for social innovation aimed at allowing citizens to exercise the right to the city.

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PRACTICES

Co-Designing the Accessibility: from Participatory Mapping to New Inclusive Itineraries Through the Cultural Heritage of Bologna

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ABSTRACT

Accessibility is one of the greatest challenges facing Cultural Heritage sites today. Yet, experiencing culture means being part of our society, as it brings people together, and it should be universally granted. Departing from a participatory process focusing on engaging local stakeholders to regenerate the University District by promoting its Cultural Heritage and public spaces, this paper analyses how the City of Bologna has been able to bring accessibility at the centre of its development programme. Starting from the living lab (U-Lab) created within an European funded project (ROCK), Bologna is working to remove any physical, sensorial and cultural barrier that could impede or discourage the access to the area. In doing so, all the institutions and actors involved relied on the co-design method to create a service with the ultimate aim to make the University area a Cultural District universally accessible.

KEYWORDS

Accessibility, Co-Design, Citizens Engagement, Cultural Heritage, Participatory Mapping

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FIG. 1 Public project release and testing - Source: Photograph by Margherita Caprilli for Fondazione Innovazione Urbana 29/09/2020, Piazza Rossini

1. Introduction

According to the experts, more than a third of the European population is represented by Persons with a Reduced Mobility (PRM) who frequently encounter physical barriers when they move around public places or they use public transports.

Moreover, if we also consider the temporary discomfort conditions, as heavy baggage transport, rehab after surgicals or diseases, or a travel experience in a foreign country, we can deduce that each of us could experience difficulties connected with a reduce mobility condition. We could hence say that barriers are something frequent in everybody's life but the way and the easiness a person have to go beyond them, makes the difference between one another.

In this context, it is fundamental to recognise the importance to involve people in co-design interventions, services and policies to concretely make the urban context, and all its elements—Cultural Heritage included—universally accessible.

This vision found a fertile ground on Bologna, as in the last 5 years it has successfully trialled an urban innovation model based on circular subsidiarity and civic collaboration: the "collaborative city". This means Public Administration governs not only on behalf of citizens, but also with citizens, basing its policies on the two concepts of "City as commons" and citizens as a great source of energy, talent, resources, capabilities, knowledge and ideas in support in urban regeneration [Fig. 1].

Accessibility became part of this vision and a central node for the Public Administration in such a way that the City of Bologna is working "to promote the accessibility culture and to guarantee the equality and participation of persons with disabilities". This effort finds its climax in the application for the 2021 Access City Award, with the aim to promote a worldwide recognition of Bologna as a universally accessible City thanks to the active collaboration between Public Administration, citizens, associations, and researchers through the Universal Design principles.

2. Cultural Heritage Accessibility and inclusion of persons with disabilities in the urban environment

The principles of Universal Design and the 2006 UN Convention on Disabilities Persons Rights, define an Accessible City as the one that "take appropriate measures to ensure to persons with disabilities access, on an equal basis with others, to the physical environment, to transportation, to information and communications, including information and communications technologies and systems, and to other facilities and services open or provided to the public, both in urban and in rural areas". However, accessibility does not refer only to infrastructure but has to do also with services, facilities and goods, engaging in activities and partaking in experiences. All these are interacting and can give a decent degree of autonomy and security to the individual, always in relation to the environment (natural, built or virtual). Accessibility should also apply in all[1] fields so as to ensure its generic effectiveness, including the access to Cultural Heritage (CH).

A wider definition of the term Accessibility associated to CH includes the initial prerequisite for anyone to be able to reach and appreciate sites and activities of collective interest; culture as a good, situation and activity imbued with symbolic value; and heritage as the percolation of past cultural elements into epoch defining legacy. Accessibility to culture and heritage thus involves a physical moment of material access to infrastructures and sites, a perceptual moment involving an understanding of the symbolic meanings inherent in cultural products and activities, and a culminant appreciation moment when such meanings are appropriated, consciously accepted or re-presented and re-worked by those in contact with them.[2] Kawashima underlines how cultural institutions and CH should be inclusive and accessible to all people in society and how accessibility and inclusion of disabled people in CH resources and institutions can be achieved through outreach. Outreach refers to the process

1 Antonia Tzanavara, Museum and People with Disabilities: Accessibility - Education - Social Inclusion. (in corsivo!) Ph.D. thesis, University of Aegean, Corinth (2013). Available at: http://thesis.ekt.gr/thesisBookReader/id/28536#page/1/mode/2up

2 Alex Deffner et al., "Accessibility to Culture and Heritage: Designing for All", *Proceedings of the AESOP*, 2015.

of taking[3] CH resources away from their usual location to areas where the audience has limited access. Reaching out to different social groups helps to reduce social exclusion and increase accessibility for vulnerable groups in society. Museums are important agents of cultural outreach because they are able to reach out to various social groups such as deaf people through learning programs, exhibitions, and experiences.[4] A comprehensive design of accessibility modalities to CH should hence take into account the needs of all citizens, including citizens with disabilities, enabling them to participate since the initial project phase and prosecuting with the co-design of the service/good through participatory methods.

3. Accessibility in Bologna

According to the Italian Institute of Statistics (ISTAT), in 2013 the City of Bologna hosted 21.200 persons with disabilities, which represents a 5.8% of the entire population with more than 6 years. Women represent 7.5% of the total while men a 3.9%. In 2018, it's been estimated an increase of 100 units bringing the total number of persons with disabilities to 2.300. Among the population group having more than 80 years, there have been 12.300 persons with disabilities, and this data would probably increase by 2033 when people with disabilities will probably be 60.000 in the entire Metropolitan area, of which 22.600 in the Municipality of Bologna.

If we refer to the cultural and socio-economic context of the City, Bologna has always been characterised by multiple elements and its success relies also on its capability to transform differences into a value.[5]

For what concerns its urban planning, it was built long before "equal access" became part of the architect's vocabulary. But being a Medieval city it is both a value and a restraint to its effort to become a resilient and accessible city and here lies the challenge: working towards guaranteeing the universal access to its cultural heritage going beyond not just physical but communication and strategic use barriers, while not losing its peculiarities.

Therefore, making its incredibly vast CH accessible to everyone is being one of the first attempts of the ROCK project, which started from a number of experimentations on the University District to enlarge the vision to the entire city centre. The main goal was to increase the common knowledge

3 Nobuko Kawashima, "AUDIENCE DEVELOPMENT AND SOCIAL INCLUSION IN BRITAIN: Tensions, Contradictions and Paradoxes in Policy and Their Implications for Cultural Management", *International Journal of Cultural Policy* 12, no. 1 (March 2006): 55–72, https://doi.org/10.1080/10286630600613309.

4 Panagiotis Kosmas et al., "Enhancing Accessibility in Cultural Heritage Environments: Considerations for Social Computing", *Universal Access in the Information Society* 19, no. 2 (June 2020): 471–82, https://doi.org/10.1007/s10209-019-00651-4.

5 Leonardo Tancredi et al., "Memorie di uno spazio pubblico: Piazza Verdi a Bologna", CLUEB, 2011, 7–195..

of CH while searching for new approaches to change the accessibility paradigm.

4. The ROCK project

Culture is one of the most important elements of Bologna's reputation in the world: the city's offer is multifaceted and ranges from music concerts, cinema festivals, and performative art exhibitions. The decision to position the city as one of the epicentres of contemporary culture rises from the acknowledgement that culture is both a competing market and a chance that should be given to everyone to enrich his existence.

The spearhead in experimenting innovative solutions that have a tangible impact on everyday life is the ROCK project - Regeneration and Optimisation of Cultural Heritage in Creative and Knowledge cities. Co-funded in the framework of EU R&I programme HORIZON 2020, with a budget of nearly €2 min for the city of Bologna, the main goal of the project—which is also being replicated in other European cities—is to increase the perception and to widespread the image of the city and its heritage, as a common good to which every citizen must have access, contributing to its knowledge, governance, conservation and transformation. Locally, the project is managed jointly by the Municipality of Bologna, the University of Bologna and the Foundation for Urban Innovation, through an innovative and balanced relationship between political and educational institutions. The cooperation between the city and its university also resulted in the creation of a joint ROCK office, where staff from the three entities work together.

The same collaborative approach is the pillar upon which ROCK is founded, based on the idea that historic city centres are extraordinary living laboratories where all stakeholders can share their needs, share proposals and suggestions, and co-design solutions, participating in a common effort to address and solve the challenges faced by the city. The most challenging objective pursued by the project is to transform historic city centres characterised by social conflicts and decay in unique and powerful engines of regeneration, sustainable development and economic growth for the whole city. Specifically, at the local level ROCK aims at regenerating the University Area (U-Area) of Bologna, nestled in the city center and characterised by different communities with different identities and needs that, often, caused tensions with one another and the institutions, naimly the Municipality and the University.

Project actions reflect the way Bologna has been working for years in defining public policies and in realising interventions involving citizens as key actors in public policies. Therefore, the entire University zone was transformed into an open-air Living Laboratory—the U-Lab—encouraging participatory practices to co-design actions of cultural regeneration, such as the greening of city squares, the mapping of urban areas to improve their

accessibility or the re-design of public lighting. Project strategy reflects the main pillars of development policies of the city in the field of sustainability and inclusion, considering Culture and Cultural Heritage as moving engines fostering welfare and economic growth. In the meantime, it also acknowledges the goals fixed by both the Agenda 2030 and the Urban Agenda as pillars and fundamental source for6 citizens enrichment, due to their key contribution to the achievement of sustainable development and accessibility.

In fact, the objectives pursued by the ROCK project, and U-Lab in particular, could be related to the 17 SDGs in several manners. First of all, by supporting accessibility with different tools, such as sign language or tools for visually impaired people, mapping of physical accessibility to CH places, and opening places which are usually closed or not accessible. Secondly, the ROCK project aims at reducing inequalities and considers cultural participation as a key factor for promoting the inclusion of all people. To this end, it provides tools to foster participation to cultural life and capacity building activities, opening of hidden treasures, promoting alternative/public use of private spaces, foster innovation through culture and tools linked to CH as analysis of people flows, tracking of accessibility barriers and threats, virtual/augmented reality applied to CH, educational interactive video games for schools and young people especially dedicated to discover hidden treasures of the city, and sensors monitoring indoor and outdoor environmental parameters. The project works to build inclusive institutions where citizens are concretely enabled to participate in the design, implementation and evaluation of actions testing practices which could feed the definition of cultural policies and programmes, through the Living Lab approach. Finally, it widely contributes to make cities inclusive, safe, resilient and sustainable by working on tangible and intangible CH and fostering local sustainable development.

4.1 U-Lab

The presence of the University has always been a key factor for the city of Bologna, fostering culture, creativity, new ideas and social, intellectual and economic growth. The life of citizens and students has always been closely intertwined, since the main University district is located in the very heart of the city centre creating a hybrid place where different communities (students, residents, tourists, business owners) coexist and try to face the respective needs and challenges. The area has a very high concentration of heritage sites (porticoes, libraries, the main Theatre, several important museums, including 11 University Museums and 5 Civic Museums plus 2 Cultural production systems, the Academy of Fine Arts, the Conservatory of Music, a network of squares, courtyards and historical

6 Urban Agenda for the EU. Pact of Amsterdam, 2016, available at https://ec.europa.eu/futurium/en/system/files/ged/pact-of-amsterdam_en.pdf

roads and several historic buildings) providing many opportunities, but it is also challenging as different communities are passing through the same public realm without actually engaging in any interaction or even producing conflictual situations.

Even though University and city life have always been influencing each other, students and citizens still represent two separate populations coexisting in the same space and creating a city in the city, often considered a no-entry zone characterised by conflicts and decay. Thanks to its innovative approach, and the declared aim to involve a large ecosystem of stakeholders, ROCK gave the City the opportunity to recognize and strengthen the specific identity of the U-area as a cultural, creative and sustainable district by improving safety, turning social conflicts into new opportunities, increasing the accessibility of the area for all, attracting visitors and tourists, entrepreneurs and private investments. The main local goal, in fact, was to develop co-designed cultural and sustainable initiatives in this area, to create ownership over the Zamboni District, empowering both students and residents to regenerate the area through culture, and to test a wide set of technologies to increase the potential of the area. The approach was systemic and aimed to not overlap but to synergically intertwine with cultural initiatives in the Zamboni district and other initiatives previously developed by the city or by formal and informal institutions. By combining conservation of cultural heritage, innovation and environmental protection, ROCK in Bologna developed shared actions between those who live, those who attend and those who animate the U-area, mixing visions, knowledge and skills. To face the challenge, FIU together with the Municipality of Bologna, the University of Bologna, and Fondazione Rusconi, provided the basis for the creation of a Living Lab, U-lab. The main reason behind the development of LL methodology was a perceived necessity to involve a variety of stakeholders in filling gaps between technology ideation and development on the one hand, and market entry and fulfillment on the other.

The term Living Lab (LL) usually refers to a variety of local experimental projects of a participatory nature. They are user-centered, open innovation ecosystems based on a systematic user co-creation approach in public–private–people partnerships, integrating research and innovation processes in real life communities and settings. They focus on a multiplicity of ingredients:[7] they relate to the subject they focus on, which has to be placed in a real-world setting in which multiple stakeholders from multiple organizations and expertise interact. They can provide a "demand - driven innovation" approach by engaging all the stakeholders involved in a specific process and across multiple phases, generating a flexible ecosystem. Users also play an active role as co-innovators in order to

7 Ana Garcia Robles et al., "Introducing ENoLL and Its Living Lab Community", *European Network of Living Labs*, Brussels, 2015.

create, prototype, validate and test products, services, systems and technologies in a real-life setting. Finally, the research setting is fundamental in facilitating the multidisciplinary dimension to achieve the LL's goals and a key characteristic is the collaboration within physical and virtual spaces of interaction in order to create the desired outcomes.[8]

Hence, following the above prescription, U-Lab was born in 2017 as a hub for collaborative practices targeting the University district of Bologna. Its main goal was to link different expertise and sectors to work together on the regeneration of the entire area, developing new ideas and experimenting new methods to use public spaces and services. Through U-Lab, Bologna launched a season of observation, conception and co-production involving the direct protagonists: students, residents and stakeholders active in the area. Co-design represented the core method on which the whole process was based, from the analysis of the spaces to the validation of the solutions co-designed with the stakeholders. Participants have hence been invited to actively participate to explore the area with the aim to highlight criticalities and characteristics of the physical space. They also collaborated in underlining the main themes to be faced and the different approaches to rely on with the final goal to give everyone a voice and to respond to all the different visions characterising the area.

U-Lab actions started with a mapping of the local stakeholders. Then, to experiment direct actions and events in the area, but also to create new uses, U-Lab launched an open call for proposals targeting associations, collective of citizens, informal groups to propose activities, initiatives and events. The call received 47 proposals. The 16 winners animated the cultural and public spaces of the Zamboni District during the spring 2018 with 60 experimental events.

In the first months of 2018, a series of public meetings and workshops with stakeholders were held to ease the dialogue between different communities and to highlight their necessities and perception on the area. The meetings focused on specific themes of analysis and on the places where implementing the actions, and were aimed to make people focus on their needs [Fig. 2].

