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INTERNATIONAL DOCTORATE
IN ARCHITECTURE AND URBAN PLANNING

Cycle XXXIV

IDAUP Coordinator Prof. Roberto Di Giulio

SMART HEALTHY CITY

innovative urban services to improve the health in the city and its residents' wellbeing

Curriculum Architecture, IDAUP topic n. 1.2
(Area 08 – SSD: ICAR/14 Architectural and Urban Design)

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Abstract

In the frame of the promotion of healthy lifestyle in urban environment, this research seeks to identify viable design solutions to motivate people, both collectively and individually, to pursue daily healthy habits while enjoying the experience, through the use of improved services in the city.

When it comes to urban health, street furniture, especially in terms of tactile and visual quality, urban placement and spacing, rarely makes headlines or attracts academic attention; nevertheless, each small object – be it a bench, a bus-stop, a waste container or a drinking fountain – can make our daily life easier, richer and more comfortable. Small-scale urban elements greatly influence the attractiveness of our surroundings, and whether people want to go to and spend time in, a crucial aspect if city dwellers are to lead healthier, more active lifestyles.
Furthermore, thanks to the digital revolution, urban amenities and facilities are currently being transformed, becoming more and more efficient and responsible to environmental conditions, or, conversely, some of them are disappearing, if no longer in keeping with dwellers' needs.

Among all pieces of street furnishings, the project investigates the frequently overlooked role of public drinking fountain, a seemingly insignificant urban element with a huge potential if properly reinvented: not only as a public utility, but also as an expression of neighbourhood identity and sustainability, a valuable Public Health tool promoting virtuous behaviour.
This research addresses the questions of **what role drinking fountains should play today in public space, how a contemporary street furniture including water outlet should look like, and where should be located to best serve the community**.

Firstly, the study highlights the most promising features of water fountains from a public health perspective; secondly, as it configures itself as an applied research, an innovative multifunctional service, likely to create new opportunities in the city for safer and more sustainable living, is designed, prototyped and tested.
Finally, the research outlines a concept of healthy-driven urban services in network, including the ones developed through prototypes, providing incentives for their most health-conscious and environmentally friendly users. In this way, urban amenities located in public spaces, linked one another, may convert demanding self-control practices dealing with health prevention and sustainability into positive moments of enjoyment and reward, thus become urban interfaces enhancing public health and personal wellbeing.

The design outcomes and the prototype development of the innovative service fall within a wider University-Industry research conducted between Next City Lab, an interdisciplinary research group at Architecture Department University of Ferrara, headed by professor Gabriele Lelli, and Hera Group, one of the leading Italian multi-utility operating in environmental, energy and water services.

Acknowledgements

Since I started and led the project described here, the contribution and help from a wide group of persons must be acknowledged.

I am very grateful for my supervisor and mentor Professor Gabriele Lelli, who has encouraged me in the last ten years of both research activity and architectural practice. Thank you for embracing my interests, making the most out of my skills, and always pushing me to look for “one more design option”!

I would like to thank IDAUP Academic Board members, each who have constantly guided me throughout the research steps, in particular Professors Theo Zaffagnini and Llazar Kumaraku for their generosity with their time and instructions that made me more confident in my research methods.
Many thanks to Professors Stefano Capolongo and Andrea Rebecchi from Politecnico di Milano, for sharing their research work and knowledge, and to Dr. Joana Dhiamandi, who encouraged me to investigate the methodological framework in the early part of the research.
To Dr. Christian Tietz, I am happy to have found amazing connections with your research activity at UNSW in Sydney, despite the physical distance and the impossibility to reach you because of the pandemic, I am still looking forward future international collaborations.
To architects Piera Nobili and Cinzia Araldi from CERPA Italia ONLUS, for their relevant suggestions about a greater accessibility of urban services and prototypes.

To LBLA architecture firm, for the technical help and assistance from partners and their team. Thank you to architect Marco Negri, who supported me throughout the ups-and-downs of research and professional adventures, I am lucky to have you as a fellow worker, start-up co-founder, and friend.

My heartfelt gratitude to my family and friends near and far for bearing with me during both stressful and exciting moments as well. Thanks for patiently listening at any hour to my inspired, fanciful and sometimes silly musings.

Lastly, I would like to thank Hera Group, Ecological Trasition section, especially Enrico Piraccini and Simone Allegra. I am forever grateful for our long-term collaboration that triggered my eager interest on public services, and for the invaluable opportunity to develop such a stimulating research, yet firmly grounded in the reality.

Figure n.1
Firenze, SS. Annunziata square from above. Ph by Paolo Pannini, 2010. Religious and civil buildings, porches, sittable steps and stairs, water fountain and monument: all of them help defining the character of one of the most fascinating public space.

Statement on Authorship

The research presented in this Doctoral Thesis is the culmination of work from several researchers and professionals. **As design practice is not an independent activity, neither is design research**, especially when it includes the development of fully functioning prototypes requiring cross-disciplinary interactions between experts from different fields. Without their efforts, this research could not have been realized in its current scope.

The study started in 2018 as the positive **convergence** between my personal interest for **innovative urban services**, accumulated by previous professional and academic experience, with a particular long time passion on health-related public infrastructure, and the commitment of the board Ecological Transition within the Italian Utility Hera Group to devise **original outdoor furnishings in line with circular economy,** and to extend their consolidated business towards new or re-invented public services.
This specific research project, which focuses on the transformation of drinking fountains into a multi-functional smart hub promoting public health, comes after several previous studies in agreement between Next City Lab, an interdisciplinary research group at Architecture Department University of Ferrara, headed by Professor Gabriele Lelli, and Hera Group. I have been involved with these University-Industry researches since 2015, actively contributing in the production of **design patents** and **innovation counts**, and the promotion of their outcomes at **international conferences** and writing papers on **scientific journals** about smart cities, green ICT systems and innovative design.

With these premises, throughout this text I used the pronouns “I, me, and my” to illustrate the research investigation I carried out independently, or to communicate my ideas and suggestions for further development of the work. I **entirely wrote the manuscript by myself**, with input from all contributors; I also took care in person of **all pictures, schemes, drawings and photorealistic visualizations of the presented urban service, unless otherwise noted**.
However, in describing prototype design features, manufacturing process and testing stage, I frequently used “we, us, and our” with a reference to the **research group as a whole**, since the names of inventors of the urban objects presented in this research, correctly appointed on the certificates of design property, are: from industry side (Hera Group), Eng. Enrico Piraccini, head of Development, Innovation Central Direction / Ecological Transition, Eng. Simone Allegra, project Development, Innovation Central Direction / Ecological Transition, Eng. Davide Cupioli and M. Arch. Federico Lazzarini, former Innovation Central Direction; from academic side, Prof. Gabriele Lelli, M. Arch. Roberta Bandini and PhD Candidate Ilaria Fabbri.

It is right and proper to emphasized that, among all contributors, my supervisor Prof. Gabriele Lelli aided in all aspects of the research, especially design solutions and urban scale insights.
It is also worth remembering that the entire cost of prototype development– including the design registration to the European Union Intellectual Property Office, fabrication drawings, sensors and technology equipment, manufacturing and installation – was supported by Hera Group.

Figure n. 2
In 19th century civil engineers tangibly improved urban quality of life, probably more than physicians did at that time, through pilot solutions initially conceived to address functional purposes, but that brought social benefits, too.
This experimental approach is best embodied by Joseph Bazalgette and his team of engineers, who invented new technologies through a trial-and-error process.
Joseph Bazalgette (top right in the picture) during a site inspection in 1860s at the northern outfall sewer being built below London’s Abbey Mills pumping station.
Photograph: Otto Herschan/Getty.

Contents

Figure n. 3
A young boy gets a drink of water from a fountain, c. 1932. Photo by Underwood Archives

Introduction

URBAN SERVICES AND HEALTH IN OUR CITIES

Public facilities and services have always developed through history in response to urban growth and public health crises, tightly connected to individual attitude and civil duty. For instance, in the late medieval city, without structured waste collection, latrines and open refuse pits served as waste disposal facilities, therefore individual behaviour was imperative for the intended work of these seemingly simple technologies, which could be badly affected by improper actions, for example by throwing waste in the streets gutters (Jørgensen, 2008).

In his book “Building and Dwelling: Ethics for the City” Richard Sennett (2018) highlights that the first actors tangibly fighting the unhealthy environment of overcrowded mid-19th century cities were engineers rather than doctors, through experimentations at street level involving both technology and design. They firmly supported the production on an industrial scale of smooth stone paving, not only because it was easier to clean, but also because it could, as a subtle result, encourage citizens to keep their street tidier; similarly, the invention of the pissoir, conceived in 1843 in Paris, marked a real **advance in public sanitation** and a **change in attitude** as well. Even more positively, all these improvements in urban services made outdoor space more appealing for social interactions.

Again, the main driver for a new, modern sewerage system was the devastating global cholera outbreak that in the early 1850s in London alone claimed more than 10 000 lives. Without this compelling public health issue, Joseph Bazalgette’s remarkable feat of civil engineering, which was designed to carry waste water safely downriver and away from drinking supplies, would never have materialized (Shenker, 2020).

Since 19th century, cities have made undeniable progress in advancing the health of their citizens, as urban living has become healthier and safer, but equally vulnerable to pandemic, as COVID-19 joined a long list of infectious diseases, like the Spanish flu of 1918 in New York and Mexico City or the Ebola Virus Disease in West Africa in 2014, leaving enduring marks on urban space, and its use.

Contemporary cities currently deal with several **daunting challenges**, some of them very different from the ones faced before in the history: increasing urban density, exposure to pollutants including outdoor noise, extreme weather, such as floods and record-breaking temperatures, increased physical inactivity, obesity and stressors, aging population, degraded ecosystems and erosion of natural capital.

In 2020 in Italy life expectancy has decreased by approximately 1,2 years, being COVID-19 a contributing factor, producing an increased demand for services that the current model of care cannot support in the long term. After all, the cost of care in Italy is about 115 billion € per year and it is rising, as presented by Italian Parliament in April 2021, whose report predicts an economic impact of Italian Healthcare on 124 billion € in 2024.

Smart cities should work against this dynamic, starting from health monitoring and risk prevention, the key to both better health and lower health-care costs over the long haul.

Figure n. 4
Urban services in a lively public space in Hafencity.
Ph Ilaria Fabbri, Hamburg, 2015


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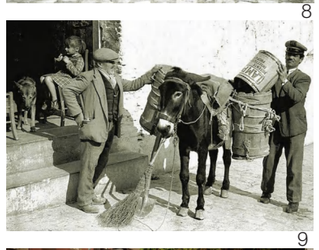
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10

2

Through IoT technologies, for instance, the biometric data of consumers areautomatically captured in real time and sent to primary care professionals, who provide recommendations and coaching for health and wellness based on the unique data streams delivered from powerful offsite computers. Technological disruption is concomitant to another social change, a sort of "**discipline of well-being**".
According to Italian psychiatrist Vittorino Andreoli (2016), people are increasingly embracing a new self-regulation of personal health, a multidimensional state of being that includes almost every aspect of life, food, beauty, love, social interactions Individuals are placing more value on health than in the past, and the definition of the word itself has evolved: health no longer simply refers to a lack of illness and disease, but to a more holistic state of being, where one's mental, physical and emotional health are in sync. The popularity of the health and wellness trend is visible across consumer groups, and it differs significantly from the various food and exercise trends that took hold in previous decades.
Eating healthily, exercising regularly using products, devices and apps that improve well-being and monitoring one's health have become a lifestyle choice.

The need of reducing resources' consumption, addressing global pressures and meeting modern-day consumerscapes, combined with the availability of new technologies and materials, are making urban services more and more sophisticated.
The ongoing **changes in public utility** driven by digital revolution is not limited to the delivery of services, but also involves **urban services' physical embodiment**: all objects and facilities in public spaces providing functions to the community.
Waste containers, benches, bus shelters, public lighting are gradually achieving a greater intelligence, interacting with dwellers, and collecting information from them. **Ordinary street furniture** is being transformed into **innovative urban interface** with huge potential, especially by the power of the widespread distribution of such pieces of equipment in the built environment; according to prof. Michele Acuto, who identifies in digital infrastructure the sanitation of our time (Klaus 2020), urban services can still serve as effective health tools.

However, the evolution of urban furnishings into sensing objects is a delicate phase.
As vividly highlighted by Magnago Lampugnani (2021), street elements, like bus stops, kiosks, streetlamps, public restrooms, trash cans, bike racks, just to name a few, although comparatively small in scale, play a significant role in determining the **character of an urban environment** and representing the **image of a city**.
Moreover, street furniture has the closest contact and interaction with people in outdoor built environment: a superficial smartization of street furniture, when limited to careless selection of standard catalogue items, often lacking tactile qualities and local colour, together with negligent urban placement, negatively impact public richness and texture.
So there are compelling reasons to explore the ongoing evolution of urban services and their physical entities, in order to actively manage and drive this change towards real usefulness and beauty.

Among all urban amenities and facilities currently being transformed, re-embraced and upgraded, **drinking fountains**, arguably the most creative and useful of any streetscape element, have remained marginalized, largely neglected both by the design practice and the academic environment.

In the upcoming parts of the research I will examine the potential of this basic urban service as a public health opportunity addressing present-day challenges, and illustrate contemporary drinking fountain trends, as a result of a complex evolution though history; later on I will present the **design process** and the prototype development of a full-scale **multifunctional urban object** dispensing drinking water, and its **connection with the urban fabric**, the potential activities that can be held outdoor and the attractiveness of the public realm.

The evolution of waste collection through history is a meaningful example of the correlation between public health and urban services.
Figure n. 5
Pieter Bruegel the Elder - The Fight between Carnival and Lent, 1559.
Medieval cities are frequently depicted as filthy places where people bumped household and human waste into the street or simply sloshed them out the window.
Figure n. 6
London during the Great Plague, 1665, with a death cart and mourners. Credit Wellcome Library, London. The outbreak of plague, cholera and other dreadful diseases prodded people to become more concerned about city sanitation and waste disposal.
Figure n. 7
Waste containers in Paris, 1913.
On March 7, 1884, Eugène Poubelle decreed that owners of buildings must provide their residents with three covered containers of 40 to 120 liter to hold household refuse, sorted into compostable items, paper and cloth, and crockery and shells. In 1890 the French dictionary officially introduced the word "poubelle" to indicate garbage can.
Figure n. 8
Italy, Lucania – waste collection with donkey cart, 1960.
Figure n. 9
Zagreb, standard waste container transformed by Mentalgassi – a trio of young German street artists, known for their use of large photographs pasted onto outdoor objects. 2012
In the 1950s, with the diffusion of plastic packaging, the number of urban waste containers skyrocketed.
Figure n. 10
Prototype of urban waste collection point, that improves user experience, recognizes users, measures the amount of garbage and provides further services for the city. Research's main authors: Eng. Enrico Piraccini and Eng. Simone Allegra (Hera Group), associate prof. Gabriele Lelli, MSc Walter Nicolino and MSc PhD Candidate Ilaria Fabbri (University of Ferrara, Department of Architecture).

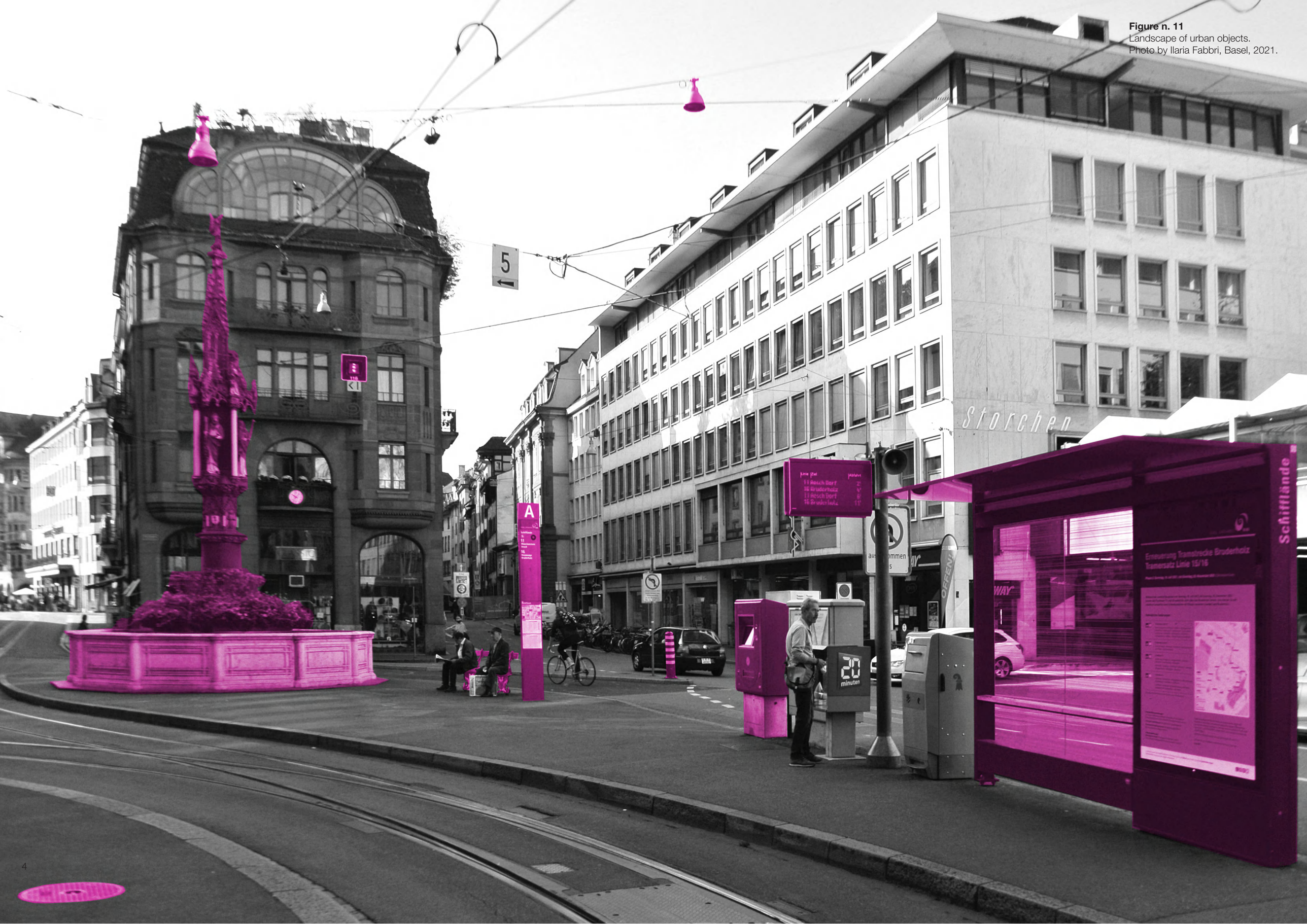


Figure n. 11
Landscape of urban objects.
Photo by Ilaria Fabbri, Basel, 2021.

RESEARCH OBJECTIVES

- Creating new opportunities for healthier living through improved urban services
- Reviving the image of public drinking fountains and foster their public health potential
- Introducing a network of health-driven services throughout the city
- Reducing plastic waste from single-use water bottles

TRENDS AND TARGETS

- Defining the health potential and the evolution of drinking fountains
- Overview of current drinking fountains in major cities
- Typological and competitive analysis of water stations

DESIGN

- Defining concept
- Functional design, specification of technologies, materials
- Processes and user interface design

PROTOTYPE DEVELOPMENT

- Technical design
- Construction and handover
- Installation

FINDINGS AND REFINEMENT

- examining the results
- verifying the efficacy of the pilots
- reporting necessary pilot improvements and implementation
- failure management
- evaluating opportunity for new added feature (sparkling/flavoured water)
- expanding the prototype to other cities

LIMITATIONS

- Limited number of investigated amenities
- Target areas with drinkable tap water, good social and welfare conditions
- Reference budget for prototype development

METHODOLOGY

- Practice-based design research
- Observational and explorative investigations
- Operative research methods (e.g. action research and case study)
- Prototype development process

USER RESEARCH

- Systematic review of national and international surveys about people's drinking habits
- Extensive real life observations
- Generating goal-driven user data with interviews
- Crafting fictional profiles – user persona

TEST AND MEASURE

- Visiting demo site
- Running usability tests
- Getting feedbacks from prototype users through surveys and interviews
- Investigating non-users' reasons

Research plan

This doctoral research looks with eager interest to the **small urban objects populating local streets** and outdoor public space in general, with the aim to find out new opportunities for healthier living through the use of improved daily services.
More specifically, the work reflects upon the **conundrum of contemporary drinking fountains**: the decline in the number and physical conditions of water outlets in the urban environment and growing concerns over tap water quality and microbial contamination from public fountains, have led to a shift away from publicly accessible water toward commercial bottled water, with environmental damage from plastic waste, and toward sugary beverages, leading contributors to obesity rates and dental decay, all burdening health care system.

The **output of the research** is a **set of prototypes** conceived to encourage people to rediscover and embrace public water, to look after the environment reducing plastic waste from single-use bottles and drink more water (rather than other high-calorie beverages), **urban placement studies**, dealing with the **appropriate siting** of the proposed service, their optimal spacing, and insights on expected benefits on urban health and **public space attractiveness**. Moreover, in a network of health-driven services throughout the city, the project intends to reward the most health-conscious and environmentally friendly citizens, and, at the same time, to deliver data to Public Administration and local utilities through sensing urban objects, in order to assist with decision-making, safety and maintenance management.
The research is focused on a limited number of facilities and amenities in the public space. In particular, the study develops the design of a contemporary water fountain; therefore, the expected positive health implications only refer to the range of action of this small-scale urban object, even though reinvented, transformed and combined with a lot of interconnected services.
Geographically, this research is mainly restricted to the built environment of small and medium-sized cities providing drinkable tap water, with normal needs, social and welfare average conditions and without particular environmental or economic challenges; in this sense, the results of the testing on precise target neighbourhood might arise questions about the generalisability of the case study approach.
Reference budget for prototype development has been an additional constraint; however, it is worth noting that this PhD experience benefitted from exceptional financial resources since Hera Group Multi utility undertook the overall product development costs, including street furniture manufacture and installation, thanks to the research–industry collaboration; this extraordinary circumstance gave the possibility to carry out innovative research in a high-level working group.
From the perspective of its **application**, this study can be defined as an **applied, practice-based research**, pursuing new knowledge partly by means of design practice and the outcomes of that practice; from the viewpoint of **enquiry mode**, the research endeavour is conducted through **prototype development process**. The products are real-context, full-scale urban objects, creating new opportunities in the city for more sustainable lifestyle and increased personal wellbeing. In summation, the study consists of a successive iterations of a phase: Awareness of a problem> Strategic definition> Concept design > Design development > Technical design > Prototype construction > Test and measure> Refinements > Conclusions.

GUIDING QUESTIONS

The guiding principles behind the research project are a set of questions concerning those small urban objects in the built environment that today tend to be forgotten; the research investigates both **physical manifestation** of street furniture and the **impact of urban amenities on public space and citizen's behaviour.**

- Why did most public drinking fountains gradually lose their purpose? Are public health concerns about drinking at water fountains well founded?
- What role can drinking fountains play today in public space?
- How should contemporary street furniture including water outlet look like to be appealing and rebuild public trust in municipal water? Where should it be placed to best serve the community? Which environmental and public health benefits could arise out of this new urban object?
- Which functional combination of different street furniture make sense? Which is rather desirable? Which other matches of urban services on the contrary should be avoided?
- How can the design of street furniture be individual and local, suitable to its specific location both aesthetically and functionally, without limiting its usage and access too much?

Urban design and water supply through history

Water has always been available in the public space in the form of springs, wells and fountains. Over the last couple of decades this basic resource has been gradually neglected because of health concerns of microbial contamination, and at the same time, overshadowed by the widespread diffusion of water in plastic bottles, with severe environmental consequences.
In modern times, public drinking fountains evolved from a simple communal cup with sanitary issues to the contemporary “bubblers”, but there is a big room for improvement to rehabilitate the image of public drinking fountain as an appealing sanitary drinking mechanism.