The process included a series of thematic meetings, held from January to February 2018 and open to invited participants. They focused on accessibility—considered as physical, cultural, and relational accessibility, and as a necessary element to ensure inclusiveness and personal security—sustainability—with particular attention to climate change and resilience issues—and collaboration for new productions - as a mean to increase the

8 Steen K.,van Bueren E., Urban Living Labs: A Living Lab Way of Working, AMS, Delft University of Technology, (June 2017)

FIG. 2 Workshop by MUVet in partnership with Unione Italiana dei Ciechi e Ipovedenti - Source: Photograph by Margherita Caprilli for Fondazione Innovazione Urbana 17/04/2018, Teatro Comunale

activation of new partnership (being those PPP, including associations, formal and informal groups...), and specific areas, namely Scaravilli Square, Rossini Square, the area surrounding the Municipal Theater, and Via delle Moline.

A number of workshops have been held in the area to further analyse the potential benefit deriving from the use of technologies applied to the urban environment (lights, sounds, greening interventions, innovative devices to be installed in the area...).

This phase promoted dialogue between some of the most important local stakeholders having specific skills or competencies on the topics discussed, and citizens with disabilities whose participation was sought from the beginning of the process. They mainly pertained to the following categories:

- Institutions;
- University and Research;
- Associations and Third sector;
- Communities (formal and informal) of citizens and students;
- Enterprises and connected associations.

U-Lab has eventually constituted a first step to define a process of mutual learning to highlight objectives and prioritise strategic lines of adaptive actions and political orientation.[9] It enabled the participation of stakeholders with the aim to connect the traditional cultural functions of the U-Area,

9 Gamze Dane et al., "Participatory Mapping of Citizens' Experiences at Public Open Spaces: A Case Study at Bologna Living Lab", in *REAL CORP 2020: Shaping Urban Change. Livable City Regions for the 21st Century: Proceedings of 25th International Conference on Urban Planning, Regional Development and Information Society, Wien, CORP–Competence Center of Urban and Regional Planning*, 2020, 645–54.

with spaces for interaction, collaboration and co-design of new products and services. The overall objective was not to provide an exhaustive solution for regenerating the entire U-Area, but to outline some discussion points, carry out experiments and construct a medium-long term vision oriented to guide the implementation of transformative actions in the historical centre.

4.1.1 A roundtable focused on accessibility

The thematic meeting on Accessibility has been organised following a specific methodology and a shared work, and saw the participation of about 50 people. During the plenary phase that opened each of the thematic meetings, participants have been instructed on the contents of a specific dossier focused on the U-Area. Through maps and data analysis, the dossier gives an overview of the projects implemented in the area as a source of inspiration for the

participants and it specifies the demographic characteristics of the U-Area declining each of the three themes according to different visions.

As for almost all the events organised within U-Lab, the meeting focused on accessibility has been planned to be accessible also to person with disabilities, by providing:

- accessible location with no architectural barriers;
- LIS translations (the Italian Sign Language for thieves);
- real time subtitles (respeaking);
- previous transmission of all the materials on a format compatible with the software used by blind and visually impaired persons.

First of all, participants have been requested to enrich the definition of Accessibility described within the ROCK project as "the chance and level of access to different urban areas — namely public spaces, cultural institutions and contents, university buildings and learning events, transports, services, community life, technologies, and commercial places — and strictly connected to the security issue as a place which is not considered safe is logically not an accessible place."

In particular, accessibility has been analysed according to different perspectives: physical accessibility, cultural, interrelational, and as an element capable of increasing personal security and inclusiveness. During the meeting, speakers having a specific knowledge on the accessibility theme, or the area, shared their view and contributed to the discussion. The second phase of the meeting has been characterised by a 1 hour working group session made up of 10-15 people, under the coordination of a facilitator. Participants analysed the U-area context with respect to accessibility, trying to create a unique definition of it, and to highlight criticalities and opportunities deriving from discussing the topic. One of the

output of the whole discussion was the creation of specific guidelines to strategically manage the future transformation of the area.

The results of the process entailed the definition of guidelines and proposals to overcome the criticalities highlighted by the participants to the process, mainly:

- personal safety to be guaranteed both in public and private spaces;
- autonomy to move and self orientate;
- the chance to take advantage of culture as an instrument to communicate, to increase personal knowledge and to enjoy cultural heritage at the large;
- a way to foster dialogue, and as a tool to access, and participate, to decision making and participatory and democratic processes.

4.2 U-area for all: improving accessibility through collaborative design methods

As a result of the roundtable discussion on accessibility, the second phase of U-Lab focused on the implementation of specific activities and foresaw a deep and concrete contribution by technological partners. To this end, in March 2019 FIU promoted U-Area for all, a call for proposals to prototype and experiment concrete solutions to increase accessibility to the area and, on a wider basis, to the whole historic centre. The call resulted in a medium-term process to experiment a guided tours service which should be inclusive and easily accessible to both tourists and people who live the area on a daily basis.

The winning team gather together project managers having a specific expertise on physical, cognitive and hearing disabilities, visually impaired necessities, simplified languages, accessibility to museums and cultural heritage, the relation between dance and artistic language, and come from local associations, namely Accaparlante CDH, Gualandi Foundation, Cavazza Institute for blind people, La Girobussola Onlus and MUVet. The co-design phase of U-Area for all focused on both citizens and users of the area and involved them since the very beginning of the process following the guidelines dictated by the co-design methodology: "One way to help design thinking diffuse throughout an organization is for designers to make their clients part of the experience [...] We find that we invariably get much better results when the client is on board and actively participating."[10] [Fig. 3]

To this end, the process started with a research that concretised in two different co-design meetings to define as precisely as possible the needs of the final users. To this end, FIU proposed "personas" as a co-design tool.

10 Tim Brown and Barry Katz, *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation*, vol. 20091 (HarperBusiness New York, NY, 2019).

FIG. 3 Urban exploration "Carotaggi" - Source: Photograph by Margherita Caprilli for Fondazione Innovazione Urbana 18/06/2019, Piazza Re Enzo

A "persona" is a fictitious user described with basis in data. It requests to use everyday experiences of the users and their needs as a starting point when developing new products. The method includes representations of the users and it leads to the inclusion of the users' perspective in all aspects of the co-design process. The method has been adapted to the specific case and it resulted in the creation of 6 personas working with cultural heritage, 11 visitors and 6 operators who have been synthesized in 6 reference figures.

Afterwards, the co-design team developed a research on the cultural heritage located in the pilot area, focusing on mapping activities, including crowdmapping, of the accessibility level of the main cultural buildings located in the U-Area, and the viability of public places. Further explorative and mapping activities have been conducted using non conventional methods to study the perception of people of the surrounding environment: dance and performative arts became exploring tools and a support to traditional technologies, allowing people having different levels and types of disabilities to connect to the public places [Fig. 4].

Data collected on the perception of people participating in the mapping and exploration activities, allowed the team to design a preliminary tour proposal focused on avoiding architectural barriers and locations reported by the participants for causing discomfort. In contrast, places providing positive sensations have been highlighted.

The project development benefited from a divergence and convergence

FIG. 4 Urban exploration "Carotaggi" - Source: Photograph by Margherita Caprilli for Fondazione Innovazione Urbana 18/06/2019, Piazza di Porta Ravegnana

phase: if the first corresponds to problem solving and represents what drives the researcher toward solutions, the objective of divergent thinking is to multiply options to create choices.[11] A number of explorations were conducted later, together with detailed mapping activities involving persons having different types and levels of disabilities, after a preliminary selection of the contents mapped in the research phase. This allowed researchers and technicians to collect more and more data useful to effectively finalise the co-design of inclusive and universally accessible paths. The process did not result in the direct removal of architectural barriers but it included the design of a service made by two guided tours: one focusing on the main historical and artistic attractions, and the other centered on the academic and scientific heritage. Both the tours include:

- a route with no architectural barriers specifically designed for people having physical disabilities or forced in a wheelchair. The itinerary description highlights points that could be critical for blind people and useful indications for move around autonomously;
- points of interest and the level of accessibility for the three main disability categories identified, namely visual, auditory and physical;
- a description of the itinerary and the cultural heritage contents encountered during the tour translated using a simplified and accessible language.

11 ibid.

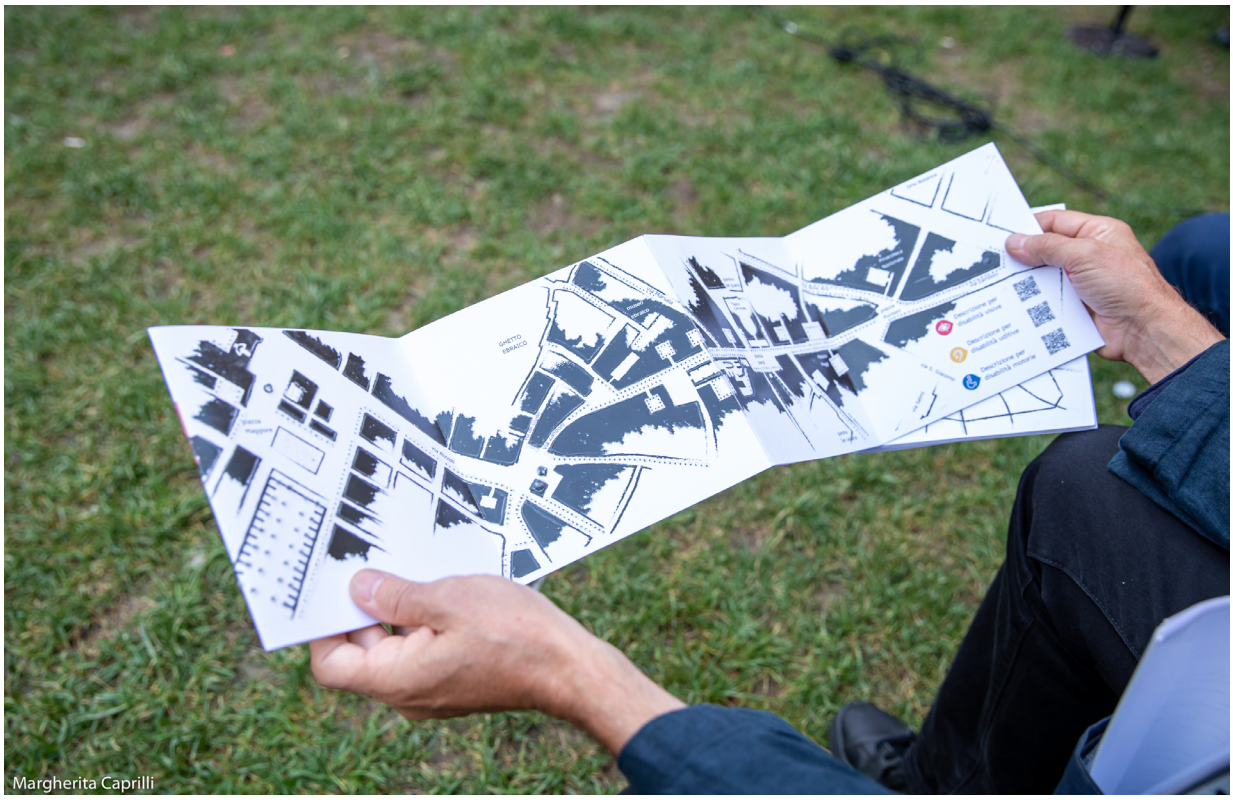

FIG. 5 Paper guide - Source: Photograph by Margherita Caprilli for Fondazione Innovazione Urbana 29/09/2020

GIS cartography as a tool to improve the knowledge and to allow the construction of a cognitive framework useful as a starting point for activities concerning cultural heritage, is not new and it has already been used with success[12]. To be efficient, it must be flexible enough to meet the needs of the different social actors in heritage studies such as urban planners, policy makers, schools, universities, researchers, commercial actors, and citizens. As an example, a territory map with a complete[13] catalogue of cultural heritage could easily be incorporated in the work of protection and management, such as urban and territorial planning instruments and civil protection programs. The issue is timely because several factors threaten the conservation of the cultural and rural landscape in the Italian countryside.[14]

The last phase of the Bologna U-Area for all process, involved Bologna Welcome, the official tourist agency of Bologna, and a group of touristic guides who provide their expertise for defining the tours. They also took part in a series of pilot tests with three groups of disabled and non-disabled persons. Two leaflets have been produced to support the promotion of the guided tours. They both include an embossed map of the suggested itinerary and will be available on a digital and printed version. The leaflets

12 as in the case of Cancellara (Basilicata, Italy)

13 Marilisa Biscione, Maria Danese, and Nicola Masini, "A Framework for Cultural Heritage Management and Research: The Cancellara Case Study", *Journal of Maps* 14, no. 2 (13 November 2018): 576–82, https://doi.org/10.1080/17445647.2018.1517699.

14 Maria Danese, Giuseppe Las Casas, Beniamino Murgante, "The Periurban City: Geo-Statistical Methods for Its Definition", *Urban and Regional Data Management*, 2007, 473–85.

have been designed to be accessible autonomously by people with disabilities and contain descriptions and focuses on the cultural heritage that could be accessed by Qr Codes.

4.2.1 Using technologies as a tool to ameliorate urban accessibility

Technologies have been a consistent part of the ROCK project and have been specifically fundamental to map the U-Area. On April 2019, the Foundation for Urban Innovation, in collaboration with the Eindhoven University of Technology (TU/e), organised a participatory mapping finalised to make up most of the spatial local knowledge, paving the participatory part in planning and policy-making, where citizens can take an active role in the discussion of their environments.[15] This represented a first general exploration of the area to highlight the main barriers impeding a universal accessibility of the District and its cultural heritage while valorising artistic and historical elements and the emotional perception of public spaces. To this end, TU/e made available a GPS device to track people flows and to register and geocalise participants' feedback on specific points of the area, with the support of a questionnaire.

During the data collection 42 people used the GPS loggers which enabled gathering their objective experiences. However, only the data of 36 respondents were available via geo-survey which enabled gathering their subjective experiences and background information. According to the geo-survey, 47% of the respondents were female while 53% were male. 56% of the participants were between 18 and 30 years old, 17% of them were between 31 and 50 years old and 37% of them were 50 years and older. Regarding their occupation, 44% of participants were students, 33% were employed and 23% were retired.[16] The number of participants allowed to track a sufficient quantity of itineraries and places within the pilot area, while furnishing a wide variety of reactions in line with the different characteristics of the participants. According to a report elaborated by TU/e and the City of Bologna "42 people used the GPS loggers. On average, their visits lasted 76 minutes. On average 11.2 minutes were spent at Piazza Scaravilli, where the experiment started[17]. This was followed by Giardino del Guasto, Piazza Verdi and Piazzetta Molinari pradelli. On these public open spaces (POS), participants spent on average 6 minutes. In addition to this, the most visited POS was Piazza Scaravilli as all participants started the experiment at that location. This is followed by Piazza Verdi,

15 Cali Warner, "Participatory Mapping: A Literature Review of Community-Based Research and Participatory Planning", *Social Hub for Community Housing, Faculty of Architecture and Town Planning Technion, Cambridge, Massachusetts: Massachusetts Institute of Technology*, 2015.

16 Dane, G. Z., Derakhshan, S., Ettefagh, T., Massari, M., Gianfrate, V., & Bigi, M. Participatory mapping of citizens' experiences at public open spaces: a case study at Bologna living lab. In Proceedings of 25th International Conference on Urban Planning and Regional Development in the Information Society GeoMultimedia, 2020 (pp. 645-654)

17 ibid.

Piazza Puntoni, Piazza Rossini, Giardino del Guasto, Piazzetta Molinari Pradelli and Piazza di Porta Ravegnana. The thicker lines represent the higher frequency of visitation. According to Figure 4, Via Zamboni, Via delle Belle Arti, Via S. Giacomo, Via Marsala, Largo Respighi and Via del Guasto were the routes that have been taken the most by the participants.

In total 273 subjective experiences were registered. Looking at the feelings of participants at point of interests (POI), 80% of subjective experiences were positive (interesting, fun, joy, inspired, relaxing, surprising) while 20% of them were negative (confusing, disgusting, irritating, boring, fear). Most feelings were registered at Via Zamboni, Piazza Verdi and Piazza Scaravilli. These places can be considered as the most feeling triggering places for participants. At these feeling triggering locations, people were also asked to report the issues relating to accessibility, dirt, smell, neglect and safety. Each participant could report more than one issue at the location. In total 106 accessibility, 53 dirt, 21 smell, 75 neglect and 28 safety problems were registered. These problems were mostly registered at Piazza Verdi and Piazza Scaravilli. One interesting finding is that although participants had positive feelings at a certain location, they still reported problems/issues.

The combined use of technologies, participatory methods targeting the final users and a real-life scenery, have been fundamental to co-design a service balanced in such a way to meet real needs and to increase a universal accessibility of the U-area. At the end of the process, technologies have been specifically considered also as a tool to boost the autonomous access to contents by city users. These contents are now available also in the form of an App, BOforAll, just developed by the Municipality of Bologna, which aims to illustrate the accessible itineraries of the U-area and the center of Bologna [Figs. 6-7].

To complete the system of technologies, in autumn 2020 tactile maps were installed in Piazza della Mercanzia with the aim of providing blind citizens and city users with information about the urban shape of the historic center and its characteristic elements (such as towers and historic arcades).

5. Conclusions: the gains of accessibility

The U-Lab experience set the basis for a permanent urban laboratory, able to define adequate spaces for listening, narration, representation and production of new urbanity for the university area and consequently for the historical centre. It allowed local stakeholders to shed light on their necessities and the criticalities of the area, with particular reference to Cultural Heritage. Then, the U-Area for all allowed to make accessibility at the centre of the process while mitigating the challenges faced by institutions and decision-makers in the development of future action plans for the accessibility of the area's heritage.

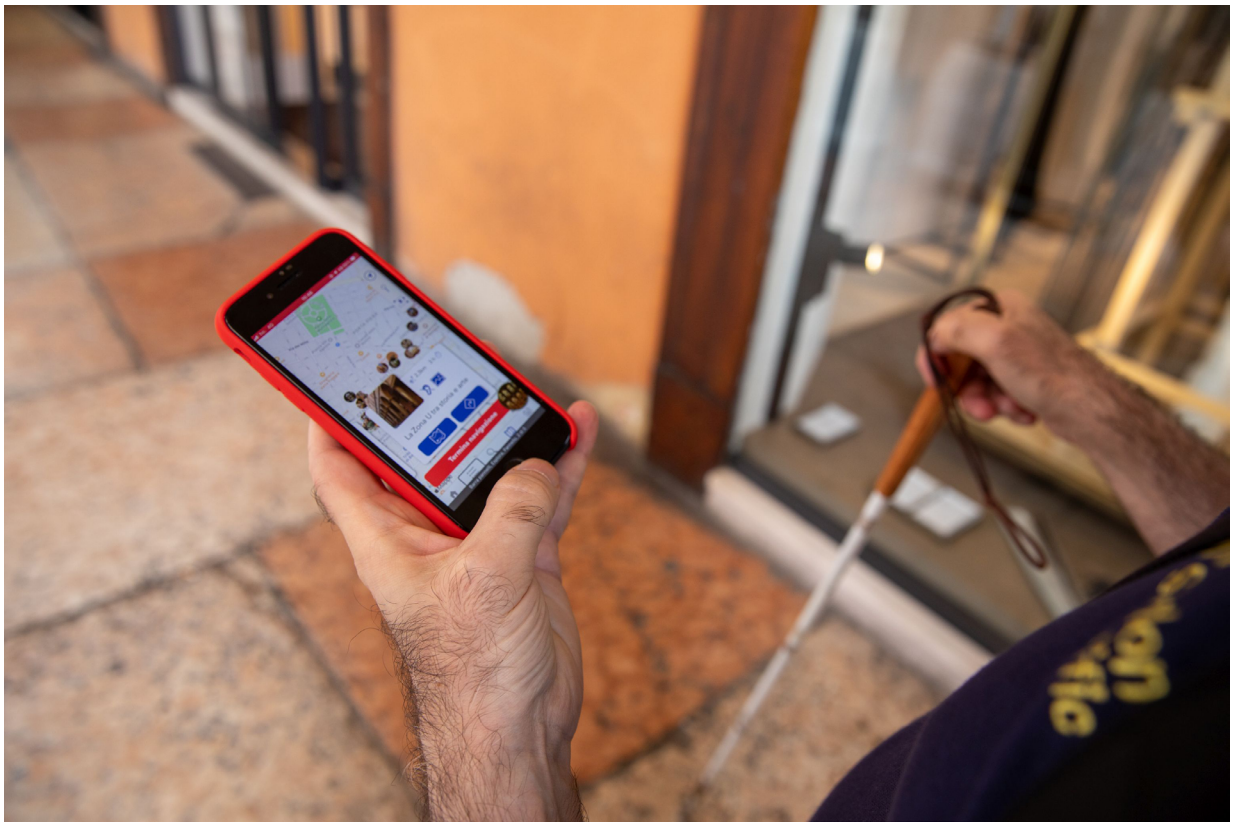

FIG. 6 BOforAll app's first test - Source: Photograph by Margherita Caprilli for Fondazione Innovazione Urbana 15/07/2020

FIG. 7 Tactile map installed in Piazza della Mercanzia - Source: Photograph by Margherita Caprilli for Fondazione Innovazione Urbana 14/12/2020

If the initial goal of the process was to engage citizens in better understanding their needs and the importance to promote and improve the accessibility to the area, the final result has been an increase in the overall awareness of the importance to ease the universal access to cultural heritage. This led to the co-design of a service that goes beyond the definition of accessibility as something related to physical barriers but also to communication tools, language, and instruments and which has been co-designed to allow a universal access to cultural heritage. This immaterial tool does not break physical barriers but highlights all the existing points of access, being those material or immaterial, while establishing new ones. The service creates a storytelling of how the area could be accessed and enjoyed according to the different sensorialities which a person would or could evaluate.

The active involvement of the final users has been fundamental for have a clear imagine of the area and to understand it in the most effective way: co-designing the service together with both able bodied and people with different levels and types of disabilities led to the creation of service studied to be concretely based on real needs. This first pilot process, involving just a limited area, led to the awareness that accessibility should be extended to the entire City, making it one of the main thematic routes towards which Bologna is driving its efforts.

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PRACTICES

Dreams of the Accessible [Cultural] City

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ABSTRACT
When we speak about access to culture, the first things that come to mind might be wheelchair ramps and braille signage. These things are certainly important, but the question is far broader than that. We might want to ask if the space is accessible for people with other needs, such as those suffering from autism, the young and the elderly, people of different faiths and different financial resources. For many people, a €70 ticket is as much of a barrier as steep stairs would be for someone in a wheelchair. And are we speaking just of the audience? Doesn't true access go beyond that, to the stage? Who has access to production, programming, scriptwriting, artistic and technical roles in cultural production (and whose culture, therefore, is produced)? In this article we will present how some cities in the EU-funded ROCK project have dealt with the question of accessibility to culture—how they have answered it, and how they have asked it.

KEYWORDS
Accessibility to culture; Cultural inclusion; CH-led regeneration; Belfast; Lyon; Warsaw

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The need for access: who are we talking about?

Accessibility is far from being a niche concern. In Lyon, for example, 13% of the locals are disabled. When you add to that those who have accessibility issues other than disability—for example socioeconomic or linguistic issues—the number expands again. When you further take into account the families, partners and friends of this diverse group, it is clear that the number of people whose choices in cultural consumption are curtailed by potential issues of access is far from being a small one. That is why Lyon, as we shall see below, takes care to extend the many provisions for the disabled within its healthcare, transport and employment services into the field of culture.

Beyond the physical

Though we will herein treat measures against physical and non-physical barriers to access, it is important to begin by stressing the salience of the latter. As Marleen Hartjes, accessibility manager at the Van Abbe museum in Eindhoven, elucidates, "The museum should be inclusive or accessible to all, and that means you will not only have physical boundaries that you have to overcome but also mental boundaries." What such boundaries consist in? "When you are in a museum you want to be part of a story, or want to understand what we are doing in the museum," that means concern with "accessible information, accessible stories and the way we approach one another."

In other words, culture must be intellectually, culturally and socially accessible. The ideal in this regard is that information is clearly presented and available in multiple languages, and that it is not only posted about within a cultural space, but also disseminated into diverse communities. Further, the content of the cultural offer must be relevant to the culturally diverse groups that coexist within a city.

For Katarzyna Miekus of Warsaw's Ochata Theatre in Warsaw, the concept of accessibility must apply to physical disability, health problems, lack of knowledge of the local language, and those who are less well off financially. This last category, says Katarzyna, are especially important to keep in mind during the COVID-19 pandemic. "For many of us it was very obvious that we can just turn on the computer and do the zoom meeting. But you know for some people it was not so easy." Katarzyna, who is involved in running the Culture Without Borders festival in Warsaw, had to ensure that there were options available to those without access to the internet, or to their own devices.

Such concerns do not to be thought of as in essence different from those that surround physical disability. As Lyon's former Deputy mayor for gender equality and disability, Thérèse Rabatel, puts it, "The difference between the two, which does not only concern disabled people but all

citizens, is rather a complementarity: One cannot go without the other, they are not in opposition."

One exemplary demonstration of how these issues can be treated hand in hand is the 'Gig Buddies' programme, which is run in Belfast, where it is supported by the local council. Gig buddies are volunteers who are paired with people with access issues of all sorts: Whether using a wheelchair to get around, suffering from autism or down syndrome, or socially isolated because of their age or background. Volunteers meet with their new buddies and schedule weekly or monthly cultural activities, from musical and theatrical performances to visits to museums or cultural sites.

"It's made a dramatic increase in the amount of people with disabilities attending gigs, and all sorts of theatre and festivals," says Christine O'Toole, acting manager for tourism culture, heritage and arts in Belfast City Council. As well as a new friend who can offer volunteers new perspectives and experiences, volunteers are also often able to avail of free tickets to events; "Many venues and festivals have special Gig Buddy tickets set aside," Christine explains.

Another such practice is Warsaw's 'Culture Without Barriers' festival. This festival aims to give access to everyone, regardless of any disability, or financial or social situation. It involves tonnes of events, such as film screening, theatre, and museum visits. "We organise this for one week every September," says Katarzyna. "It's a moment when we also host workshops and debates to discuss accessibility," so the festival is not only a moment for the city to offer more broad cultural opportunities, but also to invite feedback on its approach to accessibility, and hear what people have to say. For some institutions that find dealing with accessibility issues tricky from a budgetary point of view can take this opportunity to use the city's budget to make a change to their practices. "The festival is a way for these institutions to, you know, change something," Katarzyna says.

Include everyone

It's not always evident to which groups concerns about accessibility should be addressed, nor in what manner. In Belfast, for example, concerns about access have often centred around religious equality, ensuring that the two major religious groups, Catholics and Protestants, have equal access to the cultural offer. This is handled by constant contact between the culture department's good relations team and the equality unit. However, this approach, which has long been essential, given historical and contemporary tensions between these religious groups within the Northern Irish context, may need to play a less central role than it does at present.

According to Christine, "Many people no longer feel inclined to tick a box, because they may not identify as being defined by the religion that they were born into. The ethos of our new cultural strategy is that absolutely everyone has the right to express their identity. The whole city is supposed to be the playground, not broken into Catholic areas, Protestant areas, Chinese areas. People needn't be seen first as asylum seekers or travellers. That's the way to start breaking down preconceptions."

Given this perspective, the city's cultural department is trying a new approach: Rather than trying to name each group to which they are trying to provide access, the department is approaching access holistically. "We wanted to take a radical approach," Christine says, "and we wanted to not name them and pigeonhole them each and put them in the box because the whole ethos of the cultural strategy is that everyone is a human and equal."

This means that people of different genders, sexualities, religions, ethnicities, and physical and mental abilities all need to be kept in mind at once, taking a broad approach that is equipped with measures specific for each group.

Access to what? It's not only about the artwork

"Try to see the world otherwise" Different types of doors for different types of people

Making culture accessible does not just mean adding something on to the existing cultural offer, like braille on the description of an artwork. It also requires that you adjust the offer itself. In the Van Abbe museum, for example, a series of 'Unforgettable Museum' tours were designed for people suffering from Alzheimer's disease. "And these tours really shifted our way of thinking about how we deal with our audience in the broaden sense possible," Marleen explains, "art became a tool in order to retrieve their memories."

However, adjusting the offer does not mean that you need to present experiences that are exclusively geared towards the disabled. It is also an opportunity to enrich the experience for all. In The Van Abbe, Marleen discovered that creating a multi-sensory experience that facilitated blind museum-museum goers was widely popular amongst the general population: "the multisensory perspective is not only valuable for people that are blind but it is valuable to actually understand the artwork from a different perspective. This can open up a whole new multisensory approach in the museum and can really enrich the museum's experience for every visitor."

In the Van Abbe, says Marleen, the idea of becoming more inclusive "changed the identity of who we are as a museum." They realised that as "a place of stories that we are telling though our objects, our artworks,

FIG. 1 Social media communication from Marleen Hartjes, accessibility manager at the Van Abbe museum in Eindhoven

our exhibitions, that we need to understand that if that's the core of what we are as a museum, then that core should be accessible too." Their public funding puts an onus on them to be accessible to the whole of the public, not only in terms of how you enter, but also what you see. "The choices that you make as a museum, the collection that we build and also the meaning that we give to those collections is very important to understanding the world we live in."

One way that the museum has tried to deal with this was a mission to diversify its collection. "We set our mission to collect more women, collect more people of colour, collect more people from other countries, to give more stage and more time and galleries and programme space to people and artists with other voices. If we are not relevant, we will lose our grip on society. We have to evolve as well, because the people are evolving." This approach isn't limited to collecting new work – it's also about how the institutions show current work. "You could add multiple layers of storytelling in your way of working in order to give different perspectives on your already existing collection.

The Van Abbe's multi-sensory experiences include a 2014 exhibition with 28 blind or partially sighted artists. "They were also the ones who were giving the guided tours, so that was a bottom up exhibition." The museum

has also found that these tours don't just mean an enhanced experience of the works, but are also an opportunity to create engagement and exchanges between disabled and non-disabled guests [Fig. 1].

Thérèse had a similar experience in Lyon, when the city decided to focus on making itself more accessible for women. "Making the city more accessible for women or people with disabilities means making it more inclusive for other categories of the population." She gives the example of something simple like modifying benches by adding armrests. This makes it easier for all sorts of people to enjoy the public space, "it's good for old people, the disabled, for pregnant women, but it also creates a more enjoyable experience for everyone else. When you work for some, you work for others. That's the principle of universal accessibility."

"It's about normalising and accepting and integrating, not making a difference," is how Christine sums up the approach to accessibility in Belfast, and, according to Katarzyna, the approach in Warsaw is based on a similar lesson: "We find it very important to be with people with disabilities to see that we are all together, and it's not a problem if somebody has any disabilities. It makes you sort of get familiar with differences between us." Thérèse says that, in the experience of Lyon, this approach is more about careful thought than high costs, in fact, "It doesn't even cost much, it's just attention to others, it's human investment."