This chapter is not meant to give an exhaustive account of the history of fountains; instead the goal is to present the evolution of urban drinking water outlets in different civilizations, considering three main features:

1- Fountain as a basic public facility for daily water intake;
2- Fountain as an iconic object and a meeting point in the neighbourhood;
3- Fountain as public interface with positive/negative impacts on users’ health.

URBAN AND SOCIAL DIMENSION OF FOUNTAINS IN ANCIENT CITIES

The history of fountains dates back to Crete and Greece, where they represent both a public necessity and a strong meeting point.
Typically placed in or near temples and dedicated to gods, the fountain has always been a **strategic element for community life**, for social interactions and sharing information, especially for female citizens.
Poorer Greek women and the slaves of richer families usually met at communal fountains and chatted as they queued for the water. There are a number of ancient Greek – mostly Attic – vases that depict women filling hydriai at a fountain house (Brouwers, 2019). Such scenes, commonly diffused in the iconographic repertoire of painted vessels, are more than just the representation of female everyday activities in ancient Greece; they give an invaluable glimpse into the role and the social dimension of urban fountain as nodal gathering place.
A second century Greek writer, Pausanias, wrote that a place is never rightfully called a “city” without water fountains (Phurisamban, 2017).
Most Greek fountains were primarily functional to supply drinking water – sometimes also for ritual purposes, and flowed by simple gravity; water pressure and the siphoning principle were also used to make water jet or spout.

The ancient Romans began also using decorative fountains in 6th century BC, through a sophisticated system of aqueducts that has always be considered some of the most remarkable achievements of the ancient world, closely tied to the idea of Roman civilization itself (Aryamontri, 2009).
The attitude of ancient Rome towards water was so innovative that in 98 AD the Roman consul Sextus Julius Frontinus was named curator aquarum (guardian of the city’s water supply) and from then on providing water to its people has been part of Rome’s job. At the time Rome had about a million of citizens and nine aqueducts that provided

Figure n. 12
Pienza, Pius II square from above. Bernardo Rossellino accurately designed and located the travertine well at the side of Piccolomini Palace, not centered with the axis of symmetry of the square, bringing balance to perspective, serving as a “*metric scale of the well-proportioned public space as a whole*” (Carli, 1966).
The stone element named after “the well of dogs”, was also an essential source of drinking water for humans and animals through time.
Ph by Paolo Pannini, 2013

13

14

Figure n. 13
An Attic black-figure hydria from ca. 520 BC illustrates women drawing water at the fountain.
© Museum of Fine Arts, Boston.
Figure n. 14
Red-figured Hydria, 500 BC. Achilles and Polyxena at the fountain.
Ermitage Museum Saint Petersburg
© The State Hermitage Museum
Figure n. 15
Black-figure hydria from ca. 500 BC showing a group of women that heatedly gesticulate and talk to each other while waiting for their turn at the lion's head fountain, some of them balancing the water jar on the top of their heads. New York, Metropolitan Museum of Art.
Ph credit: commons.wikimedia.org

15

water to 39 monumental fountains, 591 public basins and an array of royal villas: the quantity of water and number of fountains in Rome was so large that the term Roma regina aquarum (Rome queen of the waters) has been commonly used since antiquity.
Public buildings like theatres and amphitheatres, attended by a large number of people, were all equipped with fountains for public service; for instance, 92 traces of fountains are still visible today in the Colosseum, built in order to provide water to the 65.000 spectators that used to attend public large venues that could even last a few days (Juuti et al., 2015).
Conversely, today water fountains are not mandatory in sport facilities as Stadiums or Arenas; indeed, builders purposely don't include them to increase owners' profit by selling bottled water. A remarkable example on this sense involves the Central Florida University, which built a 45.000-seat football stadium with no water fountains; the opening, an incredibly hot day on September 2007, hit the headlines and not for the very first match. Bottled water wasn't allowed into the stadium for security reasons and the $3 bottled water from the concessionaires sold out quickly; by the end of the game, 18 people went to the hospital and another 60 were treated at the stadium for heat-related problems. After the match, a group of concerned students organized into a group called The Knights for Free Water, asking for the introduction of free drinking fountains in the stadium.
Their demands were met and the stadium was retrofit accordingly (Mingle, 2015).

Leaving aside the extraordinary infrastructure represented by Roman aqueducts and

16

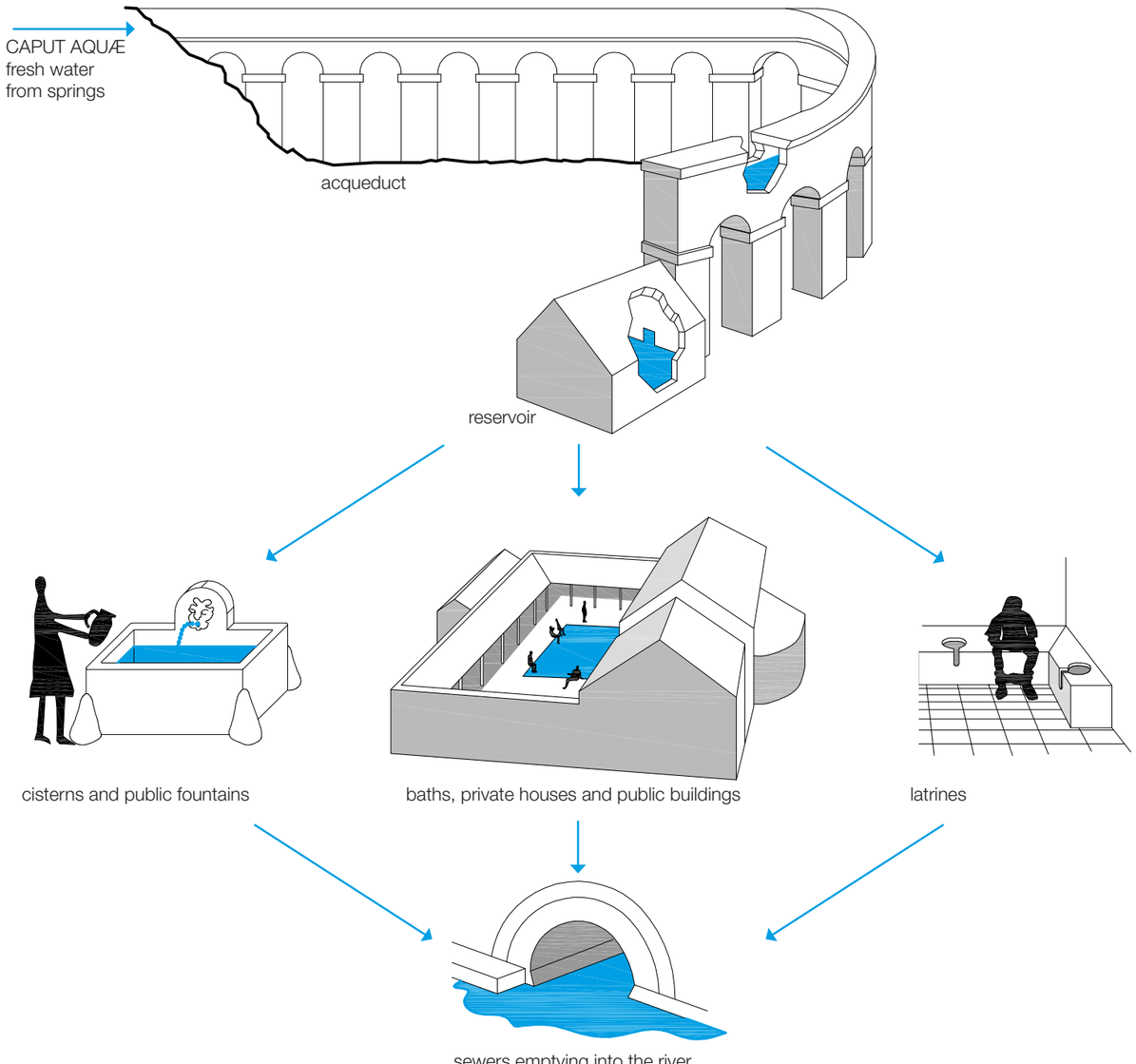


Figure n. 16
The Roman Public Health infrastructure.
Personal elaboration, based on illustrative scheme on quora.com

17

18

19

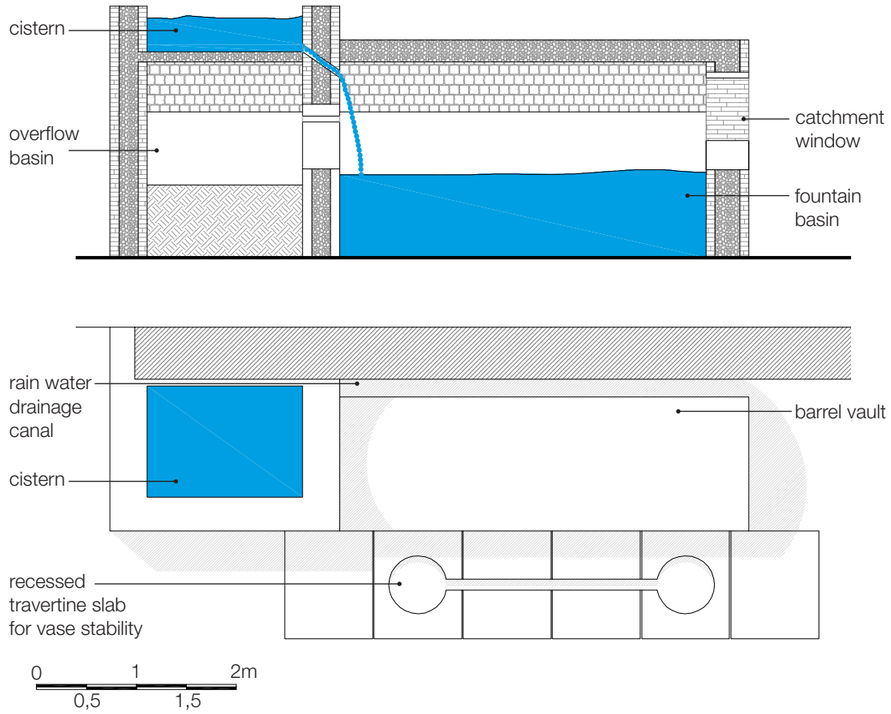
20

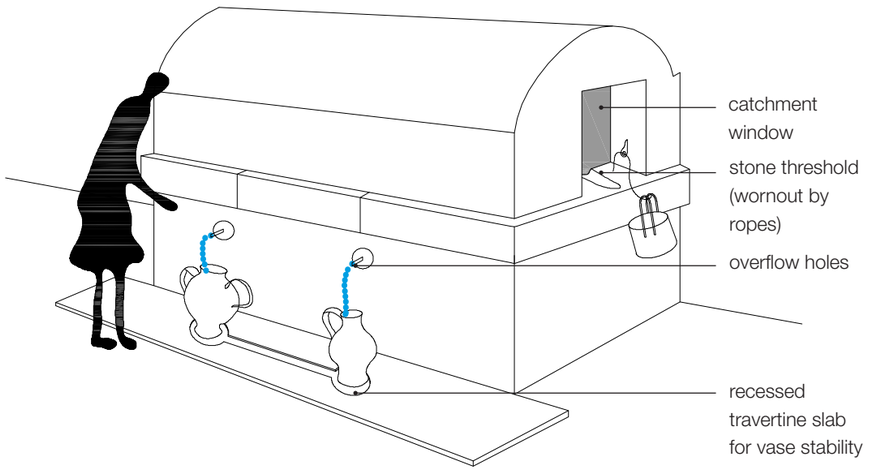
21

the magnificent monumental fountains built in the cities, in the approach that I am considering it is useful to investigate the **smaller water provisions**, the public amenities that Romans saw every day for water collection and drinking on the go; unfortunately, the ones in Rome are not well-conserved, but Ancient Ostia still have many of them, with different features. Street fountains could be simple basins, sometimes placed against walls, angular fountains, simple drinking trough (Lacus) and decorated nymphaea.

Probably the most interesting ones are large basins covered by barrel vaults, and a good example of this type can be found in Via della Fontana in Ostia.
Barrel vault fountain cleverly collects water in three different ways: firstly, it is connected to the aqueduct network, then it is fed by cisterns overflow of nearby buildings; finally, the barrel-vaulted roof conveys rainwater to a secondary smaller tank, functioning as an additional reservoir or water settling, depending on its height. The water was drawn from overflow holes in the long side of the fountain, once decorated with a bronze dolphin faucet; at the ground, were the water from the two holes touches the ground, two swallow depressions in a travertine slab can be noticed: the water buckets had to be placed in the recesses, to assure stability during the filling. Water was also collected directly from the basins, through a square window in the front, also used for maintenance and cleaning process. Traces of wear caused by ropes can be seen on the threshold stone of the window; this may suggest that sometimes the flow of water was interrupted, albeit not for a long period of time, because the reserve in the basins was small (Bakker, 1999).
In ancient Rome, water fountains were also common in the imperial residences and

22





23

Figure n. 17, 18
Traces of a public fountain in the Colosseum in Rome which tourists often interpret as a cross. The grooves contained the lead pipes that fed one of the dozens of fountains in the amphitheatre (Juuti, 2015, photo by Walter Dragoni).

Figure n. 19
The worn out catchment window of Ostia barrel vault fountain.

Figure n. 20
Travertine slab with recessed points to assure vessels' stability while collecting water.

Figure n. 21
Panoramic view of Bright House Networks Stadium during its inaugural game in September 2007where 60 people suffered from suffer from heat-related illness and serious symptoms of dehydration.

Figure n. 22
Barrel Vault fountain in Via Della Fontana, Ancient Ostia.

Figure n. 23
Personal elaboration of barrel vault fountain, based on Ancient Ostia on site illustrations.

24

25

labrum fountain for hand washing and drinking

bench for Thermopolium customers

marble basin for air for cooling effect

26

27

villas of the dominant class. Even some private "middle class" homes had little private fountains in the inner court (Juuti, 2015).
According to Locicero PhD thesis (2018), in Ancient Ostia the number of water outlets per building is small. However, one outlet could have several functions. Commercial establishments (fulleries, bakeries, bars and so on) usually had several water outlets.
The **internal courtyard** of a **commercial building** in ancient Ostia, whose rooms at the ground floor are called thermopolium (a place where something hot is sold), since archaeologists found evidence of cooking utilities, with food and beverages painted on the walls to help customers make their orders.
The rear garden of the Thermopolium in Via Diana features **two different fountains;** in the centre of the court, where consumers were supposed to eat in the summer, a square marble basin was set, with a lead pipe for a vertical water jet, probably for both ornamental purpose and cooling, with the effect to decrease the air temperature by evaporation absorption of heat and transport of heat in the hottest months.
Along the east wall is a bench, where visitors of a sit down; in the southern side there is a "labrum" fountain with a marble basin on a foot, probably used for hand washing and drinking water before leaving the tavern.

Considered as a whole, this simple yet extremely functional outdoor space depicts a vivid slide of ancient life, and highlights the role of water fountains in **gathering and leisure places**.
The cooling effect of flowing water, greater than that of water standing still, was widely exploited in Mediterranean areas and it is still a common practice in summer throughout Europe. Fountains can decrease surrounding air temperatures with 3°C and its **cooling effect** can be felt up to 35 meters away (Climate Adapt, 2016).

Even though the PhD research focuses on minor water outlets as part of a widen network of basic public facilities, a monumental fountain of ancient Rome it is worth mentioning, for its prominent role and position in the city, facing the Colosseum at the entrance to the Sacred Way. This public fountain it is known as Meta Sudans (literally "the sweating post"), and has been built by the Flavians in the late 1st century AD, around the same time as their grand amphitheatre.
The fountain presented a circular basin with a cylinder in the middle, carved out with six niches with goddess statues. On the cylinder, a huge cone of 17 metres in height stood up, resembling the pillars used in circuses, called metae, which marked the ends of the racing track. The structure was made from bricks, covered by white marble slates.

For the aspects that we are now considering, Meta Sudans has a twofold interest:

- **The iconic location**. The fountain marked a turning point for triumphal parades, that would go up the valley between Celian and Palatine hills, would turn from the Via Triumphalis left onto the Via Sacra, and onward to the Roman Forum. According to the tradition, gladiators used to visit the fountain for drinking and blessing the statue divinities as they survived the fight.

- **The technology**. Water did not gush out from a nozzle, but flowed gently down the cone. This solution gave the fountain a peculiar perspiring look, an absolute novelty in those times. (Pollet, 2016).

With the decline of Rome and destruction of the city's aqueducts, the Meta Sudans would have quickly fallen into disuse. The fountain was stripped of its marbles and even its brick core was gouged out for its internal piping – as can be seen in a 1575 engraving by Dupérac. By the twentieth century, during the Fascist era, the remains of the fountain were seen as an eyesore and impediment to increasing car traffic, so in 1936 it was definitively removed, and a round commemorative plaque was set in the centre of the spot.
Only few engravings from 1500 and 1600 (not completely reliable) and some pictures made at the end of XIX century and first years of XX century remain of Meta Sudans. However, a smaller but wonderfully preserved public fountain at Djémila (ancient Cuicul) in Algeria reproduces the Roman Meta Sudans, built by Romans in line with their habit to adorn colonies with monumental buildings and water infrastructure as symbol of prosperity and richness.

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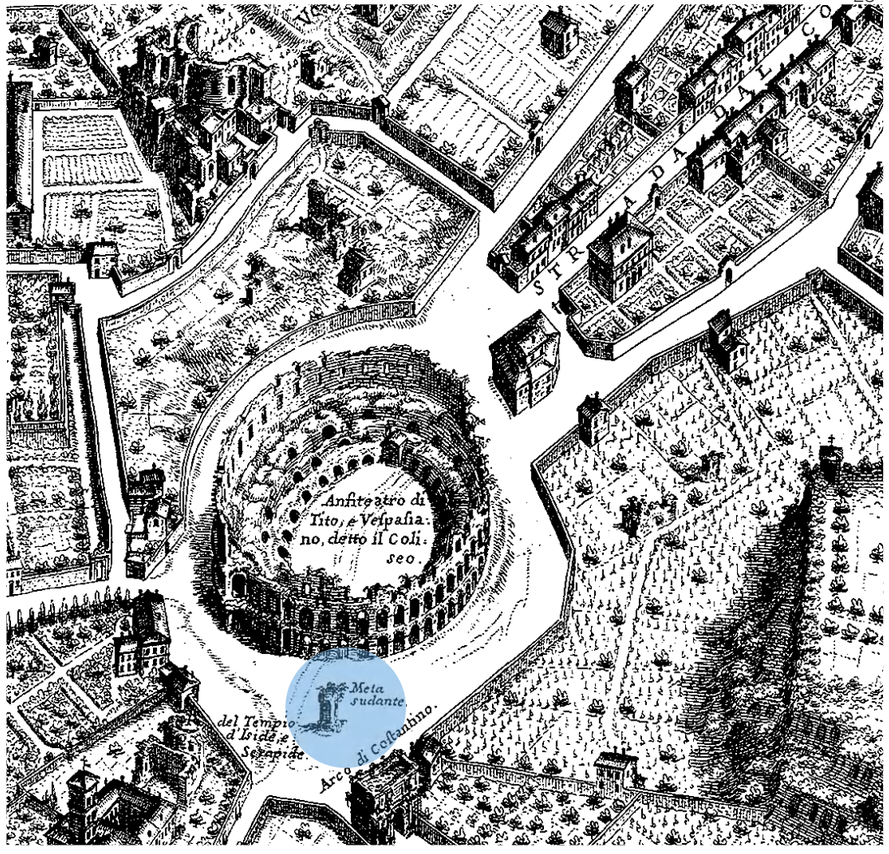


Figure n. 24, 25
The internal courtyard of a commercial building in ancient Ostia, whose rooms at the ground floor are called thermopolium (a place where something hot is sold), since archaeologists found evidence of cooking utilities, with food and beverages painted on the walls to help customers make their orders.
Ph credit: Klaus Heese

Figure n. 26
Fountain and birds, detail from a fresco of the triclinium of the House of the Golden Bracelet in Pompeii (Naples, Italy), about 30-35 AD.

Figure n. 27
Labrum fountain in a lush garden, part of the Roman fresco found in House of Venus in the Shell.
Pompei (Naples, Italy).

Figure n. 28
The Meta Sudans in a baroque representation of Rome by Giovan Battista Falda, 1667

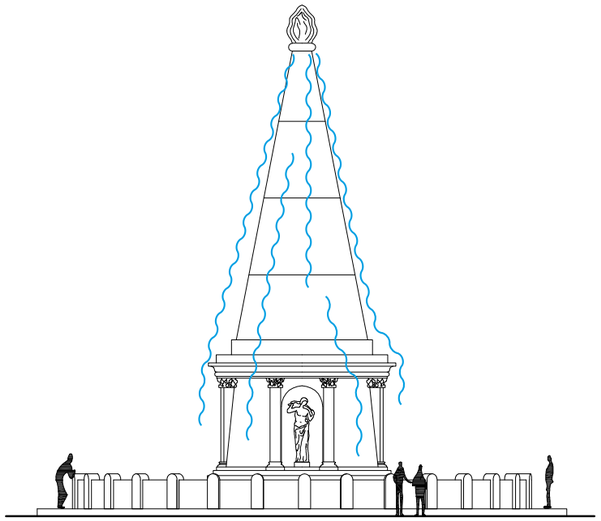
Figure n. 29
The Meta Sudans, personal reconstruction of the elevation and plan view based on historical documents.

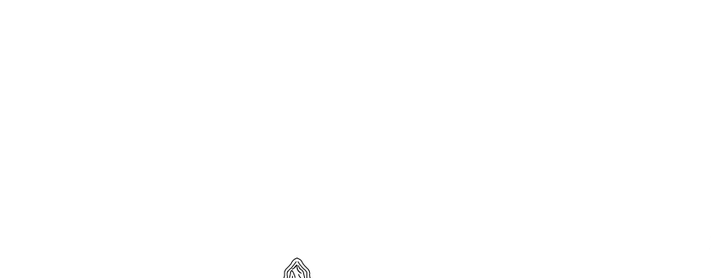
Figure n. 30
Dupérac illustration (from BNF in Paris) shows the damaged Meta Sudans, which is described as a brick cone exuding plenty of water for public convenience.

Figure n. 31
Medieval walled garden combining a grassy and shaded pleasure area with an herb garden, illumination from a 15th-century French manuscript of the Roman de la rose ("Romance of the Rose"); in the British Museum. The British Library (Public Domain).

Figure n. 32
Granada, Alhambra, Fuente de Los Leones, ca. 11th century AD.
The Fountain of the Lions has undergone different renovation and restoration works with the addition of elements (the second basin in 16th century, the top water jet added in 1837) that have altered the medieval pattern and the equilibrium of the courtyard. In July 1966 the Fountain recovers its original state by dismantling the additions.
The fountain before 1966 restauration, with balusters on the back of the lions, the second basin and the upper water jet.
Retrieved from https://www.alhambra-patronato.es/en/disfrutar/water-jet-of-the-second-basin-of-the-fountain-of-the-lions-1837

Figure n. 33
The fountain at its original, medieval design after restauration.
Alhambra, patio de Los Leones, 1977.
Retrieved from https://www.tumbral.com/tag/granada%20lions





30

KEY ELEMENT OF CLOISTERS AND SQUARES IN MEDIEVAL AGES

After the fall of the Roman Empire, Roman aqueducts were wrecked or fell into decay, and many fountains throughout Europe stopped working, so fountains existed mainly in art and literature as **symbols of purity**, life, wisdom and innocence, **in secluded monasteries** and in exclusive **palaces' gardens**.

From the 5th until about the 12th century AD in Western Europe, along with the network of little city fountains, also water distribution generally declined; with a few notable exceptions like **Islamic Spain**, that had an excellent standard of water technology for irrigation, water supply and fountains derived from Greek and Roman water culture, many citizens started drawing water from the river again, with severe health consequences. Fountains and water features produced in Spain under Islamic rulers represent a well-known cultural attraction and their description would require a separate dissertation; as regard to this doctoral research, it must suffice to highlight that they are in general much smaller than the great Roman ones, but they are fascinating for their gentle beauty and **careful location** in peaceful courtyards, frequently spotted with **trees**, **shaded areas** and **nearby seating**, to enjoy the cooling effect of water sprays and better cope with hot weather.