The digital divide

The COVID-19 pandemic has radically shifted the landscape of accessibility. The huge push that many cultural institutions have made to offer access online means that people suffering, for example, from mobility issues, have a much easier time tuning in to the cultural offer. For Marleen, another advantage is that it allows the Van Abbe to launch "a totally different relationship with our audience," and to give people access to a huge amount of material that could not be physically displayed in the museum due to space constraints. Marleen believes that this trend will help to cure what she deems to have been a misconception among cultural institutions, the 'myth of the golden visitor'. "We somehow think that our only important conversation is with those golden visitors that come through our doors. If we are only relevant to the people that are coming through our doors, we are truly missing out on an important role a museum can have, a part we can play in people's lives."

Warsaw has also exploited COVID-19 as an opportunity to engage more with pupils and students. The city launched a handbook on how to survive during the pandemic which focused on theatre for teenagers. "It was about theatre, about being together. Every day there was one subject that they were talking, about the history of theatre. It was sort of internet classes for quarantines," Katarzyna explains. None of the city cultural departments to which we spoke were concerned that online experiences

would replace culture-in-the-live, and all were convinced that this new way of going about things ought only to further invigorate and add an extra dimension to the local cultural offer and reach new audiences.

Nevertheless, it has also severely exacerbated a gap that has long gone unattended – the digital divide. Around 44% of the European population between the ages of 16 and 74 have been found to be digitally illiterate, meaning they have trouble negotiating basic tasks such as opening and replying to emails.[1] Add to this those who are digitally literate but have trouble accessing the internet due to poor connectivity or limited access to devices such as computers and smartphones, and you have an extraordinary number of people whose access to culture has been curtailed by the widespread move online.

Cultural departments in cities are ill-equipped to tackle this challenge, and it is one that urgently needs to be dealt with.

Role of the actors (cultural institutions, municipalities)

Role of cities

An ethos of the city council

Facilitating accessibility cannot just be a question of what you do. Rather, the willingness to create access must be reflected in the internal structures through which cities and cultural departments operate. Practically speaking, how are cities and cultural departments rearranging themselves to better tackle this issue? In Belfast, Christine explains, "We have a special unit within our council that focuses on accessibility and equality. We have several equality officers, and an equality manager who oversees the venues and public spaces that are used by the public." If venues are found lacking, there is a dedicated fund which will help them make purchases or carry out renovations to improve accessibility.

Christine considers accessibility to be an ethos which must be diffused throughout the council, but she also points out that it is enshrined in legislation; Section 75 of the Northern Ireland Act mandates equal access to all services, public and private. The approach to enforcing this legislation is not one of dolling out fines or sentences, "It's about giving enough money and giving that time, in order to enable people to think that they can't just cater for one particular grouping, that they need to think wider than that."

In Lyon, accessibility is enforced through a combination of national laws, strong political will and coherent, cross cutting policies. Lyon's policy spans "employment, early childhood, schools, sports, culture, transport and more. I work with all my colleagues to make connections between

1 https://epale.ec.europa.eu/en/resource-centre/content/digital-skills-gap-europe, accessed 28 December 2020.

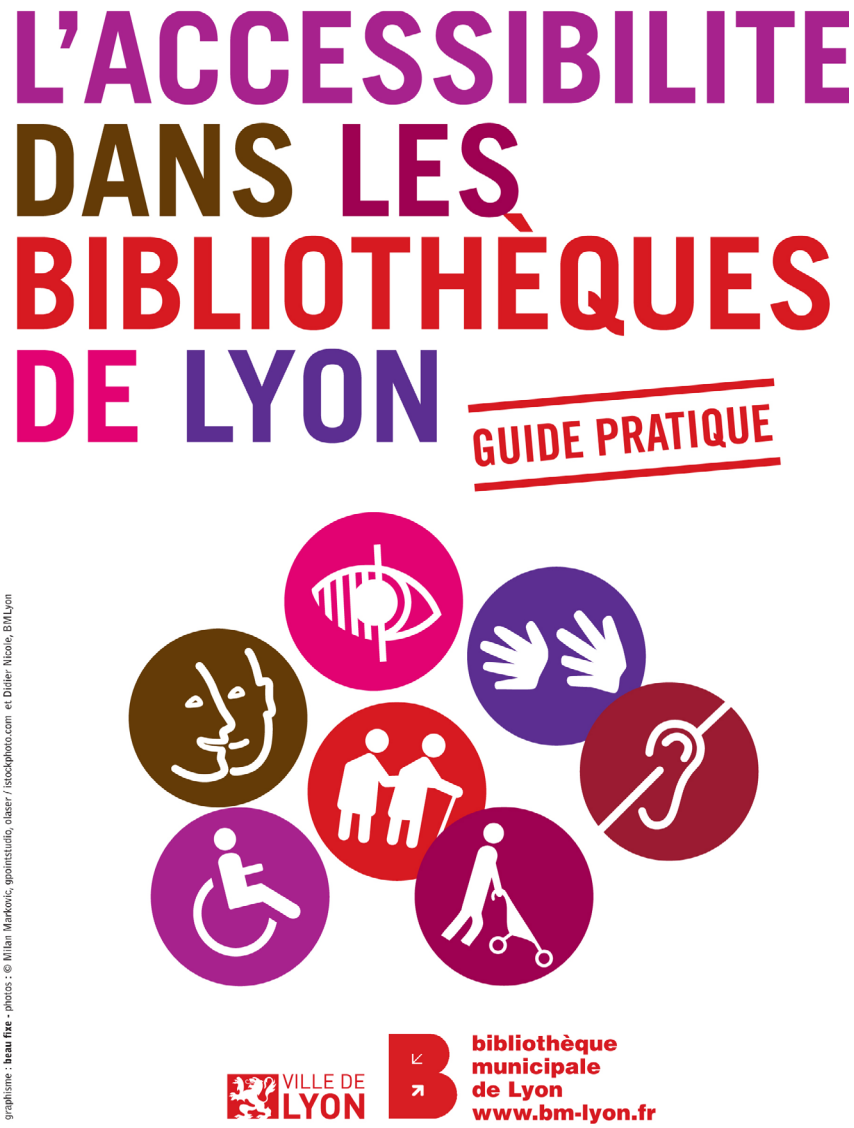

FIG. 2 Guide for the accessibility to Lyon's libraries

accessibility policies. We have strict national laws, but these have to be given force at local level," says Thérèse. This force has been aided by the creation of a network of referents on disability policy. The network has 13 referents, each of whom is posted in a different department, with one person whose job is to manage the group and bring everyone together.

A number of working groups, from 'Institutions open to the public' to 'urban spaces and accessibility' also further this goal. Another important factor is being in dialogue with representatives of the disabled community. "It is important that people can see the will of the institutions, as well as understand the difficulties that we as institutions face in realising our ambitions. Still, you have to do as much as you can, even if you can't do everything. Our objective is that cultural institutions in Lyon will become 100% accessible by 2024, except for rare exceptions, linked to the constraints of buildings classified as historic heritage" [Fig. 2].

These efforts are further bolstered by regular phone calls and on-site visits to cultural institutions, always with the aim of building trust on both sides. Regular discussions between the city and its cultural institutions, and between those institutions and the disabled communities which they serve has become a daily practice which strengthens all of those bodies involved in myriad ways.

The cultural sector is in an ideal place to lead the way in this regard, thinks Christine. "We as municipalities, as boring people who work in offices... we really rely on the cultural sector to make these changes. That it's not just us telling them what to do, it's also the cultural sector coming together and collaborating." Christine believes that local policies and investments must "go into maintaining inspiration in organisations and making sure they can go out and see good practice from elsewhere, that they have time for learning."

In Belfast, this means involving "as broad a spectrum of people as possible through practical interventions to ensure that all views are taken into consideration. It would just be so wrong for us to just talk to people who are already speaking our language."

In Warsaw, the practical approach has been to nominate an 'accessibility leader' in each institution who, besides their normal function, is tasked with keeping an eye on accessibility to all the different aspects of their institution, and coming up with regular suggestions for improvement.

Practical tools

So what are some practical tools that cultural institutions are using to ensure wider access to culture. One angle is access to language, for example in Warsaw, where they have begun subtitling works with Ukrainian and Russian. They also provide audio descriptions, closed captioning and sign language interpretations. But language issues don't always relate to foreign populations. In Lyon libraries stock 'Easy Read' versions of books on designated shelves, books that have been rewritten in a simplified manner for people with literacy issues of all sorts.

Tours can also be geared specifically to people with a given disability. Another angle, as in the Van Abbe, is to provide permanent tools, like 3D prints of sculptures, or high relief versions of paintings, that partially sighted guests can engage with through touch. Tour guides can become models themselves, assuming certain postures represented within the paintings and allowing visitors to touch the guides to get a sense of how the person within the paining is holding themselves.

Marleen remembers how one blind museum-goer's experience touching a sculpture opened up its interpretation not just for that individual, but for the institution's staff as well. "We gave her gloves and she started touching the artwork. She started saying 'it seems there are some sort of bars

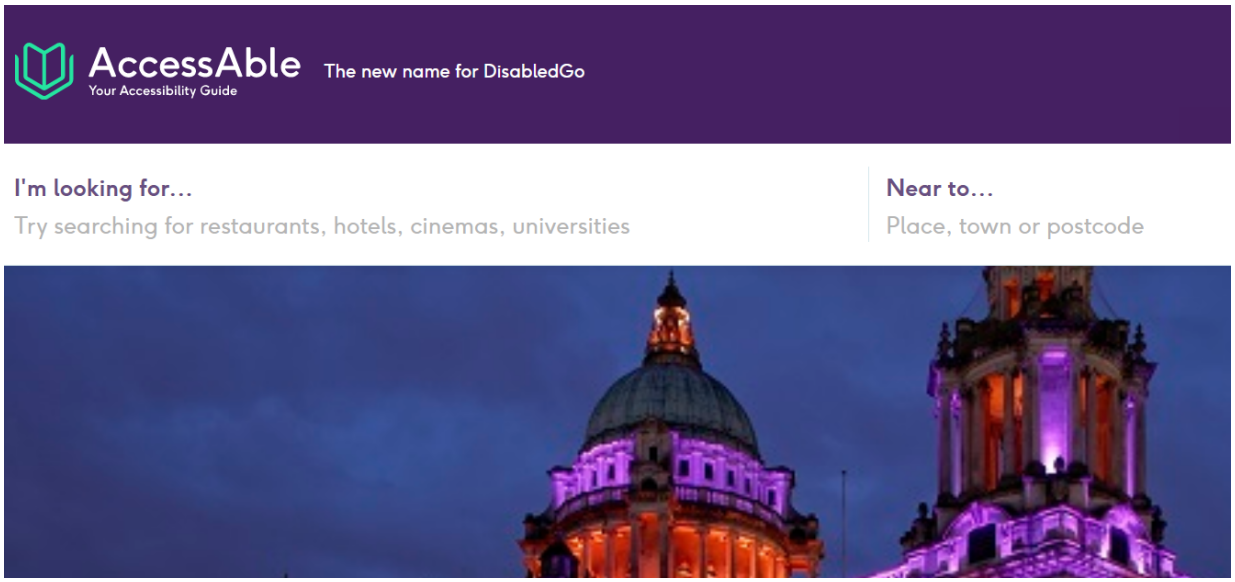

FIG. 3 Homepage of the "Access-able" website

in the eyes of the sculpture, he cannot see anything and also we cannot touch anything because the hands are on his back and he cannot move because he's just like this tumbling figure so it seems that this person is actually trapped inside of his body. One hand is turned a bit… he is doing something secretively.' We were listening open mouthed, because we understood that so many things that we had never thought of beforehand."

In Lyon, the Théâtre des Célestins opens up appointments for blind ticket-holders to come to the theatre before the show starts and move around the stage, get a sense of the space, touch the props, furniture, costumes, and even touch and speak with the actors so that they can have a fuller sense of the performance once the play begins.

Disabled people often carefully plan their trips based on where they expect to be facilitated, so spreading information about measures to make your cultural offer accessible are also really important. In Belfast, a website called "Access-able" allows venues and institutions to upload their accessibility details, from wheelchair ramps to special autism-friendly events, so that people can go to a single site to find out what's open to them across the city. Belfast also works hard to make sure that cost reductions are available to those whom socio-economic reasons might otherwise keep out of cultural spaces [Fig. 3].

Lyon has a similar approach with its "Guide de l'offre culturelle accessible de la Ville." This guide is made up of technical data sheets classified according to the fields of activity of the structures: Libraries, museums and heritage sites, performing arts, artistic and cultural education, events and associations. Pictograms by disability announce the level of accessibility of the tour route of each of the establishments.

These are just some exciting examples of the myriad of accessibility measures that some of the cities involved in the EU-funded ROCK project and in the Eurocities network have put in place.

Conclusion

In this essay we explored different approaches and strategies to increase accessibility in the culture sector in four European cities. If the approaches can differ slightly, the questions remain similar in all cases: How do we grant access to the highest number of people, despite their disability, background or status? What are the tools that cities and cultural institutions have at their disposal to ensure accessibility? Who needs to be involved in the consultation process? With the process unfolding, cities have learned that creating broader access is actually enriching the experience of the whole society. Many cities have understood that accessibility needs to be mainstreamed in different sectors to make it universal and truly inclusive. From a municipality's angle, power lies in its decision making structures, and as Christine from Belfast puts it: "We [as public officers] all have the opportunity to make conscious inclusive decisions every day in our work life." From the point of view of cultural institutions, the need to stay relevant and to represent society in its actual diversity should be the highest goal.

Culture and the arts have the power to challenge perceptions and people's ideas about others, and to do so in a creative way. Increased accessibility to culture for all brings about change and can increase social cohesion and improve cities' inclusiveness, one more step on the path to true urban resilience.

This article is based on a set of interviews realised with four cities:

Marleen Hartjes (2020), "Accessibility Practices in the Van Abbe Museum in Eindhoven", interview with Cécile Houpert, 29 May

Thérèse Rabatel (2020), "Politique d'accessibilité et secteur culturel dans la ville de Lyon", interview with Cécile Houpert, 3 June 2020

Katarzyna Miekus (2020), "Warsaw's Ochata Theatre and the Festival Culture Without Borders", interview with Cécile Houpert and Anthony Colclough, 4 June

Christine O'Toole (2020), "Accessibility Policies in Belfast City Council, Culture Unit", interview with Cécile Houpert and Anthony Colclough, 5 June

Anthony Colclough Anthony Colclough holds an MA in creative writing from Sarah Lawrence College (NY) which he has been putting to good use unlocking the stories that lie beneath innovative policy and practice for the last 10 years.He works at EUROCITES on projects in the fields of mobility, smart cities, culture, environment and social affairs. This cross-cutting role allows him to create the hooks and see the links that open cities' stories to the world.

Cécile Houpert After a Master degree in European affairs and international relations, Cécile joined EUROCITIES in 2015 as part of the culture team where she works as project officer for culture and cultural heritage. She was involved in the management of the Culture for Cities and Regions initi-ative, a three-year peer-learning programme for European cities and regions financed by the European Commission. She now coordinates EUROCITIES' activities as part of the H2020 project ROCK, monitoring implementation in the 10 ROCK cities and organising peer-learning and capacity-building activ-ities with partners. She is also involved in EUROCITIES' culture forum and working groups related activities.

PRACTICES

Social Inclusion and Museum. Communities, Places, Narratives.

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ABSTRACT

This article shows a research on museum and public space design with cultural value.
The article is divided into two parts.
The first part shows the principles followed in the design activity of the author.
Among the first is the principle of universal inclusion.
The second part of the article shows a series of case studies. In particular, we show some museum and cultural accessibility projects.
The text aims to demonstrate that cultural work cannot forget inclusion for all audiences.
Any design work must understand that the accessibility theme is not a variant.
The goal of inclusion is not an alternative.
Disability characterizes the condition of the person in an unfavorable context.
Designing favorable contexts is our mission.
A context is favorable when it allows autonomy of the persons.
An autonomy that allows you to measure your skills in order to increase them.
All this in a relational dimension.

Tactile maps, accessible books, museum displays: all opportunities for people's autonomy.

KEYWORDS

Accessibility; Inclusion; Museum; Map; Tactile

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1 City

The theater of action of this article is the city with its public spaces.

The city is the place where today we talk about accessibility.

It is rarely mentioned in relation to the campaign.

After all, it is in the city that lives over half of the world's population.

It is the space par excellence touched by this word.

It is no coincidence that the European Union has established a prize for accessible cities and has done so starting from the various areas that characterize social life: culture, education, work, participation, tourism, sport etc.

Public space is not a lifeless sculpture.

It is a space of relationship, where sociality finds its maximum expression.

In general, public space must take back the central place in the reorganization of the city.

As Simone Weil said, it is a requirement of the soul, of everyone.

We noticed it in this period COVID.

How much are we missing public meeting and meeting spaces?

How much have we missed the squares, the city boulevards?

Public space, in its full meaning, is the space where people meet feeling like citizens and not just consumers.

It is the place where exclusion occurs due to lack of attention and sensitivity.

The museum, among all others, is the public space on which I have certainly worked in greater detail.

The museum is the space where I have been able to experiment with methods, processes, solutions, strategies to try to create inclusive moments and experiences for the greatest number of people.

The major museums are located within the centers of our cities, occupy the historical places that were once used in other ways: former monasteries, former religious buildings, old university buildings, etc.

The contemporary museum often occupies the empty buildings left by manufacturing activities in the suburbs.

Often these are spaces that have been adapted, made accessible for new public functions, which are no longer productive.

In both cases, museums are committed to tackling accessibility.

The problem cannot be solved with functional adaptation following building regulations because the museum is not just an architectural space. The

museum is a space where people enter into relationship with each other, enter into relationship with the works and with the museum institution.

The rest of the territory remains a highly inaccessible limbo.

2 Spaces

When you think of an architectural project, you are not simply faced with a theme of a technical or stylistic nature.

Especially if it's a public space. We are always faced with a cultural issue.

We feel the need to break down architectural barriers, create inclusion, produce integration interventions.

This means that something has changed culturally.

If we begin to hear the requests of those who have long complained of shortcomings, it means that something is really changing in our society.

If then we respond with technical solutions to these requests then the change is tangible.

The technique is often the consequence of an ongoing cultural change and as such it does not precede but follows the change.

Often, however, the change is not felt simultaneously by the whole community and this creates frustrations, betrayed expectations, unanswered questions.

Techniques and technology are a response to housing needs, but often have a cultural origin.

They always originate in a community that has set itself the problem of solving issues related to the relationship with the surrounding environment.

This is how the principles of Design For All and Universal Design are born.

They are methods that translate design activity into a process.

They aim to respond to requests from a community of people with special requests.

How did we get to those principles?

We should not consider them an arrival point but rather a transformation process.

Homo sapiens today lives in the world having a huge amount of things between itself and the environment.

We no longer live in caves or huts.

We live in skyscrapers, palaces, villas, apartments.

These living spaces contain objects that allow us to live the present.

The same objects allow us to travel conceptually in time and space: we think of photographs, of our smartphones.

But every technology, every thing contains sometimes insurmountable thresholds.

The accommodation brought by things sometimes produces exclusion.

Our limits have changed and the perimeter we live in goes beyond the physicality of the spaces we frequent.

We don't just use things but we do it poetically, within a narrative dimension that contributes to defining ourselves in relations with others.

We are not only bodies but narrative bodies, endowed with an important story: our story.

There are no skillful stories and disabled stories.

There are only stories.

We symbolically attach value to the space and things around us.

We do this to make them known, to give them a role within the constant communicative dimension in which we are immersed.

This is a symbolic and therefore cultural dimension.

We built and modeled our environment.

Along with this, our brain and body developed.

This happened in the long term and always in presence in the presence of our fellow human beings within the various social organizations: family, colleagues, condominiums etc.

He did not do it randomly but for single steps one in a row to the other, step by step.

3 Design

Designing is not just the application of a theory or methodology, is not a creative act of a linguistic or stylistic nature but is a relational process, a process immersed in an environment that involves the communities that inhabit it.

Designing a new space of any size is an activity that connects multiple intelligences: one's own with that of others.

It was once simpler.

The choices were decided by a few individuals locked in waterproof offices. Decisions were made by few.

Much of a nation's society did not participate in the cultural life of the city.

To deal with the issue of disabilities and accessibility, it is necessary to develop a different sensitivity in the relationship with spaces and with others.

Any project contains opportunities for exclusion for some people.

4 Accessibility *versus* exclusion

It is important to say that the opposite of accessibility is not inaccessibility but exclusion.

A space, internal or external, public or private that does not take into account accessibility does not work in favor of inclusion. It produces exclusion.

Each with their own role is called to work with their own intelligence to develop social inclusion.

The equality between inclusion and lack of style, of ugliness must be overcome. The idea that often accompanies accessibility is always associated with synonym of ugliness or lack of quality.

The beauty or ugliness of an architecture never binds to accessibility but to the ability of the designer, whatever project you do.

Often, too often accessible architecture is seen as a deprivation of expressive freedom.

Alongside an architecture that interprets making space as an architectural, free and authorial gesture, we have begun to understand a new meaning of architecture as a thought that collects, interprets and transforms the energies brought into play by a community in relation to the common good.

A culture of design is developing more and more around people and not around objects.

Perhaps we can now understand that what we call disability does not only concern the characteristics of people but also concerns the characteristics of the environment in which we live and which does not always and only have a material, physical nature.

5 Cities and desire

Space must have a relational nature.

Space must be able to enter into dialogue with people, who are made of bodies. Bodies, that is, people, have a psychic nature and their own consciousness.

The architectural place is the environment where the dynamic life of the whole person is expressed. He expresses himself not only for himself but in relation to others.

It is a process that involves the whole world and leaves traces in our culture of living. A culture in constant evolution.

When you make an architectural project you impose your vision, your image of the world on others.

In order to be understood, shared and adopted, many skills and sensitivities must be developed.

The symbolic dimension is added to the cultural and technical skills.

We encounter building monsters on a daily basis. Of architectural works much less.

It is important that the concept maps we use when designing are understandable by those who will use that space.

Like Bachelard, Freud would also say that there are no cities, there are no houses, there are no landscapes. But they exist as desires of cities, houses, landscapes, in turn objects of desire. For this reason, Bachelard does not devote his attention to real spaces, but to those imagined.

More precisely, he devotes his attention to the products of reverie, of poetic reverie.

The images Bachelard talks about are poetic images contained in passages of prose or poetry; they are internal to the linguistic space.

Therefore, they are not graphic projects, they are not inhabited or habitable buildings, not even sketches or photographs. They are not concrete images or real spaces.

But they are still very powerful in understanding what it means to design within a community that has its own desires, its dreams.

He, like everyone else, lives in a space that not only has a physical nature but also a symbolic one.

What the desire is and the object of desire can indicate to us the dream, beautiful or ugly it may be, or the fantasy that is expressed also in the dream, but not architecture.

“It was a dream city” wrote Valery “it is not therefore architecture”.

As for the city, so for the home and the landscape: architecture should defend us from the dream, rather than lead us to the dream.

All this requires commitment: architecture is not done alone but with others.

6 Thinking “with”

The project is therefore a composite image of its research work with the environment.

The construction of a place is the result of an experience that takes space, builds and shapes the environment around us.

The space that is formed in this environment encompasses thought and feeling in its visual, conceptual image.

A project is always responsible for any exclusion reasons for someone.

It is important to understand that the project today cannot fail to know that there are people who need different approaches to spaces.

He can no longer ignore that there are people who need different languages to be able to dialogue and interact with the environment and with others.

But it is also important to understand that the answers are not found in the manuals and regulations.

Rather, there is a direct knowledge of the community which in itself is always potentially educating.

We must learn more and more to listen. In the communities there are important knowledge and knowledge that we must collect.

7 Integration *versus* Exclusion

Integration is the action or effect of integrating.

It means returning a whole previously divided, split, dismembered.

First of all, in the word integration there is the memory of absence.

Integration is not given without reference to what has been excluded.

So it is recognizable and for this reason it must be integrated. If the integrative dimension is specific, inclusion instead poses the problem of allowing everyone to enter

As is immediately evident, both integration and exclusion are metaphors that favor spatial language within the thinking of living.

Most often dominated by this poignant insensitive dimension, the feeling of living seems destined to produce mostly dissatisfaction.

This happens in any case: whether it leads to sedentary lifestyle or leads to more or less evident forms of nomadism.

Today we live spaces that host us for long hours: the home, the office.

As there is nomadism forced by migration, in the same way there is a forced sedentary lifestyle that can border on almost total immobility and isolation.

The protagonists of the latter condition are above all the elderly and the disabled.

Often they are condemned to remain always in the same house or in the same institution.

We all knew the sedentary lifestyle during this period of COVID. We had direct experience of forced sedentariness.

Those who paid the highest cost were precisely those who are forced to rest in silence in structures intended for this purpose.

8 Exclusive spaces

The institution for the disabled and the home for the elderly are thought of as “rest homes”. A phrase in which a whole destiny made up of some rights but not others is inscribed: the right to solitude but not to travel, if not to compulsory travel; the right to silence but not to the sharing of knowledge, the right to inertia.

The homes of the elderly and disabled are therefore devices that deny integration and exchange.

They create a sort of cocooning, a protective shell, which lacks the essentials. Comfort and autonomy are missing.

These homes seem to be a first poignant response to the contemporary experience of connected life, the dream of a self-sufficient space in which the need to move gradually decreases in importance until it disappears.

It can be said that in these spaces desire and the principle of reality are consummated.

Everything is suitable for the disabled, cognitive disabled but does not consider what desires can manifest themselves in people by being faced with a principle of hopeless inevitability.

With these speeches we simply wanted to show that the issue of accessibility is a complex problem.

Accessibility concerns living in the world and that is not just a technological issue.

We are also faced with a complex problem due to the fact that when we talk about living, it is almost impossible to get out of the subjective dimension. Because there is no living in itself but in relation to self and others.

And therefore it is important to observe relationships and listen to stories, narratives.

The architect and architecture are destined to always operate on a difficult boundary where the principle of reality and its laws (first of all the law of gravity) must deal with the forces of the unconscious, people’s desire.

An unconscious that is on one side that of the architect and on the other that of architecture, as it is inscribed in a cultural context, even unconscious.

This applies to every work, not only for architecture but for art in general, which Freud places precisely in “an intermediate realm between reality that frustrates desires and the world of fantasy that satisfies them”.

So the museum is halfway between the real city and a more intimate world of desires.

It is basically the difference between fantasy and art. Apparently all that has been said could belong to a critical thought, of reading spaces. In

reality it is one of the possible conceptual baggage that have man immersed in his environment at the center of "speculation".

The first condition of a correct all-round design is the consideration that any work of art or architecture, any work of genius must be an expression of all the energies put in place and of the community for which it is designed and to which it is dedicated.

Accessibility should be a quality of the spaces we live in continuity with the whole environment and is a quality of a non-normative cultural nature.

The regulations are always lagging behind the sensitivities that research and operate on the frontiers.

9 ICF

Up to this point I wanted to show how important it is for me to face design on a cultural and conceptual level.

Technique and regulation offer me the tools, not the arguments.

But it is the study of the context and the community involved that allows me to create inclusion. This if I share the space and time of the design.

From a conceptual point of view, this approach finds important topics within the ICF model of Disability (International Classification of Functioning, Disability and Health) which is part of the International Classifications recognized by WHO (World Health Organization).

In Italy it was first published in 2002 and then updated in 2011 and can be found on the net at this address: https://www.reteclassificazioni.it/portal_main.php?portal_view=public_custom_page&id=85

The original document in English (2001): https://apps.who.int/iris/bitstream/handle/10665/42417/9241545445_eng.pdf?sequence=1&isAllowed=y

It is a classification that has the task of describing the state of health of people in relation to their areas (social, family, work).

The aim is to recognize all the difficulties that in the reference context can translate into limitations.

In essence, the ICF model observes the individual as a whole.

He observes him while he is immersed in his environment and within the relationships that involve him.

Disability is not described simply as an impairment.

It is described as a condition that goes beyond limitations by overcoming barriers, both physical and sensory and cognitive.

The ICF has developed a new way of thinking, a different sensitivity and humanity in the confrontation of the individual with disabilities.

This made it possible to analyze his condition and understand the possible social consequences of disability.

The fixed classification of standards and parameters.

These relate individuals and the social and environmental contexts in which they live.

Data are collected within collectors which are finally shared globally.

In summary, the health model proposed by the ICF concerns the interaction between the individual and his or her own context of life.

The elements that influence to define the disability that involves a person concern:

- bodily functions,
- body structures,
- impairments,
- the activities,
- participation in life situations.

These elements are studied in the environmental interaction it analyzes

- the limitations of the activity intended as an individual's difficulty in carrying out the activities,
- restrictions on participation understood as difficulties of involvement in life situations,
- the environmental factors that make up attitudes,
- the physical and social environment in which people live and lead their existence.

We can therefore summarize by saying that disability represents the condition of the person within an unfavorable context.

Designing favorable contexts is our mission.

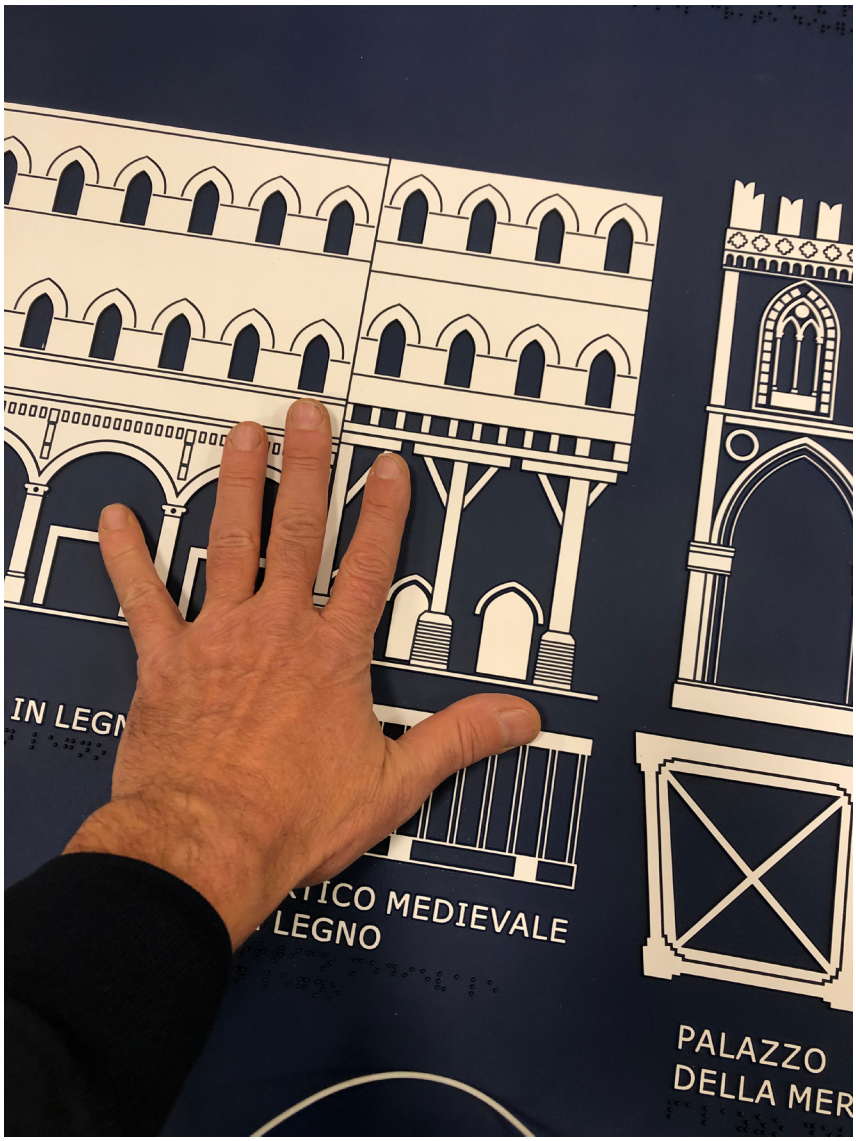

FIG. 1 The monumental tactile map of the arcades for U-AREA FOR ALL - ROCK BOLOGNA project.