Monasteries, churches and abbeys have the merit of having preserved through medieval times water supply techniques and facilities. **Wells** collected rain water and sometimes exploited underground springs providing the religious community with the adequate amount of water to maintain minimum hygienic standards and to irrigate **gardens and orchards** where monks used to grow medical herbs needed for their healing practices. Besides wells, during the early Middle Ages it was a common use for the main churches to have a fountain or a "**lavatorium**" standing in a garden or yard within the precincts, where the faithful could refresh themselves and carry out ritual ablutions before entering the holy building (Pollet, 2016).
In general, the fountains were fed by short aqueducts, usually taking water from springs located at a distance of a few kilometres. The pipes were commonly of lead and usually locally made using a technology similar to the Romans'. If the water supplied to the religious community by the aqueduct exceeded its needs, the surplus was usually given for public consumption (Juuti, 2015).

From the 12th century, old aqueducts were gradually repaired and improved, and public fountains began to reappear as urban facility serving a greater number of spots throughout the city.
Especially in northern and central Italy, where communes (city-states) flourished, the **central location** of the main fountain indicated more than just public water supply, but reflected the aim of the administration to advantage the whole community.
In fact, the urban structure of most of the towns with the cathedral and civil buildings facing each other in the main square. The fountains built at the time are in the middle, **between the symbols of religious and civil power**, giving water to the entire community (Juuti et al., 2015), so that even the lower classes could actively participate and be included in the life of the city.

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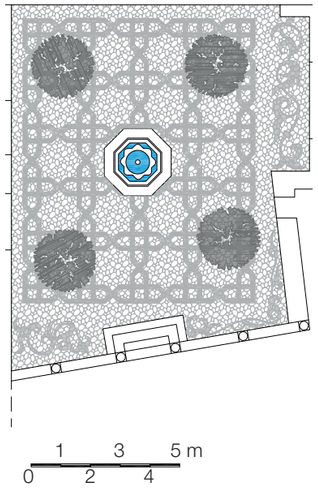

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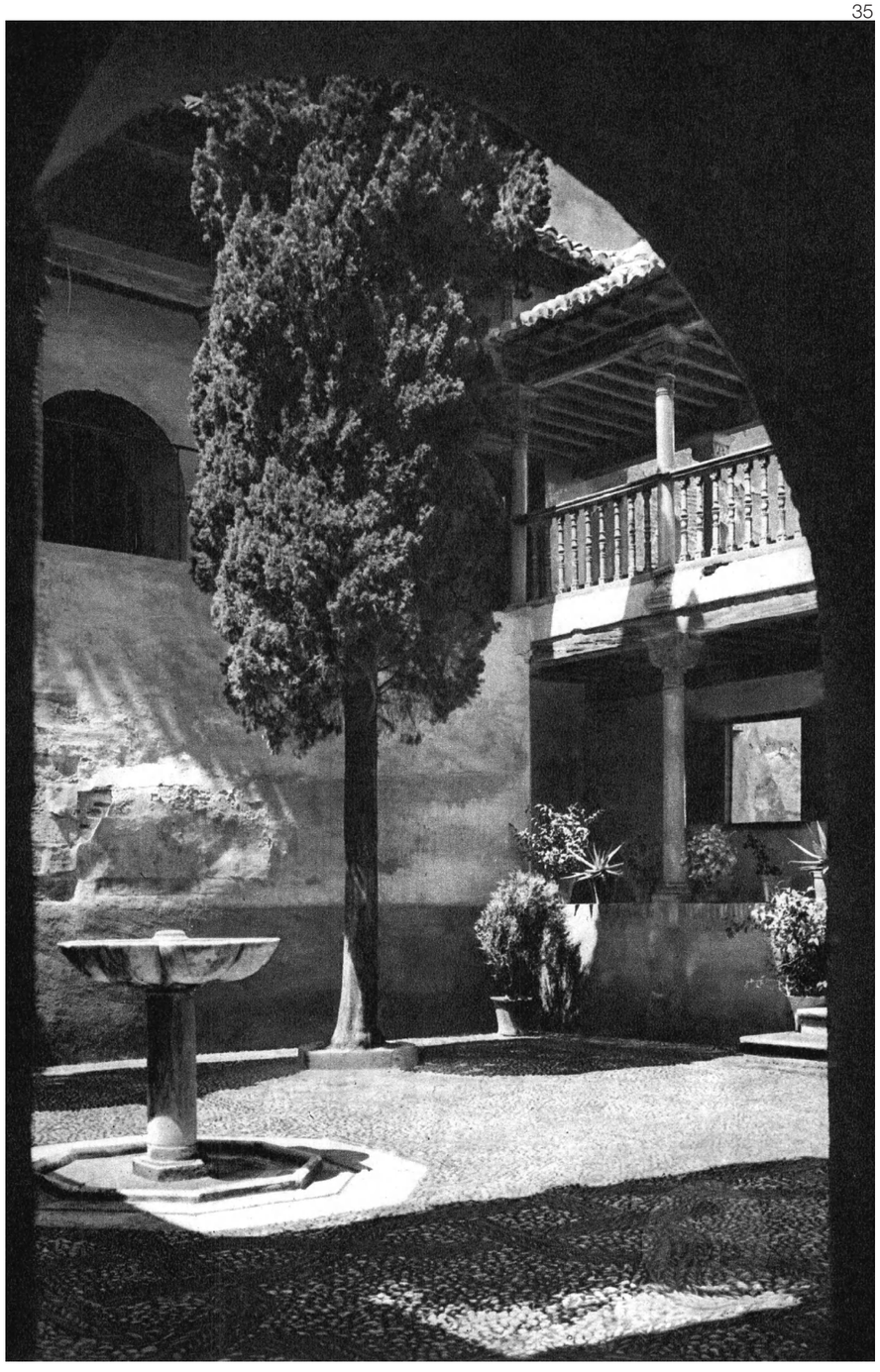

Figure n. 34
Patio de la Reja – the fence courtyard – in the Alhambra Complex, in Granada, is named after the wrought iron balcony, which covers the entire southern part on its upper floor, a suggestive anteroom, leading to the larger garden of Lindaraja.
Author's reconstruction based on historical documents.

Figure n. 35
The fence patio would have been built at the same time as the Habitaciones de Carlos V, that is between 1654 and 1655: it has a completely different style if compared to the earlier parts of Alhambra, more similar to Christian cloisters. Also the small, stone fountain in the middle is totally out of the style of the traditional low Nazarite fountains of the Alhambra (Garcìa, 2015).
Water pours from a reused white marble basin into an octagonal base of marble as well.
The court is paved with light and dark river pebbles forming refined patterns; at the corner, placed almost symmetrically, there are four large hundred-year-old cypresses.
Photo by Kurt Hielscher, 1925.

36

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Figure n. 36, 37
Medieval fountain nestled in the middle of the square in Fontecchio (AQ).
The limestone fountain, the votive niche, the surrounding walls and the four basins serving as drinking trough all date back to XIV century.
Photo by Alessandro Callea, 2019.
Retrieved from www.juzaphoto.com/p/AlessandroCallea

Figure n. 38
Figure ground of Fontecchio village and fountain location.
Author's reconstruction based on Municipality plans.

Figure n. 39
Stone animal-shaped fountain along the pilgrimage route to the Sanctuary of Our Lady of the Crown, in the little village of Spiazzi, between Ferrara di Monte Baldo and Brentino Belluno, Italy.
Photo by Roberto Onano, 2013

39

MONUMENTS AND BUILDINGS DISPENSING WATER

Renaissance can be considered the great turning point in the art of fountains, when these urban elements became larger, more articulated and refined; they were a tangible **symbol of wealth** and **royal power**.
After the 15th century, hundreds of artistic and monumental fountains were built in Italy and abroad, whose variety and importance defy any attempt of being described in detail, which is not even the purpose of this section; rather, only a few considerations and specific information will be given, with specific reference to my doctoral research topic.
Even the most impressive fountains of Baroque Era, including Nettuno Fountain in Bologna and the ones in Rome by Lorenzo Bernini, were not only conceived as spectacular works of art to adorn public places, but **still served citizens' everyday usage**: for drinking water supply, cloth washing, watering horses but also taking a bath (Lampugnani, 2021).
Additionally, an unexpected use of fountains, taking their cooling effect on extreme levels, led to temporarily upsets of the urban landscape: on the 23rd June 1652, by input from Pope Innocenzo X, fountains located in Piazza Navona were closed up, completely flooding the square, to make Romans enjoy and refresh themselves. Thanks to the wide appeal of the initiative, since than and for at least two centuries, every Saturday and Sunday of August month, Piazza Navona was transformed into a lake, in a playful moment of enjoyment able to engage all social classes (Morena, 2019).

While Rome was playing with water, in **Paris**, at the end of 15th century, public fountains gushed very little and intermittently.
Poor aqueduct maintenance and water concessions further contributed in drying up municipal water outlets, that, in 1499, where only 17 in number. Henri IV actively tried to improve water infrastructure with a tax on imported wines in order to fund the restauration of the ancient aqueduct and pipeline network; he also ordered the construction of a water pump, name after "Samaritaine", completed in 1608. The Roman aqueduct was gradually repaired and started working again in 1623, but only five years later it effectively supplied newly built public fountains (Mathis & Pierrat, 2012).
According to Municipal registers, in 1673 there were 51 public fountains in Paris: they were frequently **placed against building walls**, at **street corners** and nearby major **gathering places**, like public squares and markets.

Acquiring safe drinking water was a hard work in ancient **London** too.
Until 1600s most of Londoners had to pull it from wells, collect rainwater, or travel to **sporadic public fountains** and lug the water back home (Platman, 2021). Sewage that wasn't already flowing in the streets would have found its way into a polluted and stinky Thames, used for centuries as a convenient dumping ground for household and industrial waste. Besides the filthy air, clean drinking water access and health issues were great concerns.
When the first major **domestic water supply system** was built in 18th century, with the realization of the New River canal and a **network of wooden pipes**, it was just reserved to the wealthiest citizens who could afford the subscription fee.

40

41

Figure n. 40
The Fountain of Neptune in Bologna, 1570. Engraving. This print made by Domenico Tibaldi represents the Fountain of Neptune in Bologna completed in 1567 to the design of Tommaso Laureti, with sculpture by Giambologna.
On 29 October 1569, Laureti was granted a ten-year privilege by the Senate of Bologna that forbade printing and selling representations either of the Fountain of Neptune without Laureti's permission, going much further than comparable privileges elsewhere, such, for example, as the one granted in 1590 by the Venetian Senate to Antonio del Ponte, who designed the new Rialto bridge. Richard James Tuttle rightly emphasized (1977) the way the fountain is isolated from its context so as to be presented as an independent object.

Figure n. 41
Piazza Navona Flooded. Painting by Antonio Joli (Modena, 1700 – Napoli, 1777). Private Collection.
The square is crowded with coachmen gigging around, in the attempt to cool down the horses and wash the carriages. The community attends from balconies and packed at the perimeter.

Figure n. 42
Nicolas de Fer. Public water points in Paris, 1716.
Paris, musée Carnavalet.
© Musée Carnavalet/Roger-Viollet

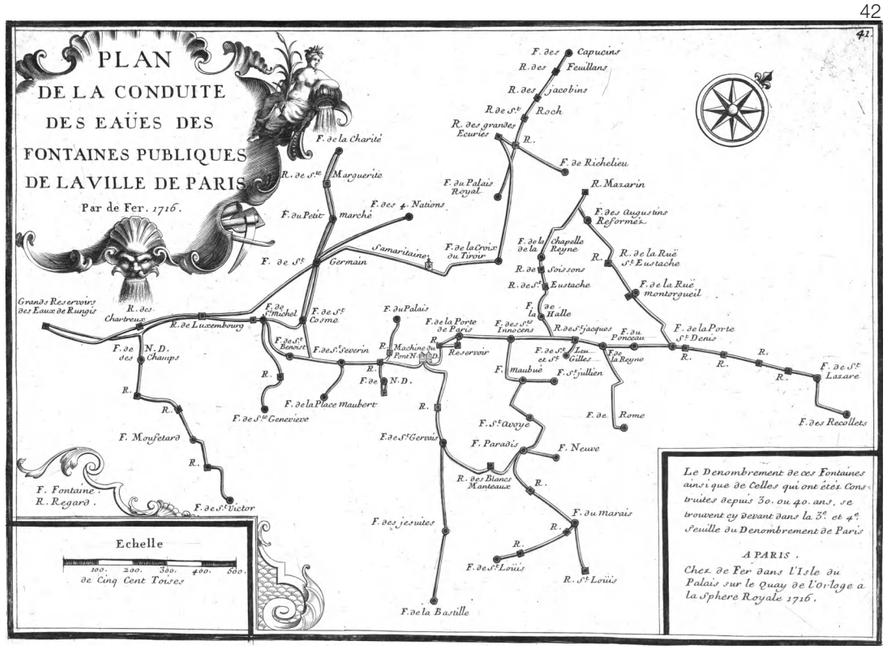
Figure n. 43
Fontaine Maubuée, where the tiny rue de Venise crosses rue Saint-Martin, the main road Beaubourg district in Paris (4e arrondisement) © Jacques Boyer/Roger-Viollet. One of the oldest fountain in the city, Fontaine Maubuée was firstly mentioned in a document of late XIV century, and rebuilt in 1733 by architect Jean Beausire, who also added stone low relief to the original unadorned urban element.
At the beginning of XX century a refined streetlamp in metal structure was installed next the water source, for a greater accessibility to the service even in the dark.
Interestingly, the name "Maubuéèe" is supposed to refer to "bad drinking"or "messy laundry" because of the poor quality of the dispensed water coming from Belleville springs, with high concentrations of dissolved minerals. Retrieved from http://maplumefeedansparis.eklablog.com/la-fontaine-maubuee-et-les-armoiries-de-paris-a144872148

Figure n. 44
Trogneux fountain, subsequently named "de Charonne", at the corner between rue du Faubourg-Saint-Antoine and rue de Charonne, built in 1719. The fountain was design by architect Jean Beausire, the chief of public works in Paris for King Louis XIV and King Louis XV between 1684 and 1740, and main public fountain-maker in that period. Photo by Robert Paul, 1892.
The picture shows the proximity and the integration of public water outlets with other street elements: public lighting, road signs, shop windows and a "colonne moresque", a XIX century combination of an advertising column and public urinal.

water access points

other pieces of street furnishings

42



43

44

WATER SUPPLY AND URBAN HEALTH IN MODERN ERA

As populations grew and cities expanded, the demand for public water systems and new water treatment, as well as the availability of new technologies and greater understanding of germ sources, led to meaningful transformation in water fountains' urban role, design and use.
Until the middle of the 19th century, **miasma theory** was still the prevalent one. This concept, that rooted in medieval and even earlier times, was based on the idea that disease was caused by toxic mists or noxious vapours emanating from filth in the towns, and that the method of prevention of infectious diseases was to establish sanitary measures to clean the streets of garbage, sewage and rotting corpses, common features of urban living (Tulchinsky et al., 2015). Miasma theory certainly improved urban health conditions and set the basis for the modern sanitary movement, but it could not make much decrease in the spread of the most virulent killers of that time, Typhoid Fever and Cholera.

In London, for example, between 1848 and 1854, outbreaks of cholera caused a large-scale loss of life. While public health effort concentrated in finding the source of the foul smell, Dr. John Snow, an obstetrician with an interest in many aspects of medical science, came with the hypothesis that the main cause of the epidemic was not the bad air, but **contaminated water supply**, and, consequently, infected liquid and food intake, and hand-to-mouth contacts. Snow published an article in 1849 outlining his theory, but doctors and scientists thought he was on the wrong way and stuck with the popular belief of the time that cholera was caused by breathing vapours or a "miasma in the atmosphere".
As a result of rapid industrialization, increasingly crowded urban environment, and failure to deal with sewage, London was actually filthy and polluted, and its water often unsafe to drink – being it bought from water delivery company or directly collected by poorest citizens at neighbourhood pumps.
In August of 1854 the London suburb of Soho was hit hard by a terrible outbreak of cholera. John Snow observed that the highest rates of Cholera sufferers were distributed in delimited London districts where two water companies supplied dwellers with overlapping water mains. One of these moved its water intake to a less polluted part of the River Thames, while the other company kept on collecting from a place in the river where sewers emptied. The scientist traced cholera deaths occurring in a 10-day period and determined that workers and residents using a specific water source – the Broad Street pump – did not escape the epidemic; concluding that it was the real contagion source, he persuaded the authorities to remove the handle from the pump, and the already subsiding epidemic in that neighbourhood disappeared within a few days. Snow is currently known as the father of modern epidemiology, but it took a long time and several subsequent studies to gain acceptance that cholera and typhoid were water-borne diseases instead of being caused by urban filthy air.
However, after this discovery, **access to clean water** took up space as a matter of national safety in every country in the world, many other contaminated water pumps and wells were closed, and a **new relationship between water elements and urban environment** began.

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Figure n. 45
Robert Seymour, Cholera "Tramples the victors & the vanquished both." October 1, 1831.
Cholera, in Miasma Theory, looks like a large shrouded specter with skeletal hands and feet, with a misterious mist, who indiscriminately crushes soldiers on both sides of the battlefield.
Image via U.S. National Library of Medicine

Figure n. 46
Death's Dispensary,' a cartoon from 1886 inspired to Dr. John Snow's investigation about the the relationship between the spreading of cholera and the use of a public water pump in Soho.
Photo: ALAMY

Figure n. 47
Detail of the map of London crafted by Dr. John Snow during the 1854 cholera outbreak. Author's graphic elaboration.
Each pink bar represents a death attributed to the disease. The map also shows the location of the pumps used by the population to draw drinking water. As the scientist found a greater density of deaths around the Broad Street pump (1), he deduced that the area was probably infected, because of the water source and not the bad air.

Figure n. 48
Opening of the first public drinking fountain in London. (Heritage Images/Getty Images)

Figure n. 49
London's first drinking fountain of Modern Era, dug into the railings of St Sepulchre-without-Newgate church. Photo by Jonathan Deamer, 2020.

Figure n. 50
London's first drinking fountain features three inscriptions, the top reading: '*The gift of Sam Gurney MP 1859*'. The bottom reminds users to '*replace the cup*', while inside under where the water used to flow reads: '*The first Metropolitan drinking fountain erected on Holborn Hill 1859 and removed when the Viaduct was constructed in 1867.*' Just eight years later after being installed, the fountain was relocated while the Holburn Viaduct was built, before finally being reinstated in its original setting in 1913.
Photo retrieved from: https://en-academic.com/dic.nsf/enwiki/1370395

47

water pump

contaminated water pump in Broad Street

Cholera deaths

John Snow study area

Residential building main figure ground (1854 addresses)

Brewery, where no case was recorded, despite being in the centre of the outbreak. On interviewing those at the brewery, it was found that "none of the workers drink water" – so perhaps they only drank beer.

A group of wealthy, mostly Christian philanthropists set up in London the **Metropolitan Drinking Fountain Association**, dedicated to the construction of public drinking fountains using private funds.
The first fountain was inaugurated on April 21st 1859 with great fanfare, and thousands gathered to watch it be turned on. It was built into the railings of St Sepulchre-without-Newgate Church on Holborn Hill. The water flows out a downwards spigot fixed to a marble scallop shell, and is collected in a red granite basin, set into the coping stones of the brick dwarf wall. Two granite columns support the upper semi-circular granite arch. Two metal cups fastened at the fence by chains hung into the basin and passers-by scooped out water to drink. It was not the most sanitary drinking method, but germ theory was just at the beginning, and the newly built public service represented a great improvement on contaminated pumps; the fountain became instantly popular and at its peak was being used by around 7000 people a day (Johnson, 2016).
Due to the vast popularity of the fountain in Holborn Hill, the Association funded other 85 elements over the next 6 years, and, by 1879, there were almost **800 water points in London** alone. The group had at least three different reasons for building this kind of piece of urban furniture:

1. Providing **clean, safe** drinking water for all citizens to prevent epidemics;
2. Create a **greater appeal to drinking water** in order to diminish the widespread consumption of alcohol;
3. **Watering horses, cows and dogs**, since new perception about cruelty to animals became widespread.

While the first point has already been explained in connection to the growing understanding of the germ theory, the second and third ones deserve further explanation, as they influenced water fountains evolution, design and urban placement.
In 19th century towns and cities, offering low public access to clean drinking water, beer, cider, and gin were much safer and tastier to drink, but constant consumption led to **rampant alcoholism** (Salinger, 2004), especially in England and Untied States. Drunkenness became such a problem for families and employers that the **Temperance Movement** sprung up to fight it.
In the late 1800s and early 1900s, through several local associations, the Movement funded dozens of fountains and so-called "temperance wagons" travelling around the city and offering citizens a drink of water to supplement a jar of beer.
Temperance fountains were built all over London, but also in New York City, Washington D.C, Philadelphia, Chicago, Portland and other towns, frequently located nearby churches and in public parks, even right outside taverns to provide passers-by a healthier alternative to quench their thirst when out. Structure, material and design of these fountains varied a lot, depending on who commissioned them, and where they would have been precisely located. They were generally made of granite blocks or polished white stone, but metal ones also exist; they could feature columns, small roofs, plinths and were often elaborately decorated with bas-reliefs, inscriptions, classical moulding and Greek mythical figures like Sophrosyne, the ideal of temperance; hence, they were not just humble drinking fountains, but outstanding symbols of philanthropy, with the aim to **nudge individuals towards healthier lifestyle**.

48

49

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Figure n. 51
View of the new drinking fountain at Madison Avenue and 23rd Street in New York 1881. (Photo by Stock Montage/Getty Images).

Figure n. 52
Combined drinking fountain for people, horses and dogs, at College Street and Spadina Avenue, Toronto, Canada, 26 April 1899. On one side, two taps feed water into a large horse trough. The other side host a demi-lune basin with a metal cup suspended on a chain. The overflow water drains into a smaller basin at ground level for dogs and smaller animals. The structure is placed on a rectangular base bolted to the ground.

Referring to the third goal – let horses, cows and dogs drink– is worth remembering that before 1860s watering animals was only possible at the troughs outside pubs, on the condition that dog walkers or horse riders would also have patronised the tavern. This proximity further encouraged workers and travellers to stop into saloons when they felt thirsty. The London-based Drinking Fountain Association came to the aid of hundreds of thousands of working animals within the cities – horses, oxen and dogs – that also needed refreshment, and, in 1867, the name of the group was changed to the **Metropolitan Drinking Fountain and Cattle Trough Association** to acknowledge the **four-legged part** of their mission. By 1885 over 50 000 horses were enjoying the Association's water points in London, with many different **design combination** of **drinking fountain/horse troughs/dog bowl**. These urban objects were often advertised with the inscription "*For Man and Beast*" and became so important that their locations – especially around cattle markets and major city intersections – began to be incorporated into **maps**, and the Victorians often referred to them as filling stations.
Many of these fountains from Modern Era can still be found to this day, including the cattle troughs that were constructed in collaboration with the Royal Society for the Prevention of Cruelty to Animals, very active in the second half of 19th century, or thanks local horse lovers' donations.
The Drinking Fountain Association still exists today, involved in building new drinking fountains, as well as restoring and maintaining the existing infrastructure.

At the turn of the 20th century, also Canadian and American cities opened their water pipes to animals, primarily with the aim to guarantee that horses were properly hydrated to do their job. Cities provided water supply, and horse advocates' donations allowed the construction of elaborated and refined fountains that citizens were very proud of. Urban placement was carefully studied and arranged by city planners. To allow multiple horses to stop and drink at once, these water points required **wide unobstructed floor space**, which led fountains to conquer **central locations in public spaces**. The appointed layout had to assure a sufficient room around the unit to accommodate horses and their wagons, dogs and other small animals, and thirsty crowd.
It was not uncommon for humans and horses to be seen drinking at the same time, but when an epidemic of glanders hit some cities at the beginning of 20th century, public health officials strongly questioned about horse water outlets. Glanders is an "epizootic" disease, which means that the bacterium can cross species' lines, taking the lives of cats, dogs, goats, and men. Human infection is rare, but the disease meant a bullet for the suffering horses long ago (Jurga, 2016). For example, the city of Boston didn't just close the fountains, it dismantled them and they were never rebuilt; hydrant-like water taps were installed in their place. Other cities simply turned off the taps and supplied no alternative, despite advocates' revolt. Most of the fountain-through combinations disappeared from American cities, although a few were converted to other purposes.
This context led to a **more difficult daily care for horses**, since drivers had to plan watering stops in advance; along with the widespread replacement of street paving with smoother, horse-unfriendly surfaces to best accommodate motor vehicles, these last appeared more and more attractive. **Urban water availability** therefore accelerated the decline of the reliance on city horses as **mood of transport**.

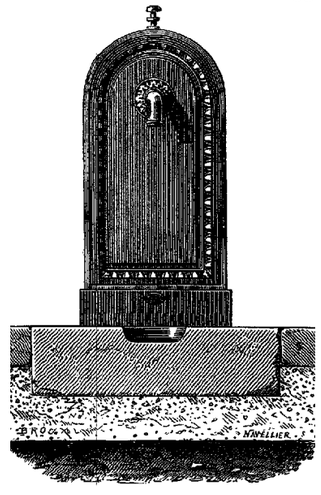
A WATER OUTLET AT EVERY URBAN CORNER

Another factor that influenced the evolution of urban fountains and boosted their diffusion in the late 19th is linked to new steel making process, which made possible increased applications and **wide spread use of cast iron** as a structural material.
Cheaper than bronze and more easily available, cast iron allowed the realization of though objects of a desired shape, melting metal and pouring it in a mould. Cast iron was therefore particularly suitable for drinking fountains **series production**, since the duplication of wooden formworks did not require extremely refined hand-skills, if compared to the manufacturing process of wrought iron urban elements.
In this way, foundries production rapidly increased across Europe at the beginning of 20th century, and with it the distribution of small cast iron drinking fountains, as proved by the great variety of models, from the simplest ones to adorned solutions, that displayed drawings and symbols referring to different local traditions.

The first and probably most famous **network of cast iron public fountains** is the one realized in **Paris** between the second half of 19th century and the beginning of 20th. The new water elements realized at that time addressed two different needs of a large Municipality facing important transformations: from the one hand, highly **adorned monumental fountains**, purposefully built to celebrate the royal power and its achievements and beautify the capital; from the other hand, **minor water outlets**, similar to each other and evenly spotted throughout the territory, to provide all citizens with a reliable access to clean water. Between the two types, the evolution of the second one is more relevant for the development of my doctoral thesis, and, as it happened in London with the first drinking fountains, also in Paris their diffusion is intertwined with local health issues and indirectly accelerated by them, too.
After the cholera outbreak in 1832, manly caused by low accessibility to clean water, the Prefect of the Seine, Claude Philibert Barthelot Rambuteau, conceived and ordered the construction of several, cast iron drinking fountains, better known as **Bornes-Fontaines**.
They came in different sizes and shapes, but all shared simple lines and downwards spigot. Bornes-Fontaines were almost **1800 in number** after 1848, installed especially in parks and urban green areas. However, they provided small amount of water, and they were turned off during the night.

Drinking water supply in Paris faced even more severe challenges in 1871; the Franco-Prussian war had left Paris with damaged aqueducts and water pipes, an extremely polluted Seine River, and highly expensive potable water from private companies.
In this difficult context, the English philanthropist **Richard Wallace** decided to donate new models of public drinking fountains, in large number, to ensure an **easier access to fresh, safe water** and **fight alcoholism**. Water stations were designed by Wallace himself, with the artistic support of the regarded sculpture Charles-Auguste Lebourg, from Nantes.

53



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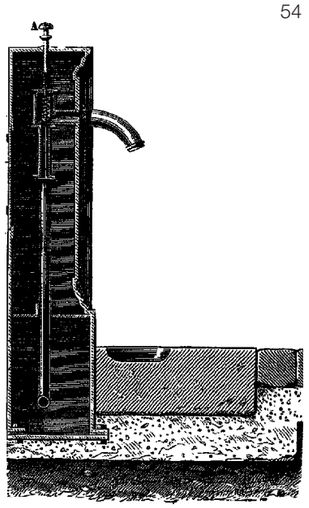

Figure n. 53, 54
A model of Bornes-Fontaines from 1877, front view and section.

These relatively small urban objects were a revolution in water supply, as they considerably increase access to free clean water. Water was supplied intermittently, until the introduction of push-button on the top, which helps preventing water wastage.
Retrieved from http://parismyope.blogspot.com/2016/07/les-eaux-de-paris-2-avant-haussmann.html

55

56

Figure n. 55
A wall-mounted Wallace Fountain. Engrave from 1882
Retrieved from https://www.biusante.parisdescartes.fr/

Figure n. 56
The large model of Wallace fountain. Retrieved from https://www.fontesdart.org/sauriez-vous-identifier-les-cariatides-des-fontaines-wallace/

The design principles that guided Wallace's work in crafting his fountains are still valid and convincing for contemporary water stations:

- **Visibility**. People should be able to see and recognize the fountain from afar.
- **Pleasant visual impact**, where beauty also means the ability to blend into the surrounding environment.
- **Functionality**, simplicity in use.
-**Toughness.** A successful public fountain should be solid, easy to build and assemble, and simple to maintain.
- **Affordability.** Since a large number of fountains is needed to set an appropriate urban network, the appropriate structure material should match with series production requirement.

Wallace Fountains were originally conceived in two different models, a wall-mounted one and a larger, well-known standing model.
The **applied model** was very successful in the late 19th century. It was fixed onto the walls of public buildings such as hospitals. The water flows out the head of a naiad, at the top of a semi-circular pediment (Guernier, 2021).

Only one wall mounted Wallace Fountain still exists in Paris, and can be found in the 5th arrondissement.
The **larger model** stands almost 2,70-metre tall and weighs more than 610 kg, possibly inspired by the Fontaine des Innocents near Les Halles. The base of the model includes a plinth with canted corners and an octagonal pedestal. Four statues of nymphs, that represent the virtues of kindness, simplicity, charity and sobriety, hold up a pointed dome decorated by dolphins and fleurs-de-lys. The caryatids are different from one another, and can be distinguished by feet and hand position, and by how each tunic is draped. A stream of water flows down from the dome into an elevated basin, whose height and close alignment of the caryatids prevented horses and stray dogs from using it as a watering trough.
Originally the fountains were equipped with two tin-plated metal cups secured by a chain, like London drinking fountains, usually left submerged in the basin to be rinsed by the continuously jet of water (Société des Fontaines Wallace , 2016), then removed for sanitary reasons.

All Wallace fountains are made from **cast-iron**, a structural material that fit Wallace's criteria and in particular made them robust and suited to large-scale distribution across the city; they were painted in **dark green** to better integrate into the city's parks and tree-lined avenues. The appointed colour also well **matched with other pieces of street furniture** like classic newsstands and Morris columns.
The first 50 Wallace fountains – 40 in the large model and 10 wall-mounted types – were installed in Paris in 1872, all placed at **strategic locations**, usually at major crossroads and squares.
The grand model proved to be particularly popular and practical, so Wallace funded an additional ten fountains in 1876 and ten more in 1879, according to French historical accounts. The city of Paris, in turn, provided the plumbing and bore all the installation costs.

Two newer models were designed later, a **colonnade fountain**, where caryatids are replaced with narrow pillars, and a **hydrant model** of 1,30 metres in height and a pushbutton faucet, making a total of four styles called Wallace fountains, although only the original grand model and the wall applied model were conceived and funded by the philantropist.
Since 2017, Paris water provider began experimenting with a few Wallace fountains. A small, stainless-steel push button was installed into five fountains that now dispense 40-50 cl of water each press, in order to prevent water waste and help preserve the historic fountains by curtailing damage from rust and corrosion caused by splashing water.
At publication date, there are **104 Wallace fountains in Paris**, all of which dispense safe drinking water; of them, there are only one original wall model and two colonnade models left.
A few of the newest fountains, mostly in the 13th arrondissement, go against tradition and are painted a different colour than the standard dark green.

Figure n. 57
The large model of Wallace fountain in a picture taken in 1910.
Photo by University of Notre Dame. https://curate.nd.edu/show/pg15bc4145n

58

59

Figure n. 58
A picture of *Torèt* in Turin.
Retrieved from
http://www.lamiatorino.it/una-mole-di-immagini-i-toret/

Figure n. 59
Drinking at Nasone, with an original two-hole nozzle.
Photo by Eugenio Catalano, Rome, 2008.

Along with the France capital, **Turin** has been one of the first and leading European cities to provide a **network of cast-iron drinking fountains** in its local precinct. The bottle green local fountain is usually called *Torèt*, which means little bull, the symbol of the city, whose head is sculpted and pours water out of its mouth. A drain with a central bowl at street level allows animals to drink.
Torèts firstly appeared in early 1862, according to a specific urban plan aimed at assuring a citywide access to drinking water, and were gradually installed near markets, public gardens, and squares: today they are **more than 700** in number.
Some of them have recently achieved a greater intelligence thanks to **iBeacon technology**; in combination with the dedicated app "I Love *Torèt*", passengers walking nearby will be able to access via smartphone tourist information and data on the quality of the drinking water.
Torèts still represents one of the most beloved symbol of the city of Turin, the citizens are very proud of, as it will be further reported in this research when discussing the connection between street furniture and local identity.

The system of small public fountains realized in **Rome** since late 19th century is extremely important as well.
As a consequence of the **rapid immigration**, Rome City Council quickly had to increase potable water access points, both in existing, crowded neighborhoods and in new ones, to **satisfy residents' daily needs**, from adequate hydration to personal hygiene. Traditional stone elements singularly carved by artists no longer addressed the requirement of a rapid distribution in large numbers, while cast-iron, again, best suited mass production and allowed keeping costs within reasonable bounds.
A new model of fountains was introduced in 1874: a cylinder with of 1,20-metre-high, equipped with three nozzles in the shape of a dragon's head. Instead of the traditional basin, this fountain had a simple grill at the ground level, where water continuously flows. A **ceaseless stream** would have acted as a useful outlet for the overflows from water supply network under pressure; at the same time, it would have avoided dangerous stagnation within the plumbing supply system. Only three examples of this ancient model are left: the oldest one in *San Teodoro* street, another one next the Pantheon and a reproduction in *Tre Cannelle* street (expressly named after the three faucets).
During the 20th century, the design of these small public fountains was slightly simplified, and the three decorated nozzles replaced with just one plain iron pipe, like a prominent nose. For this peculiar design feature, Romans tenderly renamed these little fountains as "*nasoni*", namely "big noses". The nozzle of these fountains has a hole in the upper part, that allows people to quench their thirst with an arc water jet: closing the main outlet with a finger, water is forced to gush upwards through that additional hole (Pollet, 2016); otherwise, with such a lower spigot and a downward stream alone, stooping and drinking would be quite uncomfortable.
Some of these **unique and bright devices** have been unfortunately replaced through time with standard brass nozzles and push buttons, with a double negative effect on water temperature and functionality, since modern-day taps only provide a downward water jet. According to the latest surveys, there are **over 2500 *nasoni*** scattered around Rome, and several apps help thirsty, digital-friendly passengers to easily find them.

Since 1931 also **Milan** can boast its own n**etwork of cast-iron local fountains**; they are 1,50 metres tall, and a half metre in width, squared in plan, with a sculptured ornament fixed to the top, in the shape of a pine cone, and marked, on the front side, with a red cross on a white field, Milan's coat of arms.
A semi-circular basin decorated with bas-relief collects water at ground level and once was used for watering animals. When users put their finger in the downward spigot, the water spouts from a second, smaller hole at the top of the faucet, likewise Roman *nasoni*. These measures and design features have been coded in a local catalogue at the turn of the 20th century and still observed today.
Milan drinking fountains are usually known as "*Vedovelle*" (Little Widows) because their ceasless stream of water which reminds the tears of afflicted women, but, depending on the neighbourhood, they are also referred to as "*Drago Verde*" due to the colour of the pedestal and the little dragon's head which pours water and slightly resemble one of the gargoyles on Milan Dome's roof.
Local accounts (Leopizzi, 2017) report that the first of this kind of fountains was installed at the end of 1920s in the prominent location of *Piazza della Scala*; however, historic pictures from late 19th century show a smaller, pre-existence water source in the same point, presumably **inspired to the hydrant model Wallace fountain** being produced at that time in Paris.

Do these small fountains waste water with their constant flow?
First of all, they are generally installed on **key nodes of underground plumbing pipes**, thus they permit water or air to escape from the system and relieve excess pressure, acting as relief valves; secondly, the constant stream **keeps the water from** stagnating and forming bacteria. Run off water is conveyed to the municipal water purifier and used in the cultivated fields surrounding the city.
The small *vedovelle* fountains are an iconic symbol of Milan, intertwined with curious anecdotes, popular legends and residents' pride, and almost every public space has one –**almost 600** functioning today.

Paris, Turin, Milan and Rome, with their reliable network of cast-iron water outlets, despite constantly menaced by cut back spending on public utilities, represent excellent models of the precious value of such a small urban element.
The **major takeaways of this investigation** about large-scale production of small drinking fountains are:

- Late 19th and 20th century cast-iron water sources sought to **establish a system** citywide, and are not conceived as isolated artefacts. Nobody would have reliably depended on drinking water if available only occasionally.
- In the past, different pieces of street furniture were carefully crafted and painted in order to **well match each other and with existing amenities** (be it a light post, a newsstand, a trash can, a bollard).
- Preliminary choices in terms of **materials** and structure were crucial. Street objects for everyday use should be tough, easy to build and maintain, reasonably affordable to be up scaled in large numbers.
- A successful urban element, even if simple, should incorporate **unique and local design features**, able to express the identity of the community.

60

Figure n. 60
A vedovella fountain in Milan city centre. Photo by Andrea Rossi - Photorouge
Retrieved from https://www.centraleacquamilano.it/la-citta-dei-draghi-verdi/

61

62

FONTANELLE STRADALI

MODELLO SPECIALE ADOTTATO DAL MUNICIPIO DI MILANO

Prezzi

Fontanella in ghisa con bocca ottone a getto continuo					L. 100. —
detta	senza vaschetta				» 85. —
detta	con bocca ottone a getto intermittente a molla				» 125. —
detta	id.	id.	id.	senza vaschetta	» 110. —
Bocchetta ottone a getto continuo					» 25. —

NB. — La vaschetta è costruita in modo da potersi usare anche come abbeveratoio.

La bocchetta intermittente a molla è rappresentata dal robinetto Fig. 208 del presente catalogo convenientemente modificato.

Bocchetta ottone getto continuo.

Figure n. 61
Children cool down at the fountain in Milan. © Farabola Archive

Figure n. 62
The model of cast-iron fountains of the Municipality of Milan, in a catalogue from 1898.
Retrieved from https://www.milanocittastato.it/featured/le-vedovelle-milano-la-storia-trovarle/

63

Figure n. 63
The ancient fountain with three faucets, now unfortunately dry, in via San Teodoro, at the back of the Roman forum.
Photo by Michele Rallo, Rome, 2009.

Figure n. 64
Children at the drinking fountain in Falls Park, Belfast, Northern Ireland
Photo by John Bonar Holmes, July 25, 1946
The fountain, manufactured by Walter Macfarlane's Saracen Foundry in Glasgow, features a wide base in the shape of a St. Andrew's cross with canted corners, on which was set a circular shaft adorned with water lilies. Four lion jambs support four highly-decorated basins. An obelisk with swan and bird relief rises from the center of the basins. Communal drinking cups are chained to a kylix-shaped vase at the top of the fountain.It is worth noting that shared "tin dippers" were still in use in 1940s despite being officially forbidden in all public fountains since 1912.

Figure n. 65
1910s Health Kups Advertising
Retrieved from https://sites.lafayette.edu/dixieexhibit/1910s/

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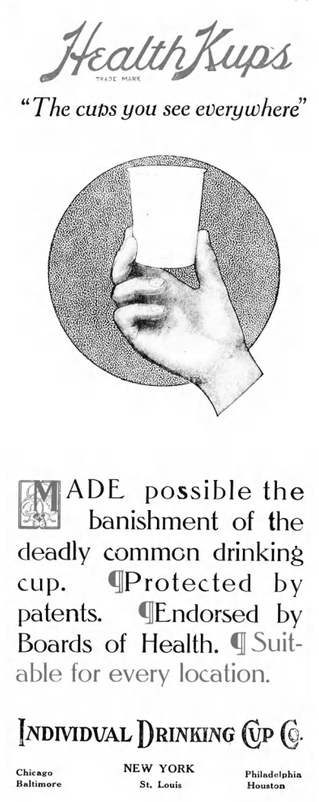

MEDICAL KNOWLEDGE AND FOUNTAIN DESIGN ITERATIONS

Innovations in the way water has been dispensed through time, and especially in late Modern Period, reflected technology advancements and growing knowledge about germs.

For the development of my doctoral research, I also investigated the transformation of small-scale design solutions and tools for drinking water consumption, which I found particularly advantageous and stimulating for the intertwined relationship I discovered between fountains and public health.

During the 1800's and early 1900's, drinking fountains, very different from one another, generally shared **three common design features**:

- One or more downward water spigots, always on;
- A basin for collecting water;
- Communal metal cups connected to the fountain with chains, and often sitting in the water.

A single "**tin dipper**" could be used in common by hundreds of different thirsty people raising the water from the basin to their mouths, thus became a fertile spot for the growth of many kinds of bacteria, like tuberculosis, diphtheria, erysipelas, syphilis, pneumonia, typhoid, measles, mumps and whooping cough. This **harmful health issue** was even exacerbated when humans and horses drank at a fountain/trough combination.

At the time, however, scientists were just beginning to understand how contagion was spread, and communal cups represented the first solution to another predominant problem: **improving access to clean drinking water**. In this context, 19th century fountains with chained metal cups were built all over London, Britain and other nations, especially France, with Wallace models, and United States, and their introduction was seen as – and in part actually was – an important improvement for public health on contaminated pumps. Only at the turn of the century the shared cup began to be questioned by academics and physicians: in 1902 Willian T. Sedwick, MIT professor and distinguished author, recognized the danger of the common drinking cup, cautioned against its use, and advocated for a healthier method. Nevertheless, the public was not still concerned, possibly due to the familiarity of its use, and neglected an alternative solution, invented and patented in 1907 by Lawrence Luellen: a paper disposable cup, called "**Health Kup**".

In 1918 the **Spanish flu** spread to large sectors of the population, causing serious mortality worldwide and finally raising awareness about the existence of germs. Suddenly, drinking out of disposable cups became a matter of life and death (Leland, 2020). In response, Luellen and his cofounder Hugh Moore rebranded the Health Kup to the memorable Dixie cup – after the name of a line of dolls that manufactured in the same building in 1919 – "for home, office, invitations and general use" as the 1920s advertising campaign said. As awareness of the health risks grew, in 1912, a federal regulation in the United States banned definitively the "tin dippers," at public fountains, and this made paper cups even more popular, especially after World War II, when the disposable culture had more than taken off. In 2012, Smithsonian Magazine even called the Dixie cup a "life-saving technology" that helped stop the spread of disease.

66

the woman in the crinoline has been careful to wipe out the cup before drinking!

she did so because the top-hatted man's beard has just been in the cup...

67

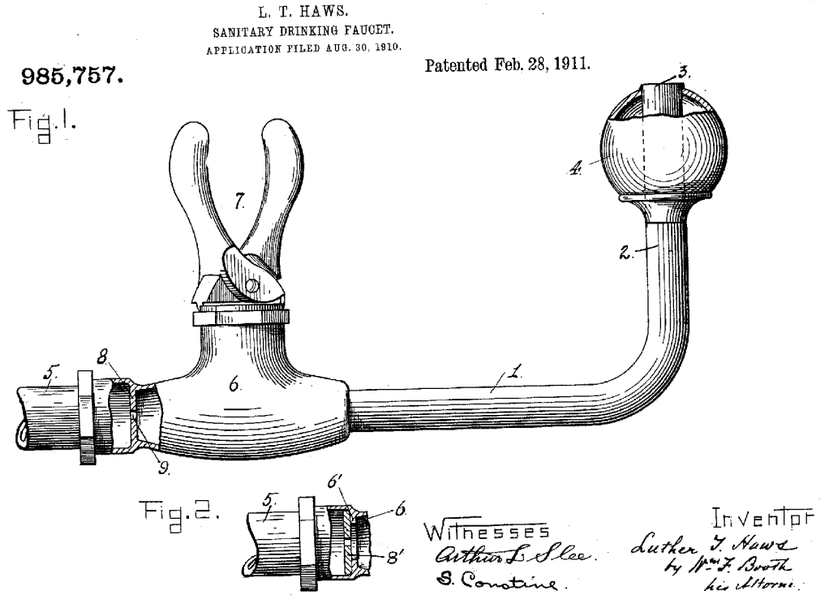

Figure n. 66
Tinted lithograph by C. J. Culliford, showing a man and woman beside the first erected public drinking fountain in London, 1859. In the background, a butcher's boy and a shoeblack make humorous comments. The butcher's boy says that the woman in the crinoline has been careful to wipe out the cup before drinking. The shoeblack replies that it's because the top-hatted man's beard has just been in the cup.
(Photo by Science and Society Picture Library/Getty Images)

Figure n. 67
Luther Haws' patent drawing for "Sanitary Drinking Faucet." 1911
Retrieved from https://www.hawsco.com/blog/tag/drinking-faucet/

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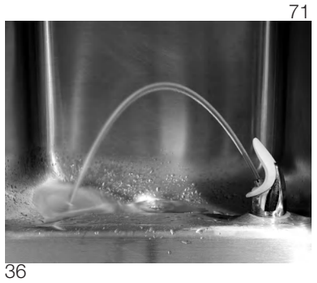


The **Ban the Cup campaign** also resulted in the evolution of those metal dippers into more and more sanitary drinking methods for outdoor water points.
A significant contribution came from Luther Haws, a Californian self-employed master plumber, sanitation inspector for the city of Berkeley. A group of pupils sharing a drinking cup at public school's fountain motivated him to seek for a healthier arrangement, so in 1906 he assembled the **world's first drinking faucet**, then patented in 1911. The Berkeley School Department appreciated the solution of a drinking fountain that did not require a cup at all, and installed the first models. Within a few years, Haws' innovation was widespread, especially in the United States.

Sanitary drinking fountains came in various shapes and sizes, but generally featured metal or ceramic ball as spigot and dispensed a **vertical jet of water** straight into the air. This technology was incorporated and improved into a renowned model of drinking fountain, typically called **Benson Bubblers**, the iconic symbol of Portland in Oregon and probably the only consistent network of monumental water points in the United States, still in use for their intended purpose (Ivanov, 2015).
In 1912 Simon Benson, a logging businessman and magnate, donated $10,000 to the City of Portland to purchase and install 20 copper drinking fountains. Beside local anecdotes, the evident, keenly-felt **necessity of safe water in the city**, together with a tangible attempt to improve lumber profits as a result of **sober employees**, were the most likely reasons of Benson's endowment.
The architect A. E. Doyle designed a **cast bronze structure** adorned with leafy designs, with four bowls equipped with vertical faucets, continuously dispensing upward jets of flowing water, like four miniature geysers.
The first fountain was installed at Southwest Washington and 5th Avenue in June 1912; then, within a year, all of the twenty fountains had been constructed and located by municipal engineers on downtown streets and connected to Bull Run water via existing water pipes. The twenty original fountains fell into disrepair by the 1950s, until longshoreman Francis J. Murnane convinced the city to restore and value Benson bubblers as part of Portland's heritage. In 1976, the Simon Benson Trust donated another twenty fountains in the occasion of Portland's bicentennial celebration. Now, there are 52 total four-armed Benson Bubblers, two three-armed Benson Bubblers, and more than 80 one-bowled Bubblers; however, four-bowl fountains are limited to downtown boundaries so as not to diminish the uniqueness of them (Portland Water Bureau, 2013).
Some changes and optimization of Benson Bubbler's water delivery occurred over time, but they did not alter the physical appearance of the fountains. For instance, local water bureau installed timers that shut fountains off during low-usage periods, generally in the late night and early morning hours, and flow-restricting devices to reduce the amount of dispensed water by 40%.
However, the so-called Sanitary Drinking Fountain, in both Luther Haws' and Benson's versions, **did not remove health hazards**. Public health experts quickly realized that eliminating common cups did not eliminate the risk of transferring germs through drinking fountains, since many drinkers were found placing their whole mouths directly on the top of the spigot; moreover, the design of the faucet openly expose the outlet to infectious material from users' mouth, any kind of urban debris and pigeon droppings.