Case studies

a) Museums, cities

In my life I participated in the opening of many museums, in different contexts and of very different types.

From ancient art museums to modern and contemporary art museums, scientific museums and archaeological museums.

I also had to deal with pieces of cities that, like real open-air museums, preserve the history of the people who produced them.

I designed them starting in different cases following paths in constant dialogue with the context and with the communities involved.

I have always tried to act as a bridge, listening to the two sides: the customer and the public. Listening, collecting and building plots is the general method.

The museum is the space where accessibility is not only possible, but where it is needed.

This is so to offer the opportunity to experience reality and satisfy the desires that we always read as needs.

We have seen the reason: houses often do not guarantee the possibility of satisfying their desires.

So we look for them elsewhere and look for them in public places, in spaces that express our collective history.

The museum is not only the physical space that contains and exhibits the collection, is the whole life that revolves around it: inside and outside the walls.

Then it includes its online version, its catalogs which are printed and brought to visitors' homes.

Living the museum today does not mean going to the rooms in person, accessing the collections with a visit to the museum.

It means free access to all possible forms that the museum produces: the web page, the publication.

The museum is a metaphor, is a system made up of people, spaces, communication and speeches that are produced there.

The accessibility of the museum therefore has the task of circumventing a new cultural paradigm, which does not just bring people to the works.

The accessibility of the museum studies and develops languages, codes, actions, to produce opportunities for those thoughts of being understood and experienced independently, in the first person. For all within the limits of the possibilities that bodily and psychic functions can allow.

b) Museo Tolomeo

Working for twenty-five years with blindness and low vision has helped me understand how important is the understanding that develops from within.

The one that develops together with and not in a definitive form.

Being within the communities to know the questions for which there are no answers and try together to find the answers with formulas that are not limited to verbal description.

Museo Tolomeo was born without knowing what form it would take.

When with Lucilla Boschi we started doing interviews with those who lived in the space we were looking for the collection, what to show and what stories to tell.

We initially had a goal, a community but we lacked the content.

With the interviews and together with the visually impaired community, the form that filled the basic concept was born: to show the world the search for opportunities to create autonomy.

To make a good project is not enough to study abstractly, on paper.

Study is a necessary, fundamental moment; but it is only by falling into the situation that it can be understood from within and also understood in the same way.

This is the case of the Museo Tolomeo of Bologna designed within the *Istituto dei Ciechi* Francesco Cavazza together with Lucilla Boschi who shares these ideas with me, supported by the various protagonists of a story of unique value.

The central question is to show how everything that surrounds the works and the museum contents provides the key to understanding the contents themselves.

All this regardless of the visual component.

Spaces, dislocations, rhythms, orientations follow the institution's customs and habits.

They contain its rules.

For this reason, the museum was born as a *wunderkammer*.

It is a space that accumulates objects and puts them closely in relationship with each other and with space.

Use space to build meaning around the works.

The museum presents itself to the city as a threshold, to show anyone, whether sighted or not, an apparently historical discourse but that in reality is a timeless journey.

It is a space where another way of organizing a knowledge of the world is shown.

Geographical consciousness and linguistic codes are the main contents to be tested. The exhibition displays the tools that using substitute senses allow the blind and partially sighted to experience the world on a sensorial, motor, cognitive and affective level.

What do you see?

People entering the museum room.

They see something they don't know yet, which they only partially recognize.

The first data collected from the first simple glance allow him to draw from the memory of concepts by similitude. This could help them but also betray them.

The look, whether of a tactile or visual nature, is not enough.

It is necessary to move inside and search for clues, all the elements to understand.

Where the work takes place

A geographical place for everyone, a place for a unique experience.

If each object is a sign of its use, the central element of the set up is a sign of how you can move within the space.

We are talking about a table that has a particular geographical shape.

at first glance it resembles an island, an archipelago.

To be known we have to walk along the edges step by step. Read its shape.

It must be discovered in all its parts, in all its variations.

Following the perimeter, we observe that the table makes the reading of the works episodic.

It enhances the value of discovery and from simple observers we become sailors, we assume a role in relation to space and works.

The museum, through the table, establishes a narrative that contains us.

The island presents itself with a work that collects the objects of the exhibition.

Books, scriptures, machines, braille displays, braille typing machines. Together with these on the table there are objects to be deciphered, objects to be studied with all senses to understand their possible meaning.

Overall, the objects, the works, merge with their support; the audiences merge together within a single experience which is the museum.

The “island” table organizes the experience using categories of topological geometry: back and forth.

Like an island, the table is made of coves and headlands.

It is a geography that accompanies the visit within a mental mapping that becomes geographic. Being interactive, it brings to the table noises, sounds and voices from the museum.

Atelier Tolomeo

Today the museum has an atelier that absorbs all our attentions.

It is an office that helps to think about laboratories, strategies, projects that go beyond the museum boundary and exports our approach of simplification, classification and narration of complexity

c) Bologna Museums:

Medieval Museum, Industrial Heritage Museum and Monumental Museum of the Certosa di Bologna.

Between 2018 and 2019 we faced a design to create a first accessibility for three Bolognese museums.

Participation in cultural life is a right that everyone must have access to.

In this sense, undoubtedly the realization of accessibility projects and inclusion is to all intents and purposes considered as an integral part of the policies of city administrations which must develop inclusion policies involving the various municipal institutions, including museums.

For museums there is a social responsibility for which the contents must be made accessible to everyone as a common cultural heritage.

The obstacles to accessing and enjoying cultural places can be manifold.

They can be:

- architectural,
- typological, not just architectural,
- language,
- sensory,
- cognitive,
- culturaleconomic,
- technology.

In the first analysis we took care of the design and implementation of accessible routes in the city museums selected by the Municipality of Bologna.

We did it with the two museums of the Istituto *dei Ciechi* Francesco Cavazza: Anteros museum for the integrative aspects of the accessibility of some works and the Ptolemy museum for the design of tactile maps and for the inclusive aspects towards the museum experience.

In the work we were joined by the CDH (Handicap Documentation Center) for motor and cognitive disabilities and the Gualandi Foundation for hearing impairment.

The itineraries are based on the selection of significant works by iconographic theme, historical content and aesthetic value, to be explored in the original.

The initial phase of the project involved a series of inspections to evaluate the state of accessibility of the museum and the selection of works.

The theme of building accessible and inclusive paths is carried out in relation to the communities involved:

- the community that works inside the museum,
- the community of people who frequent it,

- the community of people with visual impairments,
- the other disabled communities.

The first approach to the museum is of a spatial nature, understanding the nature of the building, its size, its style and understanding its spaces: how to orient oneself, how to move inside, where to find accessible rooms and how to reach the services.

For this reason, two types of maps have been created for the museums involved.

Monumental tactile maps were produced for all three museums.

Let's see what it is starting from what is meant by a map.

In general, a map has a very important task:

to represent to the mind of the beholder the possibilities, the opportunities that a place offers.

There are two types of tactile maps:

the monumental architectural map and the orientation and mobility map.

The work of simplifying the object that we have to represent for tactile exploration is complex. We have to make a great simplification that maintains the substance of the object without falsifying it.

Simple is better. Any unnecessary details detract from understanding. Understanding this fact is the greatest effort for those who design tactile maps: easy to touch is easy to understand.

The principle is general:

- disassemble the complexity into simple and recognizable elements,
- make lists,
- create a classification of the elements,
- recompose the elements within in a configuration that allows the individual aspects to be identified.

The second type of maps responds to a much more precise and practical task: orienting the experience of mobility within a space.

In practice: given a known place on the map, for example "you are here", we must reach another point far from us.

The first type of maps dismantles the building in parts to make it known.

The second type of map shows the ways to move independently within the spaces.

Making these two types of maps allows you to make a reading of the important space.

It shows us how important it would be for the planning of spaces and paths to be supported already in the preliminary phase.

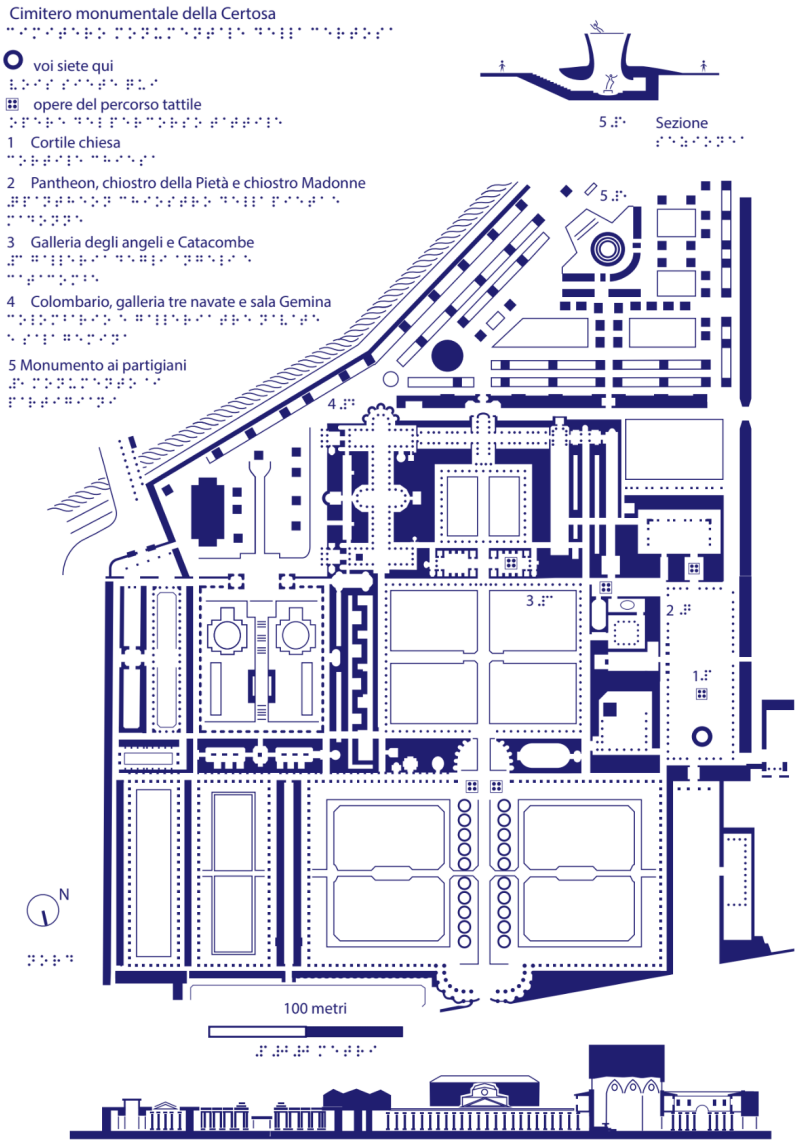

FIG. 2 Orientation and mobility tactile map design for the Monumental Museum of the Certosa of Bologna.

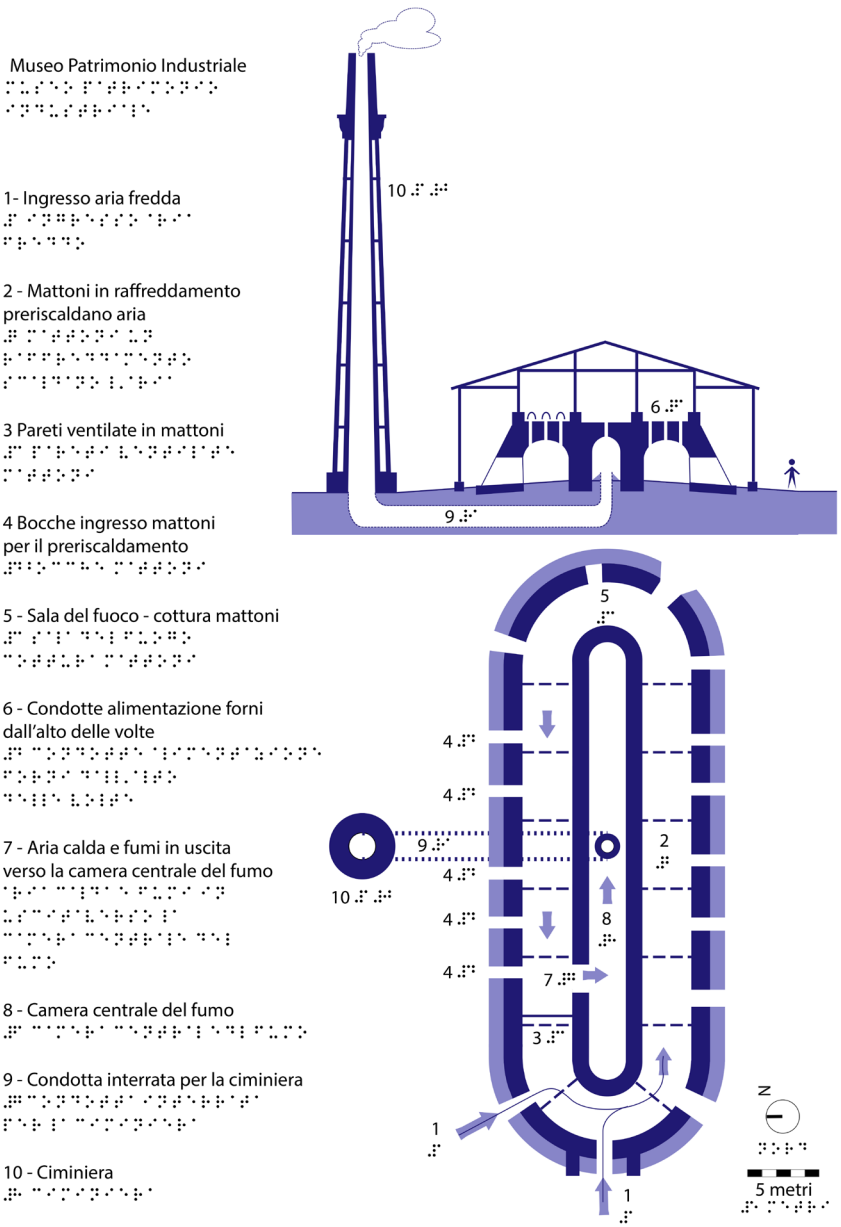

FIG. 3 Orientation and mobility tactile map design for the Industrial Heritage Museum of Bologna.