Later design iterations included **mouth guards**, sometimes in the form of brass cages or raised rings around the vertical-style faucet to prevent direct cross contamination. These solutions were only partially effective, because, as a result, people just started putting their lips on the mouth guards instead.

Plumbing engineers and fountain designers gradually settled on another solution entirely: **slanted water jets**, at approximately a 45-degree angle.
In January 1920 Dunlap, Hinman and Maffitt from the Iowa section of the American Water Works Association published a report based on **results of bacteriological experiments** on public drinking fountains under laboratory conditions that clearly states the design features to get the **safest drinking water delivery** in urban environment; according to the document:

- Vertical upward jets should be avoided;
- Slanted jets shall be considered suitable sanitary drinking mechanisms only if properly protected from users' lips, fingers and mouth droppings, and out of reach by splashing from the basin;
- All fountains' design and functioning shall be intuitive, and their proper use self-evident.

The above mentioned specifications have remained quite similar ever since – a **shield faucet** that creates an **arced stream** – with ultimate addition of special mouth guards that deflect mouth dropping and used water away, and incorporate an anti-squirt angled drinking stream.

Over the last few decades, water fountains have been disappearing from public spaces throughout many worldwide countries, since they have met their strongest adversary: **bottled water**. Growing public's distrust in the cleanliness of the tap water and the dispensing device, poor maintenance and low distribution across the territory of water points, are at the base of the relentless decline of drinking fountains. Ubiquitous and **seductive health claims** from beverage companies also played a role in building the pervasive perception that bottled water is safer, healthier and taster than tap water.
In response of water contamination scare and aggressive advertisement, bottled-water sales began to rise starting in the late '80s; in particular, Italy is now (CENSIS, 2018) the first country in Europe and the third one in the world for mineral water consumption, while public fountains, when functioning at all, remain an isolated, sad symbol of distrust in public infrastructure, neglected, covered in rust, "going the way of pay phones" (Salzman, 2012). Recently, some cities are bringing back — or at least increasing maintenance of — this basic urban fixture, as a result of a higher level of awareness about the environmental costs of bottled water, and the increasing adoption of healthier lifestyles among citizens.

In this framework, the goal of this doctoral thesis is to highlight the great potential of water fountains from a public health perspective based on international studies and initiatives, that will be the main subject of the next chapter, and to develop a viable design proposal for a contemporary piece of street furniture delivering safe and tasty water along with other services for a smart healthy city.

Figure n. 68
One of several iconic, bronze "Benson Bubbler" drinking fountains in Portland, Oregon, named after logging magnate Simon Benson. Photograph retrieved from the Carol M. Highsmith Archive, Library of Congress, Prints and Photographs Division.

Figure n. 69
Three women drinking at once at Benson Bubbler in Portland in 1920. Retrieved from https://1859oregonmagazine.com/think-oregon/history/oregon-history-simon-bensons-legacy/

Figure n. 70
Pigeons have discovered how to plunge their beaks into the hole of the Benson's nozzle, thus, creating a faster (and higher) flow of water for a more refreshing swallow. This picture put into question the cleanness of the drinking device. https://pxhere.com/en/photo/467836?utm_content=shareClip&utm_medium=referral&utm_source=pxhere

Figure n. 71
A water fountain in Toronto, with a slanted jet.
Photo by Raysonho @ Open Grid Scheduler, 2011

MAIN PHASES OF WATER SUPPLY IN PUBLIC SPACES

SINCE ANCIENT TIMES

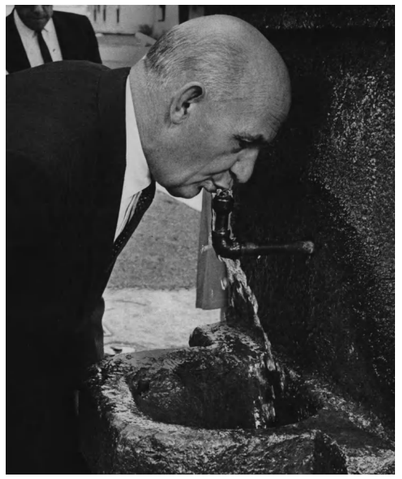
Before domestic water supply, acquiring safe drinking water primarily meant pulling water from wells or travelling to public fountains and lugging the water back home. From ancient times, people used to meet at communal water sources and chat as they queued with their own vessels.
Public fountains were a strategic element for community life, for social interactions and sharing information, especially for female citizens, and attended on a daily basis for drinking water collection, clothes washing, watering horses but also personal hygiene.

Figure n. 72: Women collecting fresh water from the town's main fountain.
Photo by W. Eugene Smith: Extremadura. Province of Caceres. Town of Deleitosa, Spain, 1951

XIX AND EARLY XX CENTURY

In XIX and the beginning of XX century, people drank water from public fountains using a metal cup attached to the fountain with a chain, the source of much waterborne disease transmission. In the second half of 1800s, germ theory started to gain acceptance, but everyone assumed that the water flowing over the cup would keep it clean, possibly due to the familiarity of its use. Tin dippers were eventually banned in all public fountains in 1912, and replaced with disposable paper cups and other more sanitary drinking solutions.

Figure n. 73: A boy drinking from a communal tin dipper at a public fountain in Madison Square Park, New York, 1913.



FROM 1911

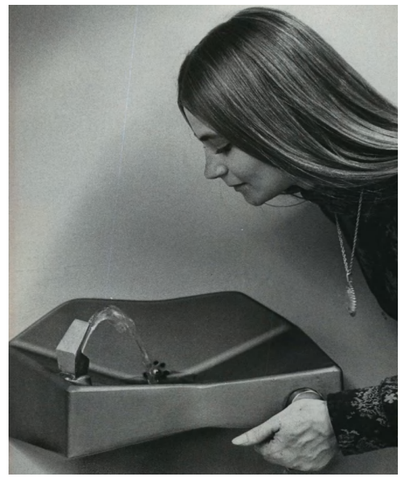
The first drinking faucet was invented in 1906 and patented in 1911 by Luther Haws, a self-employed master plumber. The device didn't require a cup at all and delivered an upward vertical water jet, flowing out a steel or porcelain spherical spigot.
The iconic Benson Bubbler in Portland also incorporated the vertical water outlet, but with some transformations: the faucet is a larger, slightly curved steel surface, with the nozzle in the middle.

Figure n. 74: Fred F. Schallert leans over to get a drink from Bay View's historic bubbler in the 1700 block of East Pryor Avenue. This photo by Richard Bauer was published in the Oct. 1, 1965, Milwaukee Journal.

1910s AND 1920s

Also vertical-jet drinking faucets created sanitary implications: thirsty citizens tended to place their whole mouth on the spigot to maximize the water intake; hence, the hygiene of the so-called "Sanitary drinking faucet" was compromised.
Therefore, several manufacturers started adding mouth guards, raised metal rings surrounding the spigot to prevent users from putting their mouths directly on the spout, but these solutions were only partially effective, as people just started putting their lips on the newly added devices instead.

Figure n. 75: Vertical spigot surrounded by a small metal shield to prevent users from putting their mouths directly on the spherical spout, which is engraved with Haws Berkeley, Calif. https://www.hawsco.com/



RECENTLY

From 1920, plumbing engineers and scientists highlighted that slanted faucets, from which water flows at approximately a 45-degree angle and creates an arced stream, is the safest drinking method.
This model has been refined through time using mouth guards and arc projection to better deflect mouth dropping and excess water away, but it is basically the same design of present-day drinking fountain today, along with traditional downwards water spigots, still in use for both "stoop and drink" and bottle refiller.

Figure n. 76: Dorothy Lind takes a drink from a new-look bubbler, a slanted jet with metal mouth guard.
This photo by Donald Nusbaum was published in the Jan. 1, 1976, Milwaukee Sentinel.

NOW

Because of the low accessibility of public drinking fountains and poor perception of tap water, combined to strong advertising by mineral water companies, bottled water has become more popular in providing hydration to us every day, even if it is the most wasteful option.
This research wants to help overcome the stigma of using public fountains, with the rediscovery and refurbishment of this basic convenience, and the proposal of a multifunctional smart urban object providing safe, tasty, plastic-free water on the go, and other services for the city.

Figure n. 77: The reliance on bottled water in out-of-home context. Retrieved from https://www.ohmymag.de/tipp/wiederverwenden-verboten-diese-gefahren-lauern-in-plastikflaschen_art16645.html

CONSIDERATIONS AND LESSONS LEARNED FROM HISTORIC REVIEW

Through history, drinking fountains have always exemplified the spirit of the time (Ivanov, 2015). In Roman Empire, they marked an era of **prominent public spaces** and refined know-how in water management, perfectly catering for both **large events** and **daily necessities**.
In early Medieval, fountains and wells, scattered along pilgrimage routes or nestled in cloisters, reflected the dominant role of religion as a social binding force of secluded communities.
In Communal Era and Renaissance, drinking fountains were reactivated or built anew in outstanding locations, like the centre of the main square, as symbol of wealth, municipal obligation and citizenship.
In industrial cities, public sources of cholera-free water embodied modern measures to fight the spreading of disease, a response to raised awareness about microscopic pathogens.
In the Temperance Movement, drinking fountains aimed to discourage alcohol consumption, and frequently accommodated humans and horses, as new perceptions of animal welfare become widespread. Public water outlets were also a sad symbol of racial segregation in the half of 20th century.
By the 1900s, style and purpose of fountains changed as a result of widespread, accessible indoor plumbing.

Historical fountain development offers useful hints for the next phase of the research, dedicated to define a contemporary urban element providing drinking water in public spaces. Some lessons learned include:

- **The role within the urban fabric**
Throughout history, drinking fountains have been important meeting places, often providing additional services, like sittable surfaces or shaded areas.
Located in strategic urban spots, in relation to public space usage and surrounding buildings' type, ancient fountains, even when comparatively small in scale, were generally rooted in cultural identity and strongly represented the whole community.

- **Simplicity in construction**
Ancient water technologies of minor water outlets and well- or cisterns-like fountains, were characterized by simplicity, ease of operation, and lack of complex controls, which makes them more sustainable, flexible in use, neighbourly, easier to be replicated in number.
In the developed parts of the world this basic convenience is highly overlooked since it lost the leading role of water supply: in its redesign, past manufacturing considerations and experiments will be taken into account.

- **Urban interface dispensing health**
A reliable distribution of water access points in the urban environment has always affected the well-being of local residents, for personal rehydration, cooling down in hottest days, and curbing alcohol consumption. Surprisingly, drinking fountains could even address present-day set of challenges, like plastic waste, heat stress symptoms due to extreme weather, overconsumption of sugar-sweetened beverages, just to name a few.

- **Iterative design process**
In the development of drinking water dispensers, each design solution revealed, with the test of time and usage, different issues that were gradually solved in subsequent steps. The design of public fountains is also extremely contextual, a key indicator of local, cultural attitude and technology advancements.

A wide variety of fountains have been built over time. On the whole, the emphasis has shifted, or rather expanded, along with societal development from just meeting basic needs, such as providing drinking water for people and animals, more towards offering **enjoyment and aesthetic values** (Juuti et al.,2015).
High expressions of sculpture and sophisticated technical abilities still occur in present-day society related to **monumental fountains**; with its quirky movements and kinetic elements, the **Karneval Brunnen in Basel** is an example, designed and built by Jean Tinguely in the square where the city theater once stood.
Another remarkable case of modern reinterpretation is the **Crown Fountain in Chicago**, designed by Jaume Plensa, one of the most renowned Catalan sculptors in the contemporary art scene, in collaboration with Krueck and Sexton Architects, who undertook the overall execution of the project.
The crown Fountain is an interactive public sculpture consisting of two towers of 15 metres in height, made from hand-cast glass blocks, at the opposite borders of a shallow pool; LED video screens are positioned behind the opposing faces of the two towers and display video close ups on faces of 1000 Chicago citizens of all ages and backgrounds. Water flows out an outlet in the screen in a way that gives the illusion of water spouting from the displayed mouths, a reference to the traditional use of gargoyles in fountains and roofs, protruding spouts designed to convey water away from their opened jaws. Water features operate during the year between mid-spring and mid-fall, while the images remain on view all the year round.
Since its public opening in 2004, Crown Fountain has established its place in the hearts of residents and visitors alike, a playful, innovative, iconic gathering place that merges public art, design, architecture and landscape.

On the contrary, **minor water outlets**, when not conceived as unique pieces of public art but just as outdoor drinking water dispensers and local meeting points, are quite **endangered species of urban objects**, in various state of disrepair, turned off, dismantled, rarely redesigned.
There is plenty of reasons to rediscover drinking fountains and their role in addressing modern day challenges, as promising expression of environmental commitments, contemporary aesthetic for everyday places and neighbourhood identity, and a valuable public health tool.
Next research chapter will display positive and negative examples and initiatives towards the rediscovery of this basic public convenience.

Figure n. 78
Jean Tinguely's Carnival Fountain realized in 1977 at Theaterplatz in Basel, with its ten iron figures, that seem to be playing in the water, it creates a wonderful place to meet and enjoy the workings of each piece.
Photo by Ilaria Fabbri, Basel, 2015.

Figure n. 79
The Crown Fountain at Millennium Park, Chicago. Design by Jaume Plensa with Krueck and Sexton Architects, 2004.
Photo © Jaume Plensa

Figure n. 80
Water sculpture, Heinz Mack, 1977.
Ph Ilaria Fabbri, Münster, Germany, 2017.

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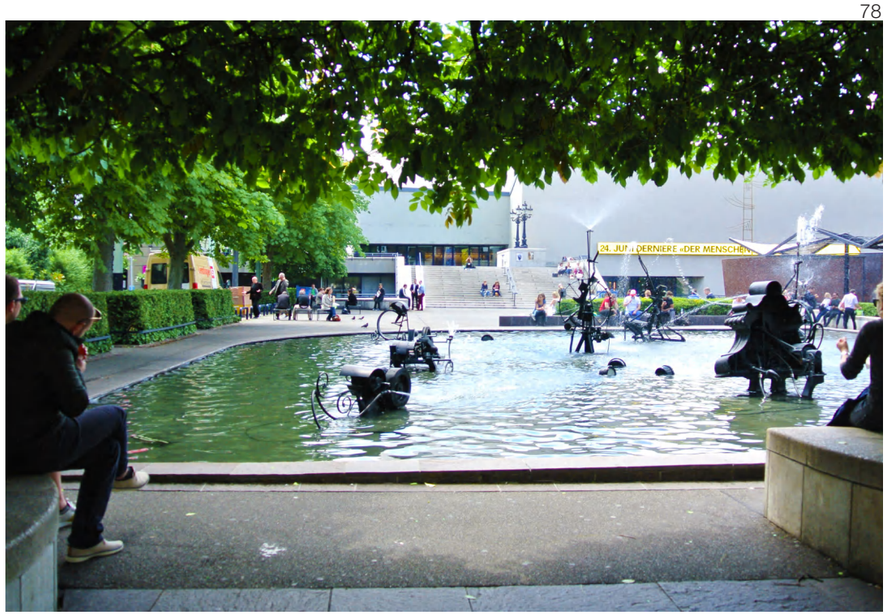

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Figure n. 81
Disused stone fountain in Monte Cerignone. Photo by Gabriele Castellari, 2015

Urban fountains and public health opportunities

In contemporary cities, thanks to the digital revolution and the advancements offered by the Internet of Things, many urban objects throughout the public space are becoming more and more efficient, sustainable and responsive to dwellers' needs.
The pace of innovation, however, is different among everyday street furniture: benches, litter bins, cycle stands, shelters, fitness equipment and other services installed in our built environment, sometimes still look unkempt and decayed. Public restroom, for instance, are seldom newly built or renovated, and the existing ones, in some cases, have been even closed. Today, when most people need to use a restroom, they are likely to interlope into some restaurant or retail space and pretend to be a customer. As a result, many businesses have taken to locking their restrooms and restricting key access to paying customers (Vaughan, 2013). The lack of this simple convenience seriously impacts toilet frequent users, especially the elderly, parents with babies and toddlers, people with certain disabilities or medical conditions, but also workers whose jobs involve driving or being outside for a long time, and can result in social isolation and create difficulties for daily life.

Along with public restrooms, drinking fountains are disappearing, too.
At one time, drinking fountains were a ubiquitous feature in public space, often fulfilling dual roles as public artwork and day-to-day convenience dispensing potable water; today they have lost their purpose: it is not rare to come across dismissed water fountains, scattered all over the city, **neglected, covered in rust and weed**, or **improperly shoved between bathrooms and trashcans** (Ivanov, 2015). This phenomenon is observed in several countries, including Italy. In Genoa, for instance, there is a kind of graveyard of disused fountains, well documented by Professor Francesco Gastaldi in a detailed reportage of GOA Magazine (2017) that comments and locates throughout the city the remains of those former public amenities with historic value.
Regardless of the cause that led to gradual drop in usage of drinking fountains– be it as consequence of damages caused by vandals, poor maintenance or the increasing mistrust in municipal water, the disappearance of this simple urban service from the public realm is symbolic of an evident lack of access to drinking water in the public realm for a wide array of users, including children, commuters, runners, the homeless, and tourists, as well as pets (Phurisamban et al., 2017).
Conversely to phone booth and post boxes that are gradually declining their prominent role in the public realm due to technological innovation, the **slow demise of public drinking fountains is regrettable and unhealthy**, and their alternatives (holding back your thirst when outside or buying bottled drinks) are far more worrisome than the shift to mobile phone calls and email letters.
Drinking fountains, a seemingly insignificant urban element, has a **huge potential** if properly reinvented: not only a public utility, but also an expression of **neighbourhood identity,** an **innovative urban interface promoting virtuous behaviour**, a **valuable Public Health Opportunity**.

Next paragraphs highlight the potential of water fountains from a public health perspective, with the support of international researches and initiatives.

83

84

Figure n. 82
Disused fountain with a she-wolf's head in Rome. Photo by Walter Bertolotti, 2019
Figure n. 83
Disused fountain in Via Dei Giardini, Genova. Photo by Patrizia Murgia
Figure n. 84
Disused fountain at Villetta di Negro, Genova. Photo by Francesco Piredda

85

Figure n. 85
Elderly and young infants are at greater risk of water deficit, but also women during pregnancy have special hydration needs.

86

87

88

ENCOURAGE TO **DRINK MORE**

Personal wellbeing is directly connected to daily water intake. Water is involved in every bodily function (Solimene, 2015), from digestion to cellular nutrition process, from circulation to joint cartilage lubrication. Daily water balance regulation also greatly affects the activity of human brain, which is composed of about 75% water. Impacts of dehydration on cognitive performance have been thoroughly investigated, and a precise summary of most relevant studies on this topic is collected by Hydration for Health Academy (2018): when levels of dehydration are induced above 2% body mass loss, results show reduced short-term memory, arithmetic efficiency, as well as motor speed and attention (Gopinathan et al. 1988). Even **mild dehydration** (below 2% body mass loss), which can be experienced in daily life because of fluid restriction and exercise-induced sweat loss, or water deprivation alone, has negative consequences on cognition, as documented by Wilson and Morley (2003).
Without any induced dehydration, a suboptimal hydration can occur when fluid intake is insufficient to adequately compensate water losses. This phenomenon is commonly called voluntary dehydration and has mostly been reported in children and elderly.
Healthy adults regulate water balance with precision, but young infants and elderly people are at greater risk of dehydration (Jéquier et al. 2010), both for physiological reasons and inadequate thirst sensitivity: in children this is mainly explained by the **lack of awareness** of insensible water losses while in elderly it may be due to **decreased thirst sensation**, and to incontinence (Masento et al. 2014).

Moreover, voluntary dehydration **concurrent with high temperatures** can not only affect cognitive performance and overall wellbeing, but also increase the risk of severe heat-related illnesses, such as heat stroke.
According to the DG CLIMA project “Adaptation Strategy of European Cities” (2016), repairing historic drinking fountains and installing new ones, are valuable interventions to help cities in their efforts to become more resilient to the negative effects of global warming and of heat waves in particular. Such investments in water supply services create more opportunities for people experiencing the negative effects of heat in the city for drinking when feeling thirsty or simply cooling down.
Providing more water fountains in public places in order to cope with hot weather, is one of the measures included in the City of London Adaptation Plan, and in particular in its **Drinking Fountain Initiative**, and **OASIS project**, one of the Action Plans of Paris Resilient Strategy.
The overall concept of OASIS project, selected in 2018 to receive funding from the Urban Innovative Actions Initiative, is to create healthier and greener spaces for children as they are the schoolyards’ priority users, while also functioning as an accessible “cool island” for the whole neighbourhood after school time and at weekends, especially during heatwaves.
Since the beginning the project transformed more than 40 schoolyards; children, teachers, extra-curricular teams, parents and local stakeholders have been involved throughout every step of the project, from designing to programming and managing the outdoor space.

Transformed schoolyards present common features:
- pervious and clear ground, in place of large asphalt surfaces.
- increased vegetation: trees, green roofs and walls, plain soil for pedagogical gardens, enhancing contact with nature and contributing to decrease the heat island effect.
- intensive play areas and inclusive playground locally produced with bio/geo sources materials.
- quiet corners to accommodate users’ different needs.
- **water points**: OASIS project highlights that most schoolyards do not provide direct access to drinking water, while it is a fundamental feature for children hydration and cooling down. A **sprinkling fountain in the middle of the schoolyard,** equipped with faucets at different heights to cater for different users with mister, and misting heads is a recurrent element of the new outdoor spaces, to hydrate and cool off the warm neighbourhood.

There are more than 770 schools (including the “collèges”: middle schools managed by the City) in Paris with an average schoolyard surface of 1000m²: the city is currently defining a set of methods and tools aiming to standardise the process and apply it in all 770 public schoolyards by 2050 (Thiollier et al., 2020).
Thus, in the project intention every neighbourhood would acquire a small park - a cool and shaded refuge for days of extreme heat, considering that every Parisian lives within a radius of 250m from a public school.

These researches and studies highlight that **reliable and appealing water fountains in public space would create more opportunities for people, especially those at particular risk of water deficit, to stay hydrated in all seasons and to cope with heat waves, lowering the risk of heat-related illnesses.**

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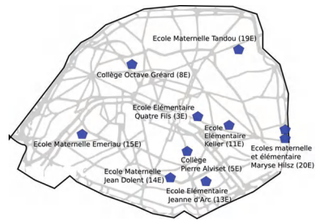

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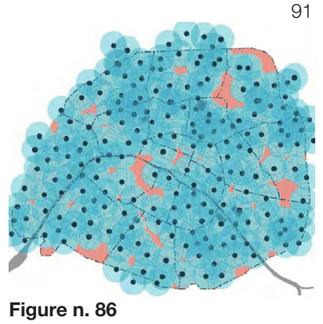

Figure n. 86
A sprinkling fountain in the middle of the transformed schoolyards in Paris - OASIS project. Retrieved from @ Anne_Hidalgo, Twitter.

Figure n. 87
Schoolyard école Daumesnil 12 arr. The drinking fountain is one of the recommended fixture o the outdoor equipment. Photo by Laurent Bourgogne - Ville de Paris.

Figure n. 88
Ecole Alain Fournier. Photo by Laurent Bourgogne - Ville de Paris.

Figure n. 89
Greenery, pervious ground and a drinking founain are some of the common features of the pilot schoolyards, transformed through OASIS project in Paris. Photo by Laurent Bourgogne - Ville de Paris.

Figure n. 90, 91
10 parisian pilot schools delivered from 2019 to 2021 by the OASIS project, as part of Urban Innovation Action program.
Every Parisian lives within a radius of 250m from a public school, a potential shaded and cool retreat during hottest days.