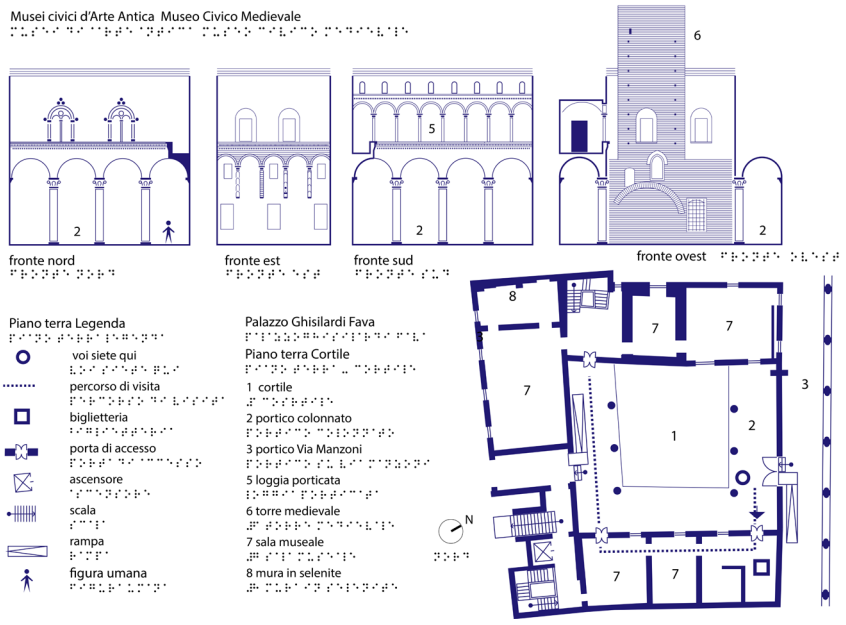

FIG. 4 Orientation and mobility tactile map design for the Medieval Museum of Bologna

The best mobility is always natural, without the addition of aids that compensate for deficiencies.

This is accompanied by the need to offer accessible room communication and to follow the training of museum staff.

Captions with synthetic texts, shown in black and enlarged font, and in Braille.

But it is also important to say two things:

- there are no two visually impaired with the same story,
- not everyone is born blind.

Our job is to create tools that help autonomy.

But it remains an ideal that is not always achievable.

It is essential to take care of the reception with an adequate educational service dedicated to the needs of the visitor with visual impairment.

d) Touch the beauty

"Touching beauty", the title of the exhibition was produced and commissioned by the Museo Omero in Ancona.

Museo Omero has been working since the nineties to offer aesthetic experiences through tactility.

We owe it to President Aldo Grassini and his wife Daniela Bettegoni always at his side in this undertaking.

It is not easy to make people understand how important it is even for those who cannot see an authentic aesthetic experience.

A profound experience, not mediated by translations and copies that replace the original.

Understanding that touching is not like seeing is not easy.

Touch does not replace sight.

Eventually it is his metaphor.

Speaking of aesthetics, it is important to understand that our culture has always believed that art was something related to seeing. On this he built all his aesthetic theories: shadow theory, central perspective as a symbolic form, divisionism etc.

Tactile art is considered secondary.

The cast and the imprint are relegated by Vasari to the minor sphere of the mechanical arts.

It was in the twentieth century that the cast became a full-fledged work of art.

For example, with Marcel Duchamp or with Giuseppe Penone.

Marinetti and his manifesto of tactilism defines the conditions for an art that no longer works on eye vision but works on tactility.

These are the premises for a set-up project that compares two important figures from the 1900s: Maria Montessori and Bruno Munari.

Both worked by developing pedagogies that worked with creativity, aesthetics and tactility in the child.

There are different ways of understanding an exhibition project.

I have always been interested in the design of the experience within the museal space and not in the design of the display cases.

I have always preferred museology to museography, the careful study of how to make a thought come. Also in this case the technique and the technologies support the objectives that the exhibition sets itself: to show the contact points of two researches through touch.

I like to think of a cognitive museology that has the ability to broaden the field of emotions. A museology that offers the tools to give birth to those who observe the curiosity to understand and the possibility of finding answers.

As mentioned elsewhere, the important thing is to provide a simple mental structure.

Provide a map that helps first of all to create a representation of the space where I can move easily.

It is important that things are arranged inside following a pattern that becomes narrative.

The exhibition collects objects, words, contents; they are organized within a narrative dimension that uses settings, sets, original material objects and supporting things.

Each element underlines and brings to the attention of the person, the qualities of the objects. The person is invited to look, touch and compare the objects of the two collections by proximity.

The sense of things must also emerge within the viewer.

I have to suggest how to look and what to look for.

But I don't have to explain.

The child instead of the new has infinity. The adult, on the other hand, makes comparisons.

These two differences are the key to designing tables that welcome the collections.

They compare them and put them into play.

Each table represents a theme of the exhibition. The tables change shape and color to highlight the internal differences between the two researches

of Montessori and Munari.

The form of the exhibition and the devices are born within the thought of the two thinkers and look for the words to say it in the habits of the public.

e) M.E.M.O.R.I. Matera 2019

Another project on which I have worked with this attitude is M.E.M.O.R.I.

Again the project had clear objectives but did not have a form with which to get its contents.

Simply put: it is a temporary museum for Matera 2019. An intercultural artistic project resulting from research in the Euro-Mediterranean area aimed at opening a museum starting from common objects.

M.E.M.O.RI. (acronym for the Euro-Mediterranean Museum of the RI-scented Object) is a traveling museum that displays fragments, traces, small objects collected during a trip made by the operators of the cooperative the *Salone dei Rifiutati* in five Mediterranean cities (Genoa, Marseille, Malaga, Tunis and Tétouan) and in five Lucanian islands (Bernalda, Venosa, Matera, Muro Lucano, Potenza).

From the very first steps, he moved in the awareness that everything had to be thought of considering all the languages we use to communicate with us.

He worked on the habits and customs of the communities crossed to collect and offer access keys to content.

But the first community studied and with which I worked was the community that started the project: the *Salone dei Rifiutati*.

It was important to design with the rules of museology, an experience capable of being recognized and understood by various audiences.

The museum today is a metaphor for an idea that always changes its shape. It is embodied within the tools it uses by adopting its rules.

The research was carried out through a practice of creative crossing of territories aimed at knowing the places of the 10 communities involved.

The urban space has been re-traced in search of artistic or domestic artefacts, souvenirs, scraps of local crafts, objects brought from the sea or found on the street.

Going back along the stories that the objects contain, M.E.M.O.RI. it is a path that tries to offer elements of reflection on the internal relationship to humanity that inhabits its spaces. He opened questions about the meaning of the cultures in which these things were born and were exchanged, handled, lived.

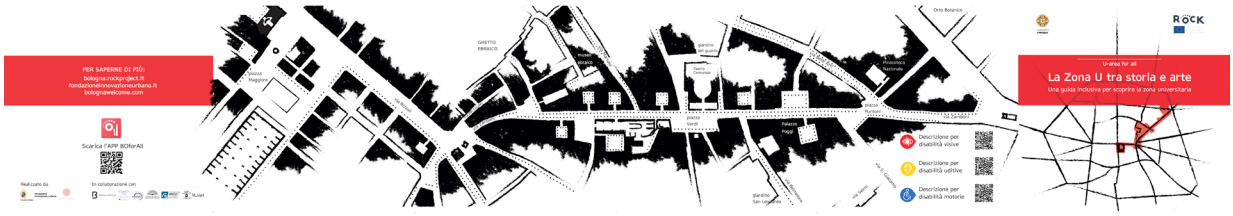

FIG. 5 Orientation and mobility tactile design for the booklet for U-AREA FOR ALL - ROCK BOLOGNA project.

f) U-AREA FOR ALL - ROCK BOLOGNA project

The project concerns a process started in spring 2019 to design and test an inclusive guided tour service in the University area.

A simple project that has once again put together the CDH (Handicap Documentation Center), the Gualandi Foundation, the Istituto *dei Ciechi* Francesco Cavazza with the Ptolemy Museum and two associations, La Girobussola onlus and MUVet.

The call that supports the project was born within the ROCK Project which involves the university area that develops along via Zamboni. Its goal is to regenerate this area through environmental, social, economic and sustainable processes to transform it into a sustainable, cultural and creative district.

The project involves alongside the University of Bologna and the Municipality of Bologna and other entities operating in Bologna and refers to the Europe Horizon2020 call, climate Greening the Economy axis.

Again, the project did not just provide advice.

We involved communities representing different disabilities to map the area, to learn about the different critical issues that produce exclusion.

This project was very important because it made the different communities work together. It created an opportunity to measure and balance the different needs in work sessions and analysis and creative sessions.

The outcome of the course was a mapping of the accessibility of the main points of interest and the cultural heritage of the university area.

This allowed to have a thorough knowledge of the movements, the attractions, the architectural barriers and in general the criticality and usability of the area.

Based on this analysis, we have designed two thematic itineraries that wind along Via Zamboni: one dedicated to the historical, artistic and religious heritage, the other dedicated to the scientific heritage. The routes

are designed to be carried out by the visitor both independently and with a tour guide.

For both cases we have created an information map that summarizes the work and helps to understand the area.

The map took the form of a bellows book with a simplified map of the relief area. Inside there are three approaches to proceed in the visit by people with visual, auditory and motor disabilities.

The three paths cross and offer those who read a double glance: what to observe and how to do it in deficit conditions.

The project did not end with the production of the guide.

We have developed training courses for tourist guides and we have developed hours of training to literate accessible communication using digital and paper support, both in terms of grammar and techniques.

FIG. 6 The installation of the monumental tactile map U-AREA FOR ALL - ROCK BOLOGNA project. Credits: Margherita Caprilli.

FIG. 7 The installation of the monumental tactile map U-AREA FOR ALL - ROCK BOLOGNA project. Credits: Margherita Caprilli.

FIG. 8 The installation of the monumental tactile map U-AREA FOR ALL - ROCK BOLOGNA project. Credits: Margherita Caprilli.

FIG. 9 The installation of the monumental tactile map U-AREA FOR ALL - ROCK BOLOGNA project. Credits: Margherita Caprilli.

Conclusions

In recent years, attention to accessibility has grown considerably.

As I wrote earlier, it is the signal that our culture is changing.

It is important that grammars related to accessibility become shared heritage.

That it becomes a knowledge that also feeds the economy.

Because accessibility affects everyone and helps in general in knowing oneself and in overcoming many legacies that still produce damage and immobility today.

It is not a variable to be added to correct the process but it is a premise for any thought that puts us in a relational dimension. It is important to listen to the frailties of others because they are opportunities for everyone.

Fabio Fornasari Museologist architect.
Art Director of Museo Tolomeo (Istituto dei Ciechi Francesco Cavazza)
Associated researcher of CNR-IRPPS.
His main projects: Museo del 900, Museum at the Baths of Caracalla, Villa di Livia Museum, Museo Tolomeo.
He builds devices to show and tell valuable stories using museographic projects and installations, and learning environments. Assemble and unmount contents to develop social innovation.
His projects involve the public within the dynamics of cognitive and sensorial interaction.
Develops educational border models with psychologists and pedagogists.
Member of staff of the Disability Manager of the City of Bologna.

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NOTES

Fondazione CRT and Accessibility

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ABSTRACT

The concept of accessibility doesn't only apply to people with disabilities. It is about everyone, as real people, with different skills and needs, in a permanent or in a temporary way. Talking about accessibility means celebrating human diversity. Talking about accessibility means facing with social role of museums in our society. Accessibility means more beauty, more comfort, more autonomy, more wealth for everyone. Since 2012 Fondazione CRT has been working with Fondazione Paideia on the initiative Museum operators and disabilities where museum staff are trained to welcome visitors with disabilities and special needs in the best possible way, in the awareness that "breaking down cultural barriers is an important step to really open up places of art to everyone".

KEYWORDS

Accessibility; Diversity; Art; Museums; Cultural Enjoyment.

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1. Who is Fondazione CRT?

Fondazione CRT[1] is a private non-profit organization founded in 1991. For 29 years, it has been one of the "engines" of development and growth in the north of Italy in three main areas: Art and Culture, Research & Education, Welfare and Territory. It implements projects and resources in the promotion of the arts and cultural activities, the promotion of scientific research and training for young people, support for innovation and social entrepreneurship, assistance to people in need, preservation of the environment, and civil protection and first response systems. Fondazione CRT also embraces the so-called active philanthropy approach, including venture philanthropy and impact investing.

2. Fondazione CRT and the theme of accessibility

At the forefront of supporting the values of full accessibility and social inclusion - since 2006 when the Winter Paralympic Games were held in Turin -, Fondazione CRT has supported initiatives and implemented projects linked by a single thread: that of preserving the dignity of disabled people, protecting their equality and respecting their right to lead an independent life as much as possible. Various initiatives have been launched with this in mind; first, *Vivomeglio*: a call for proposals for projects that improve the quality of life and autonomy of people with disabilities. Fondazione CRT has supported more than 2,300 interventions since 2005, for a total investment of over 25 million euros.

In 2019 the *Vivomeglio* initiative was enriched by a free training course, called *Kick Off: the challenge starts now*, aimed at supporting non-profit organizations in the delicate phase of planning and monitoring projects. The latter is an operation through which Fondazione CRT combines granting with an approach that favours the creation of skills and capacity building to enhance the effectiveness of financial support to the Third Sector. About 180 organizations from the Piedmont and the Valle d'Aosta Regions were involved with over 200 participants.

In 2020, Fondazione CRT launched the project *WeNet: more skills for networking*, confirming its role as a "development agent" and knowledge aggregator at the service of communities. With this initiative, Fondazione CRT proposes a new calendar of training events able to provide organizations with useful theoretical content and valuable operational tools to support them during the delicate phase of planning an initiative in the social field, and help them communicate their identity and work. About 140 organizations from the Piedmont and the Valle d'Aosta Regions were involved.

The point of arrival, but at the same time the start, of the training process

1 http://www.fondazionecrt.it, accessed 28 December 2020.

that Fondazione CRT has put in place in recent years on the disability front will be the definition of the first *Disability Agenda* in Italy: a plan of concrete actions "signed" by the institutions and civil society on the basis of the proposals and needs - changed also in light of the health emergency - of the non-profit organizations that daily work for people with disabilities, their families and communities. The *Disability Agenda* will be presented in December 2021 on the occasion of the *International Day of Persons with Disabilities*.

In addition, since 2012 Fondazione CRT has been working with Fondazione Paideia on the initiative *Museum operators and disabilities* where museum staff are trained to welcome visitors with disabilities and special needs in the best possible way, in the awareness that "breaking down cultural barriers is an important step to really open up places of art to everyone".

3. Museum Operators and Disability

3.1. The origins of the project

In 2006, an extraordinary grant from Fondazione CRT enabled the ninth Paralympic Games to take place in Turin. This, in conjunction with the 20th Winter Olympics, meant that the city acquired a good level of accessible infrastructure and developed a marked improvement in awareness of the need for the inclusion of disabled people within society that has continued until today. This was where the various interested parties of the region came together to share their resources with a view to participatory and joint planning, beginning with their own cultural endeavors. The role of promoter of the *Museum Operators and Disability* project has been assigned to Palazzo Madama, the Civic Museum of Ancient Art,[2] which in 2011 directly expressed the need to train its own staff on accessibility. From this call for training, a study was commissioned which investigated the existing level of accessibility training of museum operators in the Turin area, as well as the level of willingness to improve it. The outcome of this process of listening to and comparison amongst the area's cultural operators is *Museum Operators and Disability*, a project that Fondazione CRT and Fondazione Paideia have been developing since 2012. Fondazione Paideia[3] develops initiatives aimed at preventing and reducing child distress. Through the work of qualified and passionate professionals, it carries out projects on the territory, proposes cultural initiatives and supports each year over 300 families with disabled or sick children.