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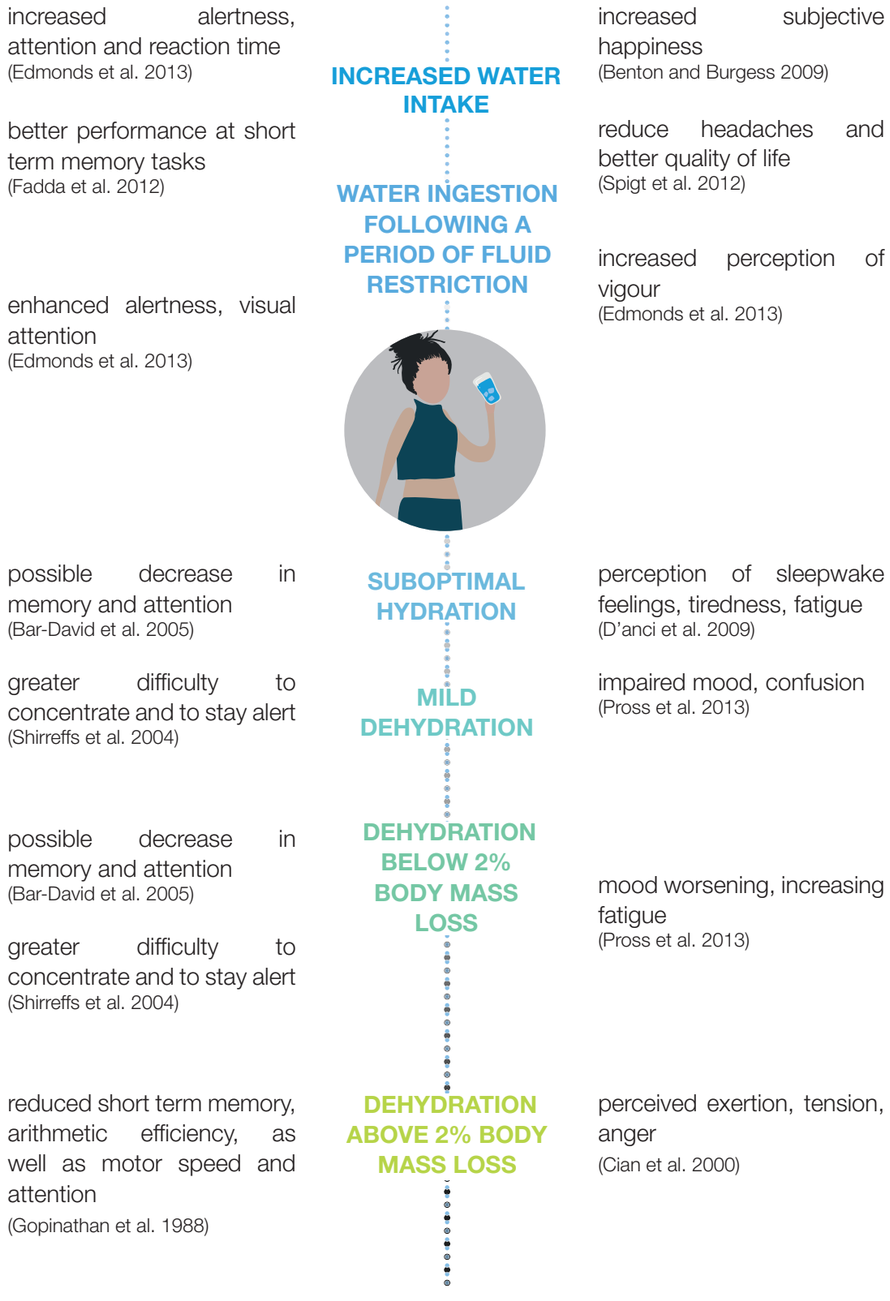

Figure n. 92
Commonly reported impacts of dehydration on mood state and cognitive function. Author elaboration based on the report "Hydration, mood state and cognitive function" made by Hydration For Health (2018).
50

ENCOURAGE TO DRINK MORE **WATER**

« *Plain drinking water should be considered the ideal choice for personal hydration. Especially considering that worldwide obesity is connected to the consumption of high-calories drinks*»; this sentence, retrieved from the consensus Paper "Water & health" by World Federation of Hydrotherapy and Climatotherapy (2015), introduces another crucial aspect linking daily water intake and public health.

Overweight and obesity have increased dramatically during the past decades, both in developing and developed countries, and this represents one of the most serious public health challenges of the 21st century.
Today, more than one in two adults are overweight or obese in the OECD Area (OECD, 2017); Italy in particular is at the top level in term of **paediatric obesity incidence and frequency** among European countries. The latest data (2015–2017) from the WHO Childhood Obesity Surveillance Initiative (COSI), a unique system that for over 13 years has measured trends in overweight and obesity among primary school aged children, show that southern European countries have the highest rate of child obesity: in Cyprus, Greece, Spain, Italy and Malta, approximately 1 in 5 boys (ranging from 18% to 21%) are obese.
COSI involves taking standardized weight and height measurements from over 300 000 children across the WHO European Region every three years. This provides nationally representative data for participating countries (38), as well as a large Region-wide data set for analysis of the determinants of childhood overweight and obesity. However, some large countries, such as Germany and the United Kingdom, do not take part. The United Kingdom, for example, has its own surveillance system for obesity in children aged both 4–5 years and 10–11 years.
Italian Statistic Data Centre (2019), that focuses on broader anagraphic target, reports that 25,2% of the subjects between 3 to 17 years of age are overweight, with higher percentage in the South of Italy.

SUGAR-SWEETENED BEVERAGES AND TAP WATER CONSUMPTION
Obesity, especially in childhood, is a complex public health issue caused by the combination of many factors, but especially unhealthy diets, overconsumption of fizzy drinks and juices with added sugar or sweeteners, and a rise in sedentary lifestyles. **Drinking sugary drinks on a regular basis can lead to weight gain, tooth decay and cavities**, and increase the risk of developing type 2 diabetes, heart disease, stroke, and obesity-related cancers. Additionally, drinking sugary beverages is associated with developing kidney disease, non-alcoholic fatty liver disease, and gout, a type of arthritis (NYSDOH, 2020).
Research articles investigating whether **mistrust of tap water leads to greater intake of sugar-sweetened beverages** are quite limited. Onufrak et al. in 2014 examined the perceptions of tap water safety and their cross-sectional association with intake of sweetened drinks and plain water, taking into account racial/ethnic differences, too. The study found that doubt about local tap water safety is common and varies by age, income, education, region, and ethnicity, and could be a risk factor for sugar sweetened

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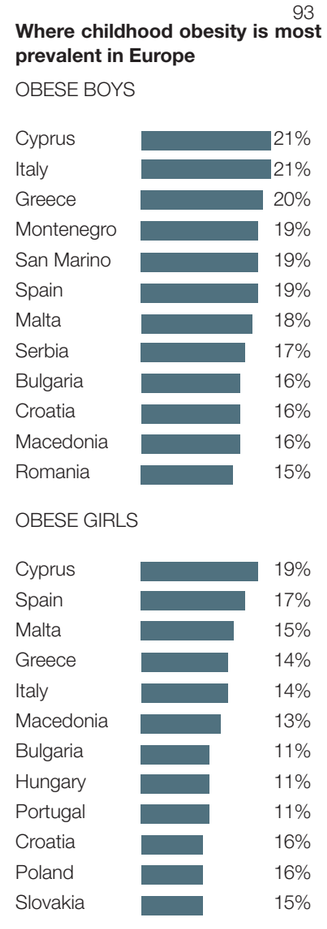

Figure n. 93
Overweight and obesity prevalence among children aged 6-9 years in European Countries participating to COSI 2015-2017. Source Childhood Obesity Surveillance Initiative (COSI) Factsheet. Highlights 2015-17 (2018)

beverage intake, especially among many minority populations.
In Italian local context, there is little evidence about the relationship between public confidence about the safety of tap water and sugary drink consumption.
To gain a deeper insight into this topic, the doctoral research compares the results of Italian Statistic Data Centre (2021) on water usage together with another national survey called “Okkio alla salute” regarding physical activity and nutrition in childhood. The comparison of the data collected by the two reports highlights an **inverse correlation between sugar-sweetened beverages consumption and perception of public water’s safety**.
The higher mistrust in tap-water across Italian cities and villages, the higher percentage of sugary drinks consumed (at least once a day) by children aged 8–9 years. Further analysis is needed, however, since other factors may play into this relationship.

94

Figure n. 94
Percentage of children aged 6-10 years old consuming sugar-sweetened beverages at least once a day. Source “Okkio alla Salute” Initiative 2019.

95

Figure n. 95
Percentage of Italian families NOT confident in drinking tap water. Source Italian Statistic Data Centre (2021) on water usage

WATER FOUNTAINS IN OBESOGENIC ENVIRONMENTS
Over the last few years, a number of new policy initiatives have emerged worldwide to tackle obesity; the ones addressing the overconsumption of sugar from drinks can be basically categorized into two types:

1. Policies discouraging unhealthy drinks consumption, like pricing and fiscal measures, and advertising regulation restricting the commercial marketing of potentially unhealthy products;
2. Measures promoting healthy drinking habits, by empowering consumers to choose water over sugar sweetened beverages.

Regarding the first type of policies and advertising regulation, for instance, on March 5 2020 Singapore’s Ministry of Health has announced that, by the end of 2021, pre-packaged non-alcoholic drinks with a high sugar or saturated fat content will have to display new color-coded nutrient-summary labels, ranging from A to D depending on how much sugar they contain. Drinks that fall under the Grade D band, the unhealthiest, **cannot be advertised across all media platforms**, including broadcast and print advertisements, television commercials, bus stop advertisements and social media ads such as paid influencer posts (Oh, 2020).

About **sugar taxes**, intended to raise revenues while addressing health issues such as obesity, diabetes and tooth decay, have already been adopted in many countries including Britain and France, Chile and parts of the United States, and turned out to be an effective way of nudging behaviour change; according to WHO (2020) is far more successful than targeting or shaming individuals.
In Portugal, for instance, as reported by the WHO Regional office (2020), the results of taxation on sweetened beverages are impressive: many companies have radically reduced the amount of sugar in their products and sales of sugary drinks have fallen overall.
Italy too is going to adopt new taxes on sugary drinks, included in the 2020 budgetary forecasting but not yet adopted. The revenue should be earmarked for public health programmes promoting healthier diets and lifestyles; the **additional revenues** could also be used to **supplement** fund related to the realization of **services and infrastructure like public drinking fountains**, that offer a healthy alternative to pop, high calories beverages and not more expensive.

The second type of policies includes school-based and worksite interventions, advertising and healthy challenges incentivising to swap sugary beverages for low calories drinks and plain water in particular.
Initiatives such as “**water-only schools**”, “water weeks” and special campaigns addressed to local authorities, schools, workplaces and individuals, are designed to help children and adults to cut down on their sugar intake.
Different pilot projects across school systems worldwide found links between installing and promoting water fountains, behaviour change and positive health outcomes.
Muckelbauer et al. (2009) carried out a unique study involving 32 German grade schools testing whether a combined environmental and educational intervention promoting water intake was effective in preventing overweight among children in elementary school. About 3.000 second and third graders were weighed and interviewed about their drinking habits. In some of the sampled schools, water fountains were added and children were given personal water bottles they could fill at the beginning of the school day. Teachers were also given lesson plans that included health messages about the benefits of water consumption. At the beginning of the study, there were no statistical differences in the prevalence of overweight kids in the different groups. By the end of the school year, however, children in the schools where water drinking was encouraged were 30 percent less likely to be overweight. It may be that water consumption slightly reduced the amount of calories kids were consuming from beverages, or it could be that kids who drink extra water eat slightly less food.
Despite some limitations, like basing on self-reports the daily consumption of non-water intake, and no data collection on daily food consumption during the experiment, this research shows that **adding school water fountains**, distributing water bottles in classrooms and teaching kids about the health benefits of water **can lower children’s risk for becoming overweight**, especially for those on the borderline of weight problems.
However, outside spotted virtuous enclosures where access to fountains is extended and the health benefit of water promoted, sugary drinks are still easily available and

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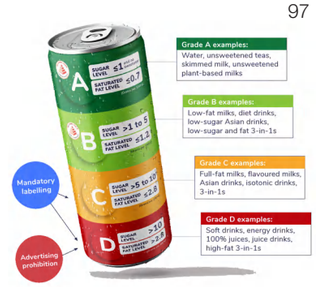


Two opposite beverages advertisements policy:

Figure n. 96
Multibuy offers and “buy one get one free” promotions on unhealthy food and drinks fuel the obesity crisis. For this reason, they will be banned at the end of 2022 in England and other countries acroo Europe.

Figure n. 97
The grading system, named “Nutri-Grade”, will apply to all pre-packaged non-alcoholic drinks sold in Singapore and will reflect the amount of sugar and saturated fat in the drinks. Source: Singapore Health promotion board.

widely advertised, while drinking fountains generally scattered and poorly maintained. While there is no scientific evidence that a greater diffusion of this essential community service could reduce the risk of obesity, making it easier to find free drinking fountain when out would increase the chances to choose water over sugary beverages.
To encourage children to drink water on the go, **Amsterdam city council**, for instance, has started placing 300 drinking water fountains around the capital since 2015, as part of its anti-obesity campaign. Moreover, since 2014 requires all festival organisers to provide a single free tap water for every 150 people attending the event. With many large events around in Amsterdam, such a law could enhance the consumption of tap water over sugary and alcoholic beverages among local residents.

The need to focus on the environmental features where people live their lives and spend their days is wisely underlined in the Call to Action that the **London Child Obesity Taskforce** published in 2019 to identify what actions are needed for London's children to be a healthy weight. The sixth ambition of the document, called "Make free London water available everywhere" aims to help change the culture of drinking water in the UK's Capital. This call to action is twofold: firstly, it proposes creating an incentive for children to drink more water through publicising local tap water as an exciting brand called London Water, owned by, and free to, all Londoners. Secondly, the task Force demands an **implementation of drinking fountains** in public spaces to ensure that no one would ever be **further than 100 m from free, fresh, desirable drinking water** when they are in high streets, civic spaces and public buildings.
In the indicated **100-metre radius**, public drinking fountains and free tap water points at cafes, shops and businesses are both included; but the expected number of water access is impressive nonetheless. For this doctoral research, London Child Obesity Taskforce sets a reference point for the ideal location and the optimal distance of water outlets, that will be taken into account for urban location studies further developed ahead.
By providing plentiful and visible access points and creating aspiration, London Child Obesity Taskforce believe children will be nudged to drink plenty of water and fewer sugary drinks. This call for action is aligned with the Mayor's ambition of reducing single-use plastic bottles in London, and pursued through the **"London water fountains project"** in partnership with Thames Water, Britain's largest privatized water supply company. A network of more than 100 drinking water fountains are currently being installed in busy and accessible areas of London; the Mayor and Thames Water cover the cost of the fountains and their installation, while they will be owned, maintained and cleaned for 25 years by Thames Water.

98

Figure n. 98
One of the "Drinking Fountains for London" refill stations, a project started in 2018 from the collaboration of Thames Water and Greater London authority, aimed to install 100 drinking fountains across UK capital.

Appropriate public access to water is an increasing concern also in **New Zealand**, where more than 1 in 3 children are obese or overweight, and the obesity rate in adults is the third highest in OECD countries (OECD, 2017). Moreover, 8700 children in New Zealand, in 2019 alone, had to be hospitalised to have their teeth removed, due to dental decay: sugary drinks are a big contributor to obesity rates and rotten teeth extraction procedures, too.
This negative records could be avoided with better access to free tap water when people are out – by councils putting in more public drinking fountains (Ford, 2020).
A study by the University of Otago showed that only 20% of the 54 surveyed playgrounds had a working drinking fountain within 100 metres of the playground equipment (Thomson, Wilson, 2018). An earlier study by the authors carried out on playgrounds in Wellington found only 6 per cent had a functioning water fountain (Wilson et al., 2017), so the scarcity of this basic public amenity seems to be a general problem for New Zealand.
For instance, in 2020 OUR Action Station called on New Zealander government to act and make drinking fountains compulsory in half of all public parks, sports fields, and playground.

Australia, the ninth fattest nation in OECD countries (OECD, 2017), actively introduced several measures to promote healthy living since 2014, and one of them tackles the overconsumption of high-calories drinks, the largest source of added sugars in the Australian diet, according to Victorian Health Promotion Foundation (2016).
Called "**The Water Initiative**", it aims to encourage people to take advantage of tap water rather than buying bottled water or other beverages and includes:

- social marketing campaign encouraging Victorians to switch sugary drinks for water for a month, through the participation to the "H30 Challenge";
- research informing the development of evidence-based approaches for the provision of water in specific settings;
- roll-out of well-designed and well located water fountains in the City of Melbourne to test whether including a bottle refill functionality on fountains, and the location of fountains, increases access and use.

In 2016 **more than 60 water fountains** were installed in 2016 across Melbourne, thanks to the partnership between the municipal government and VicHealth, the state health promotion agency, supported by utilities and other levels of government.
An online map and mobile app are also available to help residents and visitors alike find the nearest drinking fountains in Melbourne. The Water Initiative of Vic Health also funded the installation of **10 drinking water stations across Melbourne Sports and Aquatic centre** to keep patrons hydrated and minimise the amount of unhealthy beverages sold on site.

As confirmed by researches and experiences above collected, lack of access to public drinking fountains and prominent marketing of sugary drinks create an environment where it's often easier to find somewhere to buy high-calorie bottled drinks than find good quality tap water, increasing the consumption of sugary drinks and, as a consequence, increased obesity and dental decay, with related medical costs.
As in 19th century temperance fountains addressed health concerns of alcoholism and water borne diseases, a network of reliable and appealing fountains in contemporary public space can increase the occasions to choose water over sugary beverages on the go.

FOSTER ENVIRONMENTAL **SUSTAINABILITY**

Because of the low accessibility and poor perception of public drinking fountains combined to strong advertising by mineral water companies, bottled water has become more popular in providing our daily hydration, even if it is the most wasteful option.
In particular, Italy is the first country in Europe and the third one in the world (CENSIS, 2018) for **bottled water consumption**.
Over the last ten years, the country's bottled water sales volume has more than doubled, from 5 billion bottles sold in 2009 to 10 billion in 2019 (ISMEA, 2019): a steady growth pace, despite the global campaign to fight plastic pollution. Each of these bottles represents huge amounts of embodied energy in production, transport, and waste processing. Researchers Peter Gleick and Heather Cooley from the Pacific Institute in Oakland, California, have estimated (2009) that producing bottled water requires between 5.6 and 10.2 million joules of energy per litre, depending on transportation factors (a typical personal-sized water bottle is about 0.5 litres). That's up to 2,000 times the energy required to produce tap water, which costs about 0.005 MJ per litre for treatment and distribution.
Rarely bottled water is a by-product of a short supply chain: in most cases, the different components—the bottles, the water, and the consumer—all come from different places. All of this means that a single bottle of water can contribute enormously to **carbon emissions** and **global warming** (Francisco et al., 2012).
The Italian mineral water market leader bottles its water in Cuneo province, next to Italy-France boarders; the second player bottles in Sondrio province, very close to Switzerland. The availability of these two brands nationwide, including southern regions, means that water bottles travel huge distances from Piedmont and Lombardy's sources to store, sometimes for more than 1200 km. Considering these two market leaders as exceptional cases, and assuming that, on average, mineral bottled water is trucked only for 100 km, The European House Ambrosetti in SPLASH report has counted that 2 lorries in 100 travelling everyday along Italian routes are transporting water bottles.
Energy and fossil fuels are not the only resources that are utilised in the production of bottled water: the entire process consumes additional water, too.
In 2013 the International Bottled Water Association measured that water processing for one litre plastic bottle requires 1,5 litres of drinking water; in addition, previous phases of the manufacturing process –blowing PET bottles from resin, packaging and labels production – waste water.
Tandon, Kolekar and Kumar (2014) have estimated that one litre of bottled water has a **water footprint** between 15 to 20 litres, and plastic production accounts for over 60% of it. By contrast, CO2 emissions for one litre of municipal water is only connected to the energy of water through pipes, usually powered by gravity, unpackaged and untransported by fossil fuels, while water footprint almost corresponds to the amount of water drawn from the faucet.
Environmental impact of public water slightly increases in case of filtration, because of the production of the treatment equipment; given the useful life of contemporary filters it is anyway a negligible contribution, less than 0,1% (The European House Ambrosetti, 2018).

Figure n. 99
Child wets his whistle at a small fountain in Canepina.
Photo by Ernesto Spaziani, 2019

Figure n. 100
Litres of bottled water consumed per capita in Europe in 2019, by country

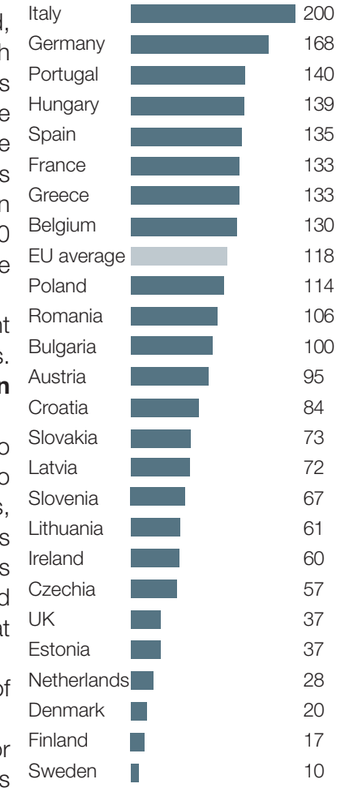


Figure n. 101
Non-renewable fossil fuels required for the production of one litre plastic bottle

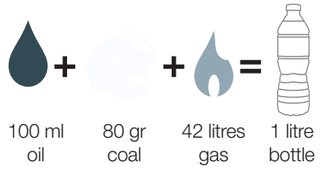


Figure n. 102
The contradictory variety in shape and dimension for a single-use water bottle. The smaller the volume size of the bottle, the higher its PET mass to volume ratio.

Figure n. 103
About two lorries in one hundred, travelling everyday along Italian routes, are transporting water bottles

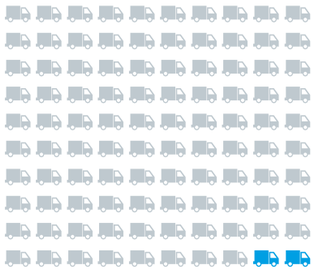
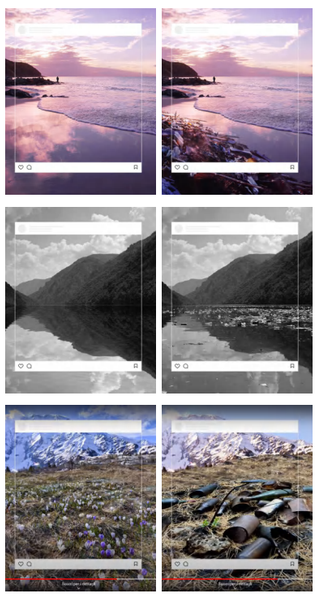


Figure n. 104
Screenshots from a video by World Wide Fund for Nature released in 2018, that points out the detrimental effects of mismanaged waste on the most beautiful places in the world; a series of paired pictures shows different natural environments before and after waste pollution's effects.



PET bottles are designed and sold for a single-use: once emptied, they should not be reused since harmful chemicals might be released from the plastic.
Nevertheless, mineral water brands work hard to meet all possible consumers' needs, and produce disposable plastic bottles in **all shapes and dimensions**, like "baby bottles" (25 cl), that conveniently fit in the smallest handbags. Unfortunately, the smaller the volume size of the bottle, the higher its PET mass to volume ratio. Also notable, is that the "sports cap" of some single-use water bottles is made of more plastic than its slim cap counterpart: conceived like a durable bottle with leak-proof open/close cap for sipping, it is pure waste.
There is a common belief that the environmental impacts of bottled water production and consumption are mitigated through **recycling practices**. However, when recycling is appropriately undertaken, it only saves 1/3 of the energy in the production stage.
In spite of Italian good waste sorting standards, of the 2,1 million metric tons of plastic waste nationally produced, only 1,2 million metric tons has been recycled. About 50% of plastic refuse properly sorted in the recycling stream is however trucked to **waste-to-energy units**, because of the **low quality of the material effectively recyclable.** Additionally, the quality of the plastic degrades each time it is recycled, thus limiting the quantity of times plastic can be recycled.
In summary, the amount of recycled PET plastic corresponds to 1 bottles every 4; the other three are accumulated in landfills, incinerated or abandoned in the natural environment as litter. Plastic bottles were one of the ten most common items picked up on **Beach Litter 2021**, an Italian initiative promoted by Legambiente, a voluntary beach clean-up combating global plastic pollution, which involved 47 beaches in 13 different Regions. Once these bottles are in the environment, they can take up to 450 years to biodegrade, so the vast majority of them still exists in some form.
As a result of pressing public opinion and international policies, average **awareness** about the **environmental costs of bottled water** is growing, though.
In 2019 the EU formally approved a pioneer legislation to curb the impact of certain plastic products on the environment: commonly referred to as the Single-Use Plastics (SUP) Directive, it entered into force on 3 July 2019, with the aim to prevent and tackle marine litter by avoid unnecessary single-use plastics, introducing economic incentives to reduce consumption and transition to reusable systems, and establishing high collection rates. 3 July 2021 was the deadline for Member States to transpose the Directive into national law, and to adopt the relevant measures for successful implementation of the Directive: Members of the Rethink Plastic alliance and of the Break Free From Plastic movement have assessed the progress made across Europe during these two years of transposition period.
This assessment (Copello et al., 2021), covering almost all EU countries and Norway, shows that only a few countries have fully explored the potential offered by the Single Use Plastics Directive to phase out single-use plastics and effectively prevent plastic pollution. Delays may have arisen due to the COVID-19 pandemic, but this cannot justify continued inaction from governments. France, for instance, has shown high ambition and went beyond the minimum requirements set in the Directive: from 2021, the use of plastic bottles for cultural and sport events is banned, followed by their bans in administrative buildings and events by 2022, and the **obligations to provide water fountains and free access to drinking water in restaurants and bars** by 2022.

Figure n. 105
Rethink Plastic alliance assessment on EU countries about the adoption of the requirements of Single Use Plastics Directive. Data Source https://rethinkplasticalliance.eu/

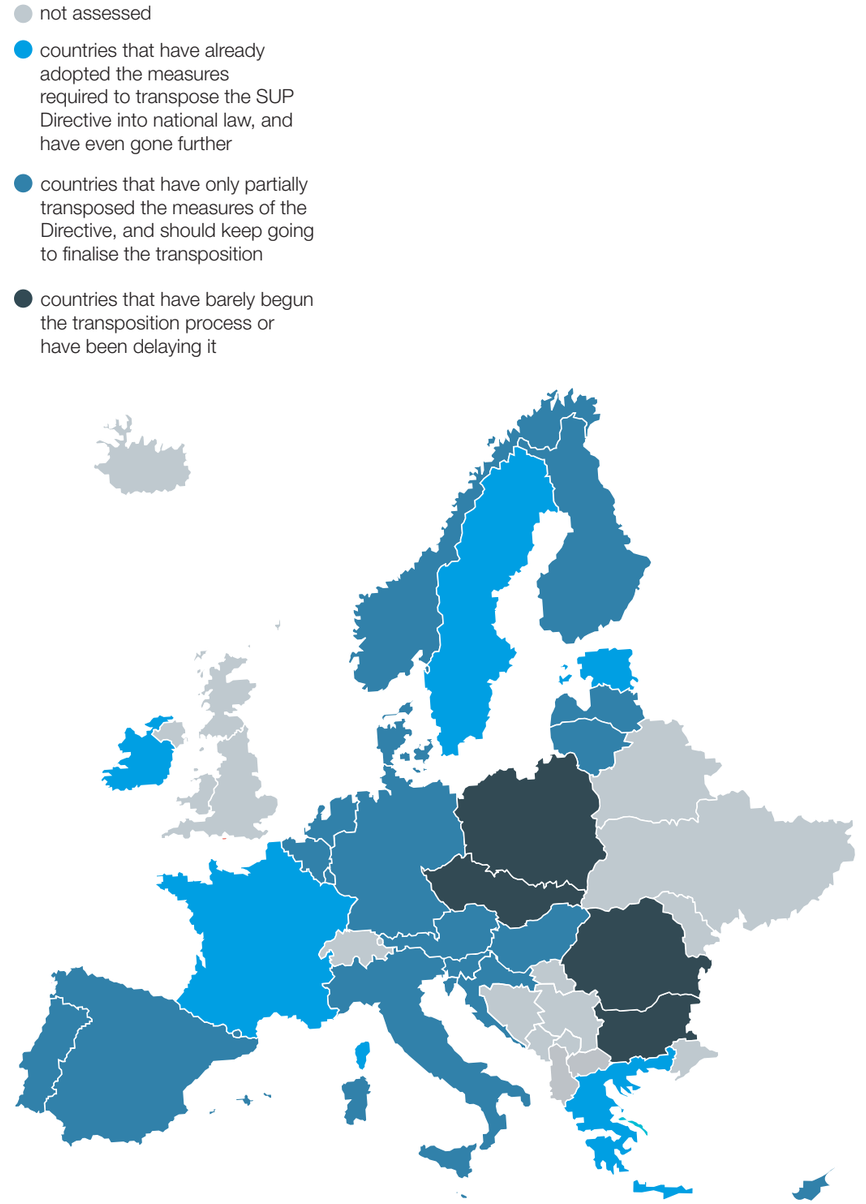
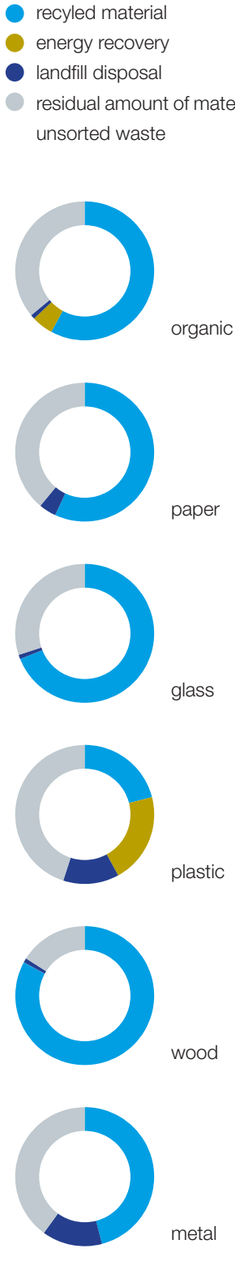


Figure n. 106
HERA GROUP recycling rate by waste stream in 2019



107

108

Figure n. 107
Concord Tap Map, to help citizens and visitors in finding the nearest water refill station, handling the local single-use plastic bottles ban.
Retrieved from https://www.concordontap.org/resources/tap-map-brochure

Figure n. 108
GlobalTap pilot dispenser in Yerba Buena Gardens, San Francisco. Photo by IDEO

Figure n. 109
Marathon runners use to discard plastic waste along their route. Ph by Stuart Gleve, Getty Images.

Figure n. 110
At 2019 London Marathon edible water pods replaced 200,000 plastic bottles. Retrieved from https://www.runireland.com/edible-water-pods-replaced-200000-plastic-bottles-at-london-marathon-how-did-it-work/
Foto source LRB Twitter

Figure n. 111
small portable cup to keep in the poket and use when passing by a drinking fountain.

In the U.S, the pioneer on the front of plastic bottle ban was the town of **Concord in Massachusetts**, where the ban on the sale of single-serving plastic water bottles, one liter or less took effect in 2013. Citizens gradually had to accept the measure: in the supermarkets and mini marts they still can find larger, liter-and-a-half plastic bottles of water, and single-serving bottles of carbonated, flavored water — both still allowed under the law, while downtown shops and bars offer single-serving-sized water in milk-carton-like boxes or glass bottles. And the town itself has also had to make changes. As reported in Herwick's interview (2018) to Erin Stevens, the town's public information officer, the ban of small plastic bottled coupled with a gradual increase in drinking fountains' installation, in particular near parks and athletic fields. In 2018 alone, the city of Concord has added five **filling stations** at a cost of about $5,000 for each one. The location of all the town's outdoor water fountains, as well as cafes, restaurants and other businesses where people can refill their water bottle for free, are listed in a "**tap map**", available online and on physical brochures available throughout the town.
San Francisco followed in Concord's path becoming the first major American city to ban plastic bottles in out-of-home context: the program started in 2016, with a municipal ban prohibiting the sale of bottled water in public buildings, then the ban extended to all vending machines and public kiosks on the way. San Francisco Department of the Environment (SFE) and San Francisco Public Utilities Commission (SFPUC) established a partnership with GlobalTap since 2009 to **expand public drinking water infrastructure** through **new refilling stations** with minimal installation costs. GlobalTap is a for-profit social enterprise with a dual mission: to sell and install tap-water-refilling stations in public places in North America and Europe, and then to divert revenues from this business to fund badly needed water projects in developing countries (Beck, 2010). The first GlobalTap's refilling station installed in San Francisco, and precisely in Yerba Buena Gardens, is a blue steel stem of 150 cm in height, designed by IDEO, with a thrusting elbow shape and a nozzle that directs a stream of water into the bottle when activated by a button.
Growing awareness of the harmful environmental effects of single-use plastic bottles has rapidly propelled the **demand for reusable bottles** in the past several years.
According to the Reusable Water Bottle Market Size Report 2021-2028 (2021), consumers across the globe are increasingly opting for reusable water bottles in workplaces, colleges, schools, and homes, willing to shift toward a healthier and more sustainable lifestyle. Durable water bottles global market size was valued at USD 8.38 billion in 2020 and is expected to expand at a compound annual growth rate (CAGR) of 4.0% from 2021 to 2028 (Grand View Research 2021) – and come in wide array of sizes, shapes and materials. In terms of material type, plastic dominated the market with a share of 35,7% in 2020, especially because of the low cost of manufacturing and BPA-free tags. BPA stands for Bisphenol A, a chemical compound that can be released from plastic and cause cancer. Furthermore, there is a growing interest towards glass and stainless steel water bottles owing to their health benefits. Glass bottles are primarily contamination-free even after several washes as the material doesn't degrade even after extensive use. Of course reusable bottles themselves contain their own embodied energy costs, but their materials are designed to last for years, with clear advantages over disposable container.

As reusable water bottle represents one of the possible interface between user and the innovative water station that is being prototyped, it is worth analyzing the main features of this increasingly popular item (be it for environmental friendliness or fashion adoption), and the ongoing design innovations on this side.

Edible water pods
Ooho! are biodegradable pods featuring a thin, seaweed-based membrane with no natural taste surrounding water drop, or any other liquid. Thirsty users can simply use their teeth to tear an opening and throw into compost after use, or consumed the entire edible pouch.
This invention comes from Skipping Rocks Lab, a London-based startup seeking to minimize the massive waste that comes from disposable cups or plastic bottles. The inspiration for these blob-like water containers came from nature when the designers looked at the surface tension that holds together drops of water. They also examined the thin membranes around egg yolks and other delicate structures that keep a balance between the exterior and the interior (Drupa, 2015).
In 2014, the company was awarded the Lexus Design Award and the Environmental World Technology Award, which itself is held in association with Fortune and TIME. Later, the start-up went on to win the 2015 SEA Award and the 2016 UK Energy Globe Award.
Pros
Cheap and low-carbon manufacturing process
Not wasteful, it biodegrades in weeks, naturally.
people can make it at home with relatively simple means.
Oohs pods are particularly suitable for marathon runners or other sport people in need of quick bursts of water to keep going.
The Harrow Half Marathon on September 16 2018 was the first long-distance race in Europe's largest city that didn't include any single use plastic cups or bottles; on the contrary, Ooho pods were offered to participants, in order to cut down plastic waste caused by their event.
Cons
Short shelf-life - just a few days - to ensure that the water within them stays fresh
Hygiene storage and transportation issues

Leaf Shaped Pocket Cup
More a portable cup than a durable bottle, the leaf-shaped pocket cup is a small foldable item, extremely lightweight, that can be carried around in a pocket or dangling down from the backpack, as it has a little hole you can use to carry on a string.
It is made of 100% FDA certificated silicone and measures about 12.2cm x 8cm x 1.9cm so it can hold just one or two gulps of liquid, particularly suitable to swish some water when out and passing by a drinking fountain.
To use the tiny cup, just take it out of your pack, squeeze the leaf so that it opens, fill in and consume. The leaf shaped silicone pocket cup can be cleaned by turning inside out and throwing in a dishwasher, or boiling water, and are great for people enjoy drinking liquids on the go.

109

110

111

112

Figure n. 112
A foldable drinking bottle, branded Reefill, a startup based in New York that promotes smart indoor water dispenser. Ph source Reefill Twitter, 2017.

113

Figure n. 113
Yuhme bottle refilled at public fountain. The sugarcane pattern reminds how these 100% recyclable bottles originated in the sugarcane fields of Brazil. Photo source https://yuhme.se/products/the-namaste

Pros
Cheap and easily cleanable
Pocket size
Great for thirsty sport people of whoever unwilling to carry around a heavy and bulky bottle
Cons
No closure cap: liquid collection and consumption therefore should be consecutive.
FDA certificated silicone is less strict than LFGB certified silicone of European safety standards

Vapur Foldable drinking bottle
One of the most annoying aspect of carrying a reusable bottle, is that, even when empty, it still takes up a lot of space in the bag.
With equal volume, the size of a filled foldable bottle is around the same as a hard water bottled, but more flexible; but the soft bottle takes less and less space as the user drinks progressively from it.
Once empty, it can be easily rolled up as small as a tissue pack.
The Vapur model features a carabiner that eases transportation, so that it can be tied to the strap of the bag when there is no room for a water bottle inside.
It is particularly suitable for hikers, whose day pack is often already full of equipment.
Pros
handy hydrating space-saver
More flexible then hard bottle
very light: when full, it weights little more than the water itself.
Cons
It might not stand straight when half full
It is made of different materials, so an accurate waste sorting is needed when thrown away.
Soft bottles do no provide insulation

The rollable bottle in the scheme is branded Reefill, a New York based startup providing indoor water dispenser for a cheap alternative to one-time plastic bottles on the go.

Yuhme sustainable water bottle
Yuhme – an acronym for You, Us, Humanity, Me, Environment – claims to be the world's most eco-friendly reusable water bottle. Produced from sugarcane with a negative CO2 footprint, it is 100% recyclable and free from all toxins such as Bisphenol A, Phthalates, and additives.
For every bottle sold, the producers give at least 3 months of clean, plastic-free water to someone in the Central African Republic. The design pattern of each collection reminds of the sustainable origins of the material and the importance of water in life.
Pros
Eco-friendly
A good deed to the Central African Republic
Lightweight but sturdy

Cons
The flip-flop lid has to be removed for water refill and cleaning
It has no loop or carabiner
Flavours might cling to the interior of the bottle
As biodegradable, it is less durable than other reusable bottles

It's logic bottle
With its 28 mm in thickness (and 500 ml of capacity), It's logic water bottle is probably the world's flattest stainless-steel reusable bottle. Thanks to its shape (mm 120 x 28 x 180) it fits into pockets, bags and laptop cases with ease. The security lock makes the bottle totally leak proof, at the time of sharing space with any device, electronic or not (Itsliquid, 2021).
It's logic it is not a bottle brand but a company from Spain with the aim to finance environmental actions through the sale of well-designed products.
Pros
Great portability
Sleek design
Cons
Narrow mouth bottle, more difficult to clean
No thermal insulation
It dents and get scratches easily without a protective sleeve

Phil, Palomar
While app-based refill points' locators are more and more numerous and widespread among sustainable and digital savvy citizens, the Italian brand Palomar introduced Phil bottle, an analogical guide towards urban drinking fountains. The designer Emanuele Pizzolorusso created a series of rectangular, BPA-free plastic water bottles; each one is dedicated to a specific global city, from Milan to Paris, from Tokyo to New York: on one side, the bottle displays a list of the city's drinking fountain locations, with easy to find addresses, divided up according to district. For the cities that have many water fountains, such as Rome, Pizzolorusso made a selection of fountains, but for the majority of places he listed all of the available locations. The Anywhere bottle instead has a short text playing around with the concept of filling a bottle.
Pros
Compact and lightweight
encourage people to refill at designated sites – and sometime discover hidden corners of the city
Cons
It may acquire a strange scent over time, due to the material
No thermal insulation
It can easily crack or get warped through general wear and tear.

Closca bottle
Closca bottle is made of borosilicate glass, one of the strongest and toughest glasses on the market, with an elastic silicone cover. Thanks to its strap system, Closca can be

114

115

Figure n. 114
It's logic reusable bottle
Retrieved from indiegogo.com

Figure n. 115
Phil, the analogic guide to urban fountains. Retrieved from https://www.dezeen.com/2018/11/14/emanuele-pizzolorussorefillable-water-bottles-guide-water-fountains/

"The list of drinking fountains reminds us that every city has a privileged relationship with water, the most precious and often forgotten public asset"

Emanuele Pizzololorusso, designer

116

117

Figure n. 116
Closca bottle at public fountain. The opening at the bottom facilitate cleaning and refilling. Photo retrieved from https://closca.com/products/closca-bottle-beach

Figure n. 117
Larq self-cleaning reusable bottle Photo retrieved from https://www.livelarq.com

Figure n. 118
Overview of different types of reusable bottles: they are evaluated on the sustainability of their materials, hygiene and durability, thermal insulation and portability, including weight. The cost of each item is not indicated, but the affordability is one of the evaluated aspects. One drop indicates that the product insufficiently meets the criteria; five drops are give when, on the contrary, when the item perfectly stands out in that specific topic.

attached to user's backpack, bicycle or stroller.
The bottle features a double opening, both at the top and bottom, to facilitate refilling at the fountain, cleaning and putting ice cubes or tea bags inside.
The company, based in Valencia, also developed a dedicated app that shows the nearest water refill points, which can be rated and commented on. Users can also suggest new locations which may be missing from the map, in turn building an active and sustainable community.
Pros
Zero effect on taste and smell of the water
Easily transportable
NFC embedded, useful to find water refill sports worldwide through Closca Water App
Cons
Heavy. Among the different bottle types, glass water bottles are the heaviest.
Can break easily

LARQ

Larq feature the world's first portable digital water purification system, with UV-C LED technology and no filters to be replaced in a stainless steel bottle. Pressing the button once activates normal mode cleaning cycle, the ring on the lid emits a soft blue glow and the system provide a dose of UV-C light for 60 seconds; two taps activate adventure mode, that offers additional protection when sanitizing water from natural or unreliable sources, and last for 3 minutes. This process neutralizes up to 99.9999%* of harmful bacteria and viruses. During Adventure mode cycle, the ring on the lid emanates a darker blue light. Moreover, UV-C LED activates autonomously every 2 hours to keep the bottle odor-free and pristine water at every sip.
The original LARQ is double walled for liquid thermal insulation. It will keep your cold drinks cool for 24 hours or your hot drinks warm for 12.
Pros
10,000x more hygienic than regular reusable bottles
Thermal insulation
Cons
Havier than single-wallet steel bottle
It might dent and get scratches easily

Hydrate Spark steel

To work properly, this smart bottle requires to be connected to the HidrateApp, which determines recommended daily water goals based on user's age, weight and exercise frequency, but also weather condition. The bottle gives glowing visual reminders when it's time to take a sip.
Pros
It helps to increase personal water intake on a daily basis
Insulated stainless steel
Cons
Standard looking water bottle
Improvable ergonomics and portability

118

OOHO EDIBLE WATER POD
sustainability
hygiene
durability
temperature control
ease of transport
lightweight
affordability

LEAF-SHAPED POCKET CUP
sustainability
hygiene
durability
temperature control
ease of transport
lightweight
affordability

FOLDABLE WATER BOTTLE
sustainability
hygiene
durability
temperature control
ease of transport
lightweight
affordability

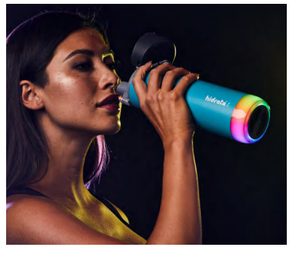
YUHME
sustainability
hygiene
durability
temperature control
ease of transport
lightweight
affordability

IT'S LOGIC WATER BOTTLE
sustainability
hygiene
durability
temperature control
ease of transport
lightweight
affordability

PHIL PALOMAR
sustainability
hygiene
durability
temperature control
ease of transport
lightweight
affordability

CLOSCA BOTTLE
sustainability
hygiene
durability
temperature control
ease of transport
lightweight
affordability

LARQ SELF-CLEANING BOTTLE
sustainability
hygiene
durability
temperature control
ease of transport
lightweight
affordability



HYDRATE SPARK STEEL
sustainability
hygiene
durability
temperature control
ease of transport
lightweight
affordability

Whether the choice to switch to a reusable bottle is moved by environmental-friendliness or fashionable reasons, it is fundamental to support current behaviour change appropriately.
In most developed countries, tap water is filtered and safe to drink, so in **household context** or at the workplace people can easily have access to potable water and refill their bottle. It is also possible – and in some countries widely promoted – to refill personal reusable bottle at cafés, bars, restaurants and other venues, although it's sometimes awkward to enter coffee shops and ask for free water.
On the contrary, in **out-of-home context**, as drinking fountains have generally **disappeared from the public realm**, people are still forced to buy bottled water if their flask is empty, if they don't spot any reliable water source nearby and neither know whether they will encounter one on their way.
For these reasons, a number of applications and websites have been developed to help citizens and tourists to find a place to refill their reusable water bottle on the go.
Crawford and Phurisamban from the Pacific institute, a global water think tank, examined and reviewed (2017) 27 Android and iOS drinking fountain finder apps. Most of them display a map of water outlets, often distinguishing between drinking fountains, bottle refill stations, and indoor businesses that offer free drinking water. Some of them also suitably provide walking directions to water points. The majority are too specific to a certain region to be useful to most users, but, above all, these tools show that average urban environment largely lacks a proper outdoor water infrastructure.

Environmental awareness is truly becoming widespread, but it is urgent to assure a **pervasive network of drinking fountains and bottle fillers** to effectively support people efforts in curbing their bottled water consumption. These basic amenities are one of the most economical and sustainable conveniences that a city can provide.

Figure n. 119
"I'm Sorry" is an art project by Matt Starr . The artist says apologizes in the name of America, the media and plastic, among other things and groups of people that can't or won't. Retrieved from https://www.matt-starr.com/i-m-sorry

PROMOTE **PHYSICAL ACTIVITY**

A well-designed, well-maintained drinking fountain network can help people meet healthy lifestyle not only by increasing opportunities for drinking water when outside and replacing sugary beverages, but also by facilitating outdoor exercise.

The correlation between the availability of potable water sources and more positive conditions for physical activity is something that almost everyone experienced at least once in life.
Strategically located along walking routes and running trails, as well as next outdoor fitness stations, drinking fountains certainly encourage the **consumption of tap water for rehydration** following a bout of sport. When planning a run, sport people also rely on drinking fountains, especially the ones with upward water jet, to **avoid carrying water bottles**, an undeniable silly burden when jogging.
In addition to the fulfilment of their basic function, the provision of drinking water in the public space, humble fountains may serve as effective contributors to physical activity in other subtle and less evident ways.
Scattered across the territory at defined spacing, sharing a common and recognizable aesthetic, water points have the potential to become **incremental distance markers**, helping people to set goals for daily walking, keep an eye on the trip's length and encouraging runners to push forward and experiment longer routes.
Traditional drinking fountains also usually mark **landscape focal points** along biking routes, trails and walking pathways, and thus have served over time as informal meeting place and refreshing stage for cyclists, where to pause and get a sip of water in stunning locations.
Finally, drinking fountains are part of a numerous **group of small-scale urban elements** that greatly influence the attractiveness of our surroundings, and whether people want to go to and spend time in. An appealing, high-quality public realm is of great importance if people are to lead healthier, more active lifestyles.
Jan Gehl has extensively written about the impact of amenities on the liveliness of public space. In his book "Soft City. Building Density for Everyday Life" David Sim (2019), partner and creative director at Gehl, lists humane scale among nine criteria for livable, resilient urban density, and highlights the importance of designing with attention the urban experience at eye level. "Smaller spaces bring people closer to each other and closer to things" (p. 220), and this closeness allow citizens to better appreciate small details, distinguish small sounds, to smell and touch and intensify personal experience. Therefore, well-finished elements at human scales should be consistent across neighborhoods, and not just exist in isolated spots.
Water fountains can add value and richness to the urban landscape at eye level, making physical activity in the urban environment easier and more enjoyable.