3.2. The types of training

The types of training are:

2 https://www.palazzomadamatorino.it/it, accessed 28 December 2020.

3 http://www.fondazionepaideia.it/, accessed 28 December 2020.

- Basic courses about the different types of disabilities and the basic techniques of communication and accommodation;
- In depth seminars on the themes covered in the basic courses;
- Beginner courses in Italian Sign Language for the museum context;
- Workshops in the production of social history.[4]

Initially developed on a local dimension, addressing the museums of Turin, the project has gradually expanded to the provincial, regional and national territory, involving almost 200 museums and cultural institutions in the national territory and over 1000 operators. Since the start of the first edition of the basic course in January 2012, there have been 39 editions of the basic course, 28 in-depth seminars, 7 courses on the first literacy of Italian Sign Language applied to the museum context and 5 workshops on the production of social stories.

3.3. Objectives

The general objective of the project is to increase awareness, implementation and sharing of professional skills through specific training aimed at museum operators to foster a culture of inclusion and reception of visitors with disabilities and special needs.

The specific objectives are:

Adapt the customer service, communication and reception skills of the museum to the "special" needs of users;

Train the museum structure to be inclusive and integrated;

Qualify the operators who work there;

Improve the knowledge of the different disabilities and the "special needs" connected to them;

Qualify the perception of the visit experience in the museum and, consequently, also in the city where the experience took place.

3.4. Strengths

1. It's a joint project resulting from teamwork between a philanthropic foundation (FCRT) and an operational foundation in the field of disability (Fondazione Paideia) and constant collaboration between the promoters and the recipients of the intervention.

4 *Social Stories* represent the most widely used "targeted intervention strategy" with people with autism spectrum disorders. Social Stories are particular texts, written according to specific criteria, that describe clearly, concisely and precisely a situation, a skill, a result or a concept. Their aim is to help people with autism to better understand the social situations and events they encounter in their lives, thus supporting their ability to be active subjects in daily routines and activities.

2. It's a transversal project that involves every member of staff at a museum, from the cloakroom staff to the head curator.
3. It's a flexible project that develops and adapts to the needs expressed by the participants at the end of the courses.
4. Participation in the project has acquired over time a strong motivational value based on the voluntary involvement of staff who – on their only free day (Museums are closed on Monday's) – decide independently to take part in a personal and professional growth path.
5. The project is evidence of the virtuous process that can be triggered in every city if there is a subject that stimulates flexible collaboration between museums, organizations that deal with disabilities and foundations that have in their mission the social and economic development of the territory.

3.5. Beyond training

The project *Museum Operators and Disability* is not just training.

3.5.1. Published works

In 2017 the project *Museum Operators and disability* was the object of the publication of the homonymous volume.[5] It explores the values that support the design experience, its methodological assumptions and the contents that represent the consolidated backbone of the basic courses. Created by the project professors, the book intends to open or consolidate in its readers an innovative definition of accessibility and stimulate similar educational experiences in other areas [Fig. 1].

3.5.2. Experiences of replicability

Thanks to an important consultation in terms of content, methodology and organization by Fondazione CRT and Fondazione Paideia, the format of the project *Museum operators and disability* has been exported to the national territory. Adapted to the needs of the museums involved, it has given important contributions to training courses in the following regions: Piemonte, Liguria, Lombardia, Veneto, Emilia Romagna, Friuli Venezia Giulia and Lazio.

3.5.3. Events

The project *Museum Operators and Disability* has been the driving force for the organization of national public events for comparison and reflection

5 Fabrizio Serra, Franco Tartaglia, and Silvio Venuti, *Operatori museali e disabilità. Come favorire una cultura dell'accoglienza* (Roma: Carocci, 2017).

FIG. 1 The cover of the publication *Operatori museali e disabilità. Come favorire una cultura dell'accoglienza*

dedicated to the world of culture around the concept of accessibility, understood from a human and communicative point of view, even before starting the structural changes.

In March 2017, Fondazione CRT hosted the conference entitled *Museums towards a culture of hospitality*, a training day dedicated to national museum directors aimed at highlighting the right mix of ingredients required to make a cultural visit fully satisfying for all visitors. Reception, attention to communication, dedication to building and maintaining relationships are the key factors at the center of new organizational and management models to make culture an all-inclusive experience. Accessibility is not just the removal of structural barriers but also the removal of relational barriers. The person is the center. His or her condition comes after,

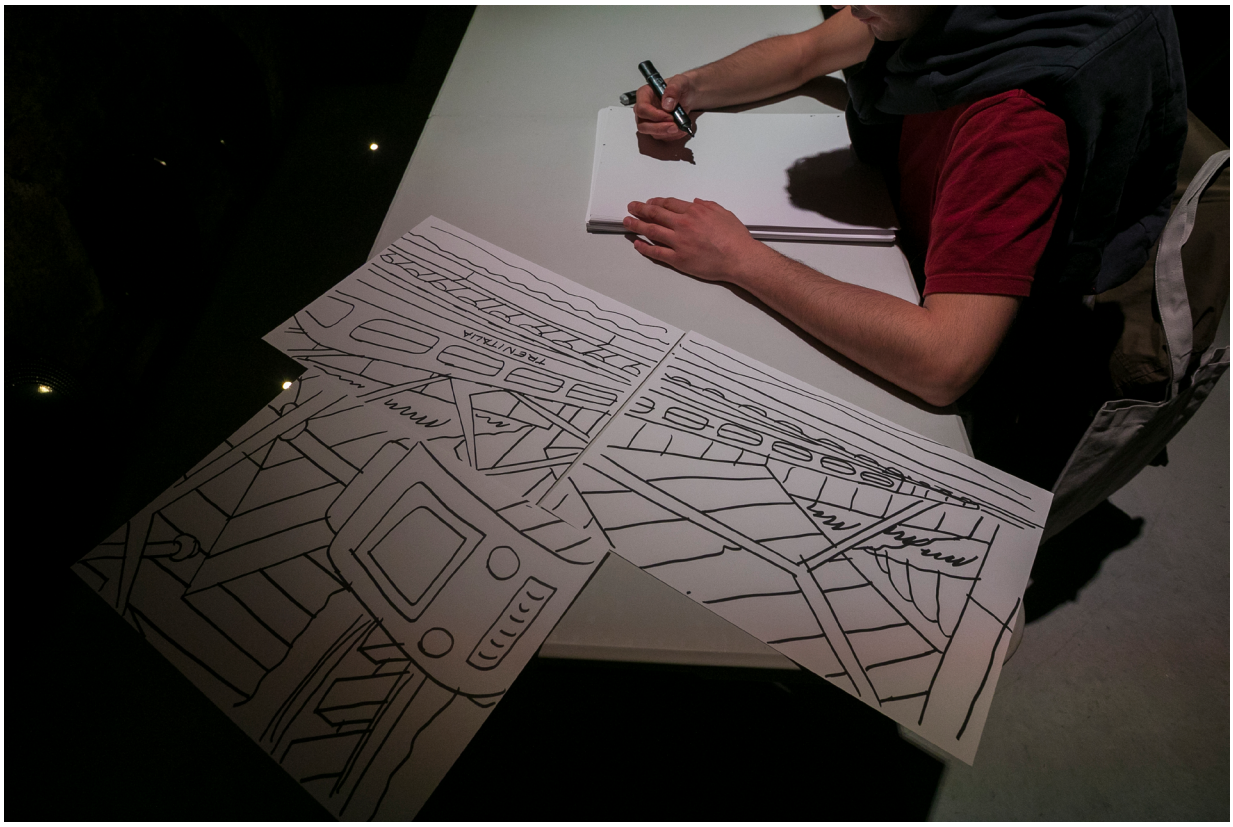

FIG. 2 Lorenzo Filardi, Trenitalia, 2018

if necessary. The role of the museum has evolved over time. Today a museum is no longer a passive destination, object of visits and studies. Today a museum is like a "square", a place to meet and share stories… A museum transmits contents, but it can also create live positive cultural and relational experiences. This is the right to cultural enjoyment. However, we can still go further.

In December 2018, thanks to the European dimension that the theme of accessibility acquired during the European Year of Cultural Heritage 2018, Fondazione CRT organized at the OGR – Officine Grandi Riparazioni a conference entitled *From art for all, to everyone's art. Towards a new perspective of accessibility*. On this occasion, the concept of accessibility of culture for all was proposed as a tool to promote community welfare actions through diversity during the process of planning and cultural production. Assuming that accessibility is not just the removal of structural barriers, but also the removal of relational barriers, it is possible to make the transition from the right to cultural enjoyment to the right to cultural production. Art cannot only be enjoyed by everyone, but Art can also be created by everyone. Accessibility is a guarantee of everyone's right to culture. Accessibility is democracy, but it also opens up to a new concept of art and a new way of proposing it. These are some artworks, produced during the conference by artists with disabilities. But, as always, the person is at the center. His or her condition comes after, if necessary, which in this case it is not **[Figs. 2-3]**.

FIG. 3 Lorenzo Filardi, Trenitalia, 2018

3.5.4. Beyond museum boundaries

The extent of potential impact of *Museum Operators and Disability* has allowed the project to reach out to cultural centers that are not strictly museums. This is the case of the OGR – Officine Grandi Riparazioni. With a budget of 100 million Euros, Fondazione CRT completely restored the OGR (a former large industrial building in the heart of Turin) and reconverted it into an innovative and experimental center for contemporary culture, art, research and business acceleration with an international vocation, covering over 35.000 square meters.

3.5.5. From theory into practice

In the 2019 edition of the project *Museum operators and disability* has been tested for the first time the itinerant workshop: a training experience with a laboratory character and highly innovative content, aimed at the development of operational tools and organizational designs that can be implemented in museums willing to connote a truly inclusive perspective. Through an "itinerant" training, both with respect to the places of training and to the timing of the same, participants have had the opportunity to approach some good practices of the territory of Turin presented through experiential evidence. In addition, they were able to confront the point of view of people with disabilities and their needs in the context of a museum visit, to decline in operational terms the core themes underlying the basic course of the project *Museum operators and disability*, to measure their

ability to develop project work really implementable in the museum reality of belonging.

All this has been achieved thanks to the professional competence of selected teachers who have been delivering the courses of the project *Museum operators and disabilities* for years, to the advice of expert trainers in the museum sector, to the comparison with non-profit organizations that deal with disabilities, through an interactive and dynamic teaching method, which has made peer coaching the privileged working tool.

The workshop was hosted by the following museums, emblematic cases of accessibility in the Turin area:

- Museo A come Ambiente;[6]
- OGR – Officine Grandi Riparazioni;[7]
- Museo Nazionale del Cinema.[8]

3.6 Future goals

With the 2019 edition, the project *Museum Operators and Disability* broadened its boundaries, extending our training out to the operators of a variety of cultural services. Everyone has the right to participate in every part of cultural life and all museum activities. The ambition of the project has always been that the approach and model will garner interest for those who, in their own territory, intend to give life to similar training and training initiatives. For this reason, the project structure is flexible and open to incorporate inputs and proposals from the museums and cultural services themselves. The ambition of the project has always been to develop andreplicate the model, and export the approach and format of the Turin experience.

Why take such a challenge? Why make museums an open space for dialogue and meeting? Which objectives need to be set? Talking about accessibility means embracing the social role of museums in our society. Accessibility means more autonomy, more comfort and more wealth for everyone. From the Universal Declaration of Human Rights to the Agenda 2030 for Sustainable Development, the position and the responsibility of cultural heritage about building our future are extremely important. The eleventh Goal of the Agenda 2030 is to "make cities and human settlements inclusive, safe, resilient and sustainable". A community is sustainable if it is accessible.

So can we move from the right to cultural enjoyment, to the right to cultural production and to the right of citizenship? The answer is probably yes.

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6 http://www.acomeambiente.org/, accessed 28 December 2020.

7 http://www.ogrtorino.it/, accessed 28 December 2020.

8 http://www.museocinema.it/, accessed 28 December 2020.

4. OGR – Officine Grandi Riparazioni

For over a hundred years the OGR - Officine Grandi Riparazioni, an imposing late XIX century industrial complex drove the growth of the city of Turin. Abandonment and dereliction ensuing the early 1990s closure, led to their planned demolition, luckily averted. In 2013, Fondazione CRT purchased the 20,000 square H-shaped building, the offices and the yards and, through OGR-CRT Society, their redevelopment began. One thousand days were required to return them to Turin, converted into a new heart beating on creativity, culture and shows, projected towards the world. One hundred million euros invested by Fondazione CRT to bring back to life the OGR, the "cathedral" of Turin's industrial history. Hi- tech solutions, environmental sustainability, historical preservation, versatility of spaces and accessibility for all: these were the specifications behind the radical refurbishment and conversion of the OGR: from former train repairs Workshops to new Workshops for contemporary culture, innovation and business acceleration, with a marked international stance. OGR are the first cultural center in Italy to be equipped in 2017 with the Decalogue of accessibility of "for all" events. It was there, that in 2018, a training course on the accessibility of art sites involved the employees and the staff of all the sectors in which the activities of OGR are organized (ticketing, security, reception, catering, etc.).

4.1. OGR Cult: where visual and performing arts meet

OGR Cult's multifunctional spaces cover an area of about 9,000 square metres and host, alternating all sorts of exhibitions, shows, concerts - from classical to electronic music - theatre and dance events.

The names of the areas reflect the history of the places: the *3Binari* (tracks) situated in the west area host exhibitions and display projects, as well as the *Team Lab Kids Future Park* installation.

The area dedicated to performing arts and music shows has kept the original name of *Sala Fucine* (the forges), *Duomo* (the Dome) is the heart of *OGR Cult* spaces: this imposing hall, 19 metres high to allow maintenance emissions to be released from the workshops, is now dedicated to symposiums, workshops and conferences. The redevelopment of the areas pursued a rigorous restoration project that, while adapting the building to its new purpose, left intact the sediments of the past: for instance, on its walls, in a game of cross- references and fusion between memory and the present day – one of the concepts behind the reborn Workshops – the traces of the building's past have been preserved for the visitors.

In 2020 *OGR Cult* was been temporarily converted into a healthcare area for Coronavirus patients.

OGR Cult in numbers:

- 9,000 m^2 in total;
- 2,700 m^2 for exhibitions;
- Up to 2,750 seating capacity;
- 350 m^2 in the Duomo Area;
- 500,000 visitors since opening.

4.2. OGR Tech: 12.000 m^2 of future

OGR Tech, which relies on international partnerships, is the new innovation hub for scientific, technological and industrial research that – over the next twenty years – intends to catalyse half a billion euros of investments and accelerate 1,000 new startups. Techstars, global leader fostering startups growth, Fondazione CRT, Fondazione Compagnia di San Paolo and Intesa Sanpaolo Innovation Center all teamed up to create the first Startup Accelerator Programme in Europe dedicated to smart mobility. Together with Microsoft, Tech Revolution Factory was founded at OGR Tech: it is the first digital innovation platform characterised by three distinctive axes of development: acceleration of disruptive startups on Artificial Intelligence, tech training for any type of audience, events and contests for the growth and development of entrepreneurial ecosystems.

OGR Tech in numbers:

- 12,000 m^2 in total;
- 499 work stations;
- 15 meeting rooms;
- 8 soundproof phone booths;
- 38 chat sofa;
- 50 led wall and video wall;
- 1 Certified data center Tier III Certification Uptime Institute .

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He is also the author of numerous publications.