PUBLIC SPACE FEATURES AND PHYSICAL ACTIVITY: A LITERATURE REVIEW
Given consistently high levels of sedentary time, an expanding body of research are investigating what neighbourhood factors can influence physical activity. As an example, the book "Active City. Public paths into urban body" (Borgogni, Farinella,

Figure n. 120
How can drinking fountains support physical activity in the urban environment?

121

122

Figure n. 121
Cyclist refreshing themselves at a fountain in paris, June 1930.
Ph Keystone France Gamma, Getty Images

Figure n. 122
The Watercarriers. Tour de France 1961. Oil painting by Pat Cleary, 1989. Thirsty riders during le Tour de France filling their water tank and drinking from a public fountain. Unlike today, Tour contestants were expected to make their own arrangements for feeding and watering, carrying everything they needed on the bike until the finish line (Cripps, 2014), with strict penalties if something was thrown away along the cycling route. Now, thanks to a better awareness of the importance of hydration in physical performance, riders can rely on team cars and sponsored motor bikers, ready to distribute water and energy fuelling drinks. Restrictions still exist, but, regrettably, modern participants use to discard increasing amount of plastic bottles, drink flasks and food wrappers during the race; in 2013, for instance, complaints about rider littering threatened to prevent nearly 20 professionals from starting the Liège-Bastogne-Liège competition, (Fry, 2014).

2017) highlights the need to adopt integrated and multidisciplinary urban strategies in order to shape a built environment supporting motor skills, physical and sport activities. Among different public open spaces, parks and green areas are particularly likely to entice people to engage in daily physical activity: they are, in general, accessible throughout the day and provide citizens with many opportunities to exercise for free.
Many studies have focused on the **relationship between access to parks and physical activity**, and have found a positive association across all age groups (Kaczynski, 2007, Mowen, 2010, Liu et al., 2017). However, some researches have had mixed results or found no relationship between proximity to and quantity of green public open space, and health outcomes. These mixed results suggest that **other features** of green public open space, and not just quantity and proximity, **affect whether they are used or not**: for example, people may not use their closest park if it is small, uninteresting or has few amenities (Koohsari et al., 2013a, 2013b).
Green areas alone are not sufficient.
Borgogni and Farinella (2017) argue that an "active" city, along with designated places for exercise and suitable infrastructure for walking and cycling, can also offer multiple stimulations to people's sensory needs. Parks' attributes should inspire interest and a sense of safety, in order to draw users in from the street. Tree canopies, water features, natural soundscape, inviting street furniture, art, small kiosks… can deeply influence built environment's attractiveness and perception, and therefore increase active engagement. According to this, also **well-designed and strategically located drinking fountains could encourage people exercise better and stay outside longer**.
To assess the quality and quantity of park characteristics, researchers have frequently used three instruments: the Physical Activity Resource Assessment (PARA), the Environmental Assessment for Public Recreation Space (EAPRS), and the Bedimo-Rung Assessment Tool-Direct Observation (BRAT-DO). Other measurements exist, but are excluded from this analysis because too much focused on specific features, like Path Environment Audit Tool (PEAT), or dedicated to rural community instead of built environment, as the Rural Active Living Assessment (RALA).

As this Doctoral Research aims to rediscover small urban objects as potential public health tools, and in particular reinvent public drinking fountains, I investigated how they are evaluated as "**activity facilitators**", and which aspects of water features are taken into account in the above-mentioned audit tools.

OVERVIEW OF ASSESSMENT TOOLS
PARA. The PARA instrument is a brief, one-page audit tool (only 49 items) designed by Rebecca Lee et al. (2005) to assess urban physical activity resources. It is worth noting that this tool, over the other two, has the advantage of considering other public open spaces besides parks: the listed types of resources are, in fact, fitness clubs, sport facilities, trails, community centres, churches, schools, in addition to parks, and a combination of two or more these physical activity resources is also taken into account. Approximately size and cost of entry are additional required data about the physical activity resource.

The tool rates the 13 features, including sport courts, bike racks, sidewalk, exercise stations and play equipment, and 12 amenities, (access points, bathrooms, benches, drinking fountains, decorative fountains, landscape efforts, lighting, picnic tables, shelters, locker rooms, showers and trash containers), on a scale of 0-3 to represent not present, poor, mediocre, or good conditions respectively.
Target area's incivilities – auditory annoyance, graffiti, broken glass, litter and vandalism, to name a few – are rated on a scale of 0-3 to represent none present, few present, some present, or a lot present respectively. Given the conciseness of this tool, the existence of unkempt or messy areas heavily influence the global assessment of the physical activity resource.
Finally, the tool does not consider disability issues.

EAPRS. The EAPRS instrument is a direct observation tool designed to evaluate park characteristics with an emphasis on functionality and accessibility to specific categories of users, as children and people with disabilities.
The instrument is 59 pages long and assesses 16 categories including trails, eating/drinking features, landscaping, safety-related features, play set features, and athletic fields, just to name a few (Saelens et al., 2006), with several subcategories for each one, for a total of 751 items. It is the most comprehensive observational audit measure available.

This tool considers disability issues and it is more focused than the other on quantitative data (as the proximity between two complementary features, and width or height of specific elements). There is no section specifically dedicated to incivilities, however perceived safety and features' conditions are some of the rating criteria indicated throughout the tool.

BRAT-DO. The BRAT-DO is a paper-pencil-based tool designed for observers to visually identify the quality and quantity of park characteristics. The instrument evaluates the park overall and multiple aspects of each target area, including the aesthetics and sensory experience, and the general condition of benches, bike racks, shelters, restrooms, stands, drinking fountains, picnic tables, water features, art/monuments, parking area and park staff. Within the different sections, each question has its own rating scale to better assess each characteristic. Because the tool was developed in New Orleans where hurricanes are frequent, BRAT-DO also includes a section that can be used to evaluate parks after hurricane or flooding damage (Bedimo-Rung et al., 2006).

COMPARATIVE ANALYSIS AND BASELINE DESIGN INPUT
Each instrument evaluates similar topics such as types of features-amenities in the park, quality of each feature-amenity, signage and overall attractiveness, but each method differs in its depth of measurement (Sevening and Janz, 2017).
The definition itself of amenities and features is not univocal among the three tools: bathrooms, for instance, are defined as amenity in PARA instrument, while listed among park feature in EAPRS. Researchers also use the two words differently.
For example, Kaczynski et al. (2008), using EAPRS to collect data at 33 neighbourhood

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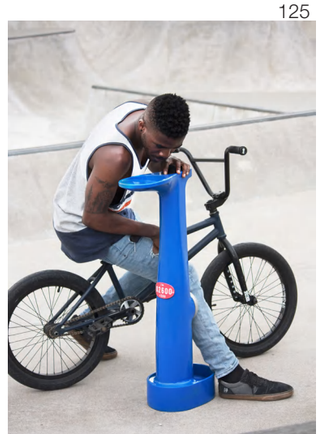


Figure n. 123, 124, 125
A prototype drinking fountain reimagined from traditional fire hydrants.
Dimitri Nassisi, who studied at École Cantonale d'Art de Lausanne (ÉCAL) in Switzerland, designed a lengthened fire's revision, styled in blue, with two-way switch and two spouts: one side features a downward spigot, conceived as bottle filler (**Figure n. 123**), but also pouring water into a dog bowl located at the foot of the hydrant. At the top, a raised arc bubbler can satisfy runners and other thirsty people who are not carrying drink water flasks (**Figure n. 124, 125**). Unfortunately, the upward water jet does not have any hygiene guards avoiding mouth contacts.
In order to fulfil its original role as a fire hydrant too, it has a standardized firefighting water-hose outlet that firemen can use when necessary
Pictures retrieved from
https://www.designboom.com/design/dimitri-nassisi-fire-hydrant-drinking-fountain-ecal-08-01-2018/

parks in Ontario, Canada, refers to general spatial features as facilities if they were the primary setting for physical activity, and calls amenities those elements supporting opportunities for physical activity.

In comparing the measures, the first level of review was to evaluate which are considered the **most likely urban location for active engagement**; in this sense, only PARA instrument extends its assessment besides parks, and encompasses other target areas, both indoor and outdoor (e.g., fitness clubs, sport facilities, community centres and schools).

The second level of analysis was focused on specific amenities assessed, and their recurrence within the three audit tools. Moreover, I looked for **quantitative data of street furniture** (e.g. seize, height, width), in particular for water fountains.
All three measures include drinking fountains among the evaluated items; PARA instrument just rates this amenity on a scale of 0-3 to represent not present, poor, mediocre, or good conditions respectively; BRAT DO instrument assesses both functionality and general cleanliness; EAPRS is the most detailed measure on fountains, regarding both water areas and eating-drinking features categories. In the first case (D.4 category), EAPRS evaluates **ornamental water features** in terms of size, condition, water height and quality (presence of algae and man-made litter either within the fountain or outside the structure, cleanliness, colour of water), water containment, and association with other elements (sculptures, lighting and seating looking at the fountain). In eating/drinking section, on the contrary, E.1 category is dedicated to **potable water dispensers**, and evaluates, besides presence and functionality, water taste and temperature, the cleanliness of the faucet and its accessibility to children and people with disabilities. Finally, the presence of paved surface at the base of the drinking fountain and the quality of the surrounding are also rated.

The third level of review was dedicated to find out whether the assessment tools consider **cross relationships between fountains and other amenities** or facilities: BRAT-DO partially does, with reference to a list of possible park features that can be found under shelters, including drinking fountains.
EAPRS is the only tool to rate fountain proximity to facilities and other amenities: drinking water points need to be less than 100 feet (=30,50 metres) from trails, within sight and directly accessible from the walking route. Similarly, drinking fountains must be in sight from playgrounds, athletic fields and skate areas, without impediments to getting to (the maximum distance is not assessed in this case). EAPRS measure also positively evaluates target areas in which operational water fountains are no far then 25 feet (7,60 metres) from picnic furniture and shelters.
Aimlessly, while the presence of benches is one of the valuated criteria for the effectiveness of monumental fountains, sitting or resting features are not taken into account regarding drinking water outlets.
The omission of this rating criterion matches with Ivanov's consideration (2015) that fountains underwent a gradual and **regrettable split between aesthetic and functionality** through history. Water sources in the urban environment have been

landmarks, meeting points, works of art and utilitarian services at the same time; today, on the contrary, most ornamental fountains do not provide potable water, and drinking stations unreasonably have been driven away from prominent location, and paired with restrooms and trashcans rather than benches and trees.
This comparative analysis is not conceived as a systematic review of physical activity resources assessment tools; it is limited to investigate which urban amenities research literature pays close attention to, as supportive infrastructure for physical activity. As far as drinking fountains are concerned, the study and comparison between observational instruments allowed to:

- Confirm the acknowledged role of drinking fountains in supporting physical activity, although they are (generally) only rated in terms of availability and bare functionality;
- Draw baseline references about fountains design and optimal locations to maximize their role as activity facilitator;
- Highlight gaps in the assessment of the combination between fountains and other urban services.

Therefore, this review shows the need to dive deep into the role of specific urban amenities as biking and walking facilitators, and provides useful insights for the subsequent design phase.

LITERATURE GAP ABOUT THE POTENTIAL OF URBAN AMENITIES AS PHYSICAL ACTIVITY FACILITATORS
The comparative analysis of the three most commonly used tools that assess built environment settings promoting physical activity, along with the study of correlated active living papers, reveal several limitations.

1- The individual influence of each urban amenity on physical activity is unclear.
There is a growing number of researches that investigate the associations between public open space features and physical activity or walking, but few studies have examined the specific role each public open space feature has on physical activity (Koohsari, 2015). For example, Kaczynski et al. (2008) argued that park facilities (i.e., paved trail, water area, and playground) were more important than park amenities (i.e., drinking fountain, picnic area, and restroom) for public open space-related physical activity. But it is worth considering that studies using audit tools mainly assess features/amenities availability and cleanliness, and **do not take into account their design quality, appropriate location and spacing**, dependable network; this objective evaluation could mask the promising role as "activity facilitators" of specific urban elements.
On the other hand, the presence alone of outdated and uninteresting amenities might appear irrelevant to users and do not affect their physical activity at all.
In particular, **poorly designed and incautiously located drinking fountains do not live up to their full health potential.**

2- The effect on physical activity of combination between different features/ amenities in is not fully explored.
Despite different measurements depth, all the reviewed audit tools provide an

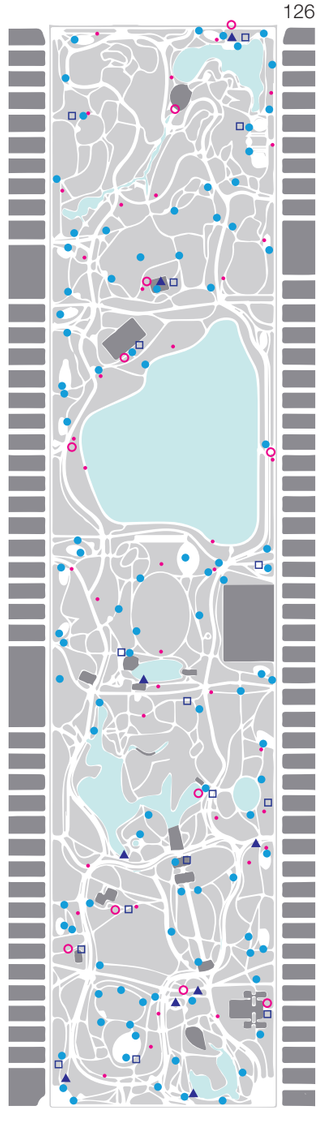


Figure n. 126
Personal elaboration of central park's amenities along running and bike trails

- drinking fountains
- emergency-related features
- kiosks
- bike parking
- restrooms

environmental assessment which is basically a summation of rates derived from the evaluation of each single characteristic.
The most equipped urban environment is therefore expected to be the most effective in promoting physical activity. However, this kind of assessment do not properly consider the positive reinforcing effect of co-existent features, nor the possibility of conflicts between some of the listed amenities if carelessly pulled together.
Are drinking fountains and public restrooms a good pairing?
What about benches and trash cans proximity?
Which services provide the perfect complement to modern outdoor fitness stations?
Some of the amenities listed in the assessment tools are gradually being transformed into new urban objects, best serving modern day citizens' expectation and leveraging technology for extended services (e.g. smart waste containers, digital billboards, connected shelters). Also **drinking fountain is due to a redesign**, and this could be the occasion to reinvent it, even **incorporating other well-matching services into a multifunctional innovative element**.

3-Active living researches mainly concentrate on parks in residential contexts, with less focus on mixed-use areas (e.g. in squares, around schools, at walking distance from workplaces). Parks and urban gardens certainly represent an ideal setting for outdoor exercise, but, as highlighted by Borgogni and Farinella (2017), local streets may equally offer a stimulating environment for healthy and active lifestyle.
Home-work trips, the run to the corner store for immediate goods, neighbourhood dog-walking, greatly influence people daily routine, and therefore are likely to influence physical activity.
However, only few recent studies have examined the relationship between environmental attributes and **physical activity in non-residential contexts** frequented by children and adults as much as parks are; for example, Karusisi et al. (2014) found that the number of supermarkets around workplaces was associated with walking for transport among workers. Future research should identify the relevant attributes of public open spaces to support physical activity in a number of settings outside residential contexts; drinking fountains should be part of that **set of urban healthy amenitization** including seating, public restrooms, bike parking and other street furniture that support increased frequency and duration of outdoor exercise.
Provision of water fountains in mixed-use contexts and its influence on people's physical activity, while rather ignore d by academic literature, is a recurrent recommended measure of **Active Design Guidelines**, published in 2010 by New York City Departments of Design and Construction, a milestone in the commitment to building a healthy, more active city. In the second chapter, for instance, talking about **retail venues** and grocery store's optimal layout, the guidelines suggest: "*Include sufficient bicycle parking outside supermarkets. Provide conveniences such as drinking fountains*"(Active design guidelines, p. 37). With regards to **office districts**, chapter 3 recommends:
"*Provide supportive infrastructure along walking routes. Facilities such as restrooms, drinking fountains, water refilling stations, and benches both provide reasons for taking a walk within the workplace and offer refreshment and support during physical activity. Seating in landscaped areas can also offer sensory stimulation and lunchtime distraction from workplace stress*. (Active design guidelines, p. 85).

Table n. 1
Comparative analysis of three commonly-used audit instruments assessing the quality and quantity of public space characteristics, in relation to physical activity: the Physical Activity Resource Assessment (PARA), the Environmental Assessment for Public Recreation Space (EAPRS), and the Bedimo-Rung Assessment Tool-Direct Observation (BRAT-DO)

	Physical Activity Resource Assessment (PARA)	Environmental Assessment of Public Recreation Spaces (EAPRS)	Bedimo-Rung Assessment Tool Direct Observation Instrument (BRAT-DO)
authors	Rebecca E. Lee, Katie M. Booth, Jacqueline Y. Reese-Smith, Gail Regan	Brian E. Saelens	Ariane Bedimo-Rung
year	2005	2006	2005
number of evaluated items	49	751	181
quick assessment (expected)	✔	✖	✖
evaluation of different urban settings, besides parks	✔	✖	✖
FEATURES/AMENITIES			
trails and paths	✔	✔	✔
sidewalks	✔	✔	✔
water features	✔	✔	✔
drinking fountains	✔	✔	✔
shared grills /barbecues	✖	✔	✔
vending machines/kiosks	✖	✔	✔
benches	✖	✔	✔
picnic tables	✔	✔	✔
trash cans	✔	✔	✔
landscaping elements	✔	✔	✔
lighting	✔	✔	✔
restrooms	✔	✔	✔
showers	✔	✖	✖
changing rooms	✔	✖	✖
FACILITIES			
playground	✔	✔	✔
sport courts	✔	✔	✔
exercise stations	✔	✔	✖
event spaces/stages	✖	✔	✖
SENSORY EXPERIENCE			
soundscape	✔	✖	✔
smell environment	✖	✖	✔
art and monuments	✖	✔	✔
enhanced prominent views	✖	✔	✔
incivilities	✔	✖	✔
DESIGN HINTS			
quantitative data of street furniture	✖	✔	✖
disability issues	✖	✔	✖
cross relations between rated items	✖	✔	✔

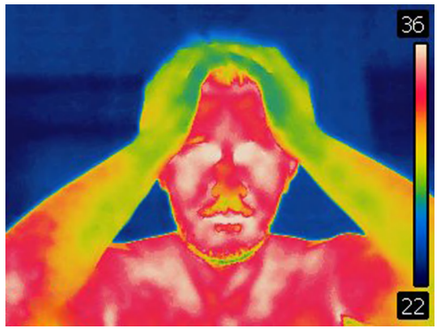
Also the **International WELL Building Institute** highlights the importance of fountains and bottle filling stations in all urban contexts, and it lists these basic conveniences among the **compulsory active design elements** required in the building's outdoor pertinence in order to promote active lifestyle.
According The WELL Building Standard™ (WELL), addressing not only the design and operations of buildings, but also how they impact and influence human behaviours related to health and well-being, in **all sites in which the built area takes up less than 75% of the total lot size**, at least a drinking fountain or water refilling station, together with a bench and a cluster of movable chairs and tables, should be provided to comply with "Feature n.67- PART 1". The listed pedestrian amenities shall be conveniently located within highly-trafficked areas, such as building entrances, public transportation stops, walking paths and plazas.
Water fountains are also cited in "Feature n.67- PART 2" aimed at pedestrian promotion. Appointed project sites, to achieve WELL Certification, should also feature at least two elements amongst water features, a plaza or open air courtyard, a garden or other landscaped elements and public art.

In conclusions, while practice-oriented design guidelines recognize and recommend (or require) fountains and other public amenities as "activity facilitators", my literature review reveals certain gaps in the acknowledged tools assessing the type and quality of public features for active environments.
Academic researches about the associations between outdoor equipment and increased physical activity or walking rarely take into account amenities' design quality, appropriate location and spacing; moreover, if conventional urban services do not properly serve the community nor do they live up to their potential, should be reinvented. Therefore, it is worth investigating how contemporary drinking fountains should look like to meet consumer's preferences and successfully act as public health tools, and test the effect of their combination with other well-matching urban features, operating in a broader spectrum of urban contexts, not-exclusively residential.

Figure n. 127
Young child refreshing at the fountain in Little Italy. New York, 2015. Photo by Stefano Balotta

SUMMARY OF DRINKING FOUNTAINS' HEALTH OPPORTUNITIES

The humble drinking fountain has the potential to take on hot temperatures from climate change, to fight obesity, providing citizens with an affordable alternative to the consumption of sugar-sweetened beverages, and reduce the reliance on single-use plastic bottles. Public fountains may also indirectly contribute to population health by facilitating outdoor physical activity, including dog walking.
Therefore, drinking fountains would be an increasingly important civic investment, one of the most economical and sustainable conveniences that a city can provide.



ENCOURAGE TO **DRINK MORE**

Personal wellbeing is directly connected to daily water intake. Dehydration has negative consequences on cognitive functions and mood state, and especially young infants and elderly people are at greater risk of water deficit, both for physiological reasons and inadequate thirst sensitivity.
Not only having more fountains would increase water consumption in general, but, in an era of climate change with increased risk of heat waves, drinking water in public places would make it easier for people to stay cool and well-hydrated in extremely hot days.

Figure n. 128: Thermography of man holding his head with arms. mage taken with Flir T420 infrared camera. Getty Images

ENCOURAGE TO DRINK **MORE WATER**

Lack of access to public drinking fountains and prominent marketing of sugary drinks create an environment where it's often easier to find somewhere to buy high-calorie bottled drinks than find good quality tap water filler, increasing the consumption of sugary drinks and, as a consequence, increased obesity and dental decay. As in 19th century temperance fountains addressed health concerns of alcoholism and water borne diseases, a network of reliable and appealing fountains in contemporary public space have the chance to fight obesity by curbing citizens' thirst for sugary beverages, leading contributors to weight gain and rising obesity rates.

Figure n. 129: screenshot from a video by the New York City's Department of Health and Mental Hygiene (NYC Health) part of NYC Health's "The Sour Side of Sweet" campaign, launched in 2017.

FOSTER **SUSTAINABLE** CHOICES

The environmental effects of bottled water are detrimental, as the entire life cycle contributes to global warming, creates a lot of waste and relies on fossil fuels. In recent years, pressing public opinion and international policies against single-use plastic have raised awareness about the environmental costs of bottled water and consumers are increasingly opting for reusable water bottles. In out-of-home context affordable and sustainable options should be the norm: a network of drinking fountains has to be implemented or completely established, as it can reduce reliance on single-serving bottled water and conveniently support citizens' environmental-friendly efforts.

Figure n. 130: a Chinese laborer sorts through plastic bottles at a recycling operation in Dong Xiao Kou village, on the outskirt of Beijing. Photograph by Fred Dufour, AFP, Getty.

PROMOTE **PHYSICAL ACTIVITY**

Physical activity is an important aspect of healthy living and drinking fountains may help people exercise better and stay outside longer. Parks and green areas, that literature extensively investigates as primary physical activity resources, require water to encourage organized sports and personal fitness. In spite of that, most researches assessing parks' characteristics overlook the importance of design features of this simple urban object, or the positive reinforcing effect of pairing it with other services. The recognition that urban water provision is an effective activity facilitator would help to make the case for a new dependable network of well-design strategically located water points.

Figure n. 131: One of the free-resistant fountains installed in 2018 along the Prospect Park Drive in New York.
Ph Paul Martinka.

Figure n. 132
Stone drinking fountain in Mühlenplatz, Luzern. Photo by Ilaria Fabbri, 2015