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Co-creation and participation for designing sustainable playable cities

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Abstract: Smart city technologies offer the potential to address issues of sustainability and efficiency in cities. Continuous monitoring, geotracking and ubiquitous computing offer tools for engaging citizens, influence their behaviour and measuring its impact on the city. These technologies, however, are not neutral: if handled in a top-down way, give rise to many concerns (e.g. privacy, instrumentalist urban planning etc.). In this chapter, we illustrate an alternative, playful approach to urban sustainability, based on playable cities and on different ludic strategies. To do so, we will reflect on two playful artifacts created within the Mobility Urban Value (MUV) Project and aiming to make cities more sustainable. The first artifact in an app[1] that helps citizens in making sustainable mobility choices by transforming commuting in a gameful experience and rewarding sustainable choices. The second artifact developed within MUV is Asphyxia[2], a screen-less device simulating the breathing movements of living lungs as a poetic way of communicating air quality and presenting an artefact that is non-solutionist, open to interpretation, aesthetically complex, and playful.
This chapter, hence, is built around: a reflective account of the ideation, design, implementation, and deployment of the two artifacts, a short set of "designer interviews" with their creators and an artefact critique / semiotic analysis of the various digital and physical artefacts composing this project. Drawing on these perspectives, the chapter will outline an approach for urban sustainability based on playfulness and ludicity.

Keywords: urban sustainability, playable cities, gamification, ludicity, sustainable cities

Introduction

Urban areas are one of the key areas of intervention for a sustainable future. Cities consume more than three-quarters of the world's energy resources while accounting for less than two percent of its surface (United Nations 2019). At the same time, half of the global population currently lives in urban areas, and this number is still expected to grow in the next years (World Bank 2010). While we recognise that these numbers fail to take completely into account the difficulty of pinpointing the realities of urbanisation and its ecological impact (cf Brenner 2015), we are confident in stating that cities will be a fundamental concern for designers, policymakers, activists, and public officials for decades to come
However, especially when dealing with issues like pollution and resource consumption, there is a gulf between what we know in abstract and what a majority of urbanites are well-disposed to do. Stricter environmental policies are considered necessary by experts but are sometimes opposed

[1] The app is available at https://www.muvapp.eu/ and was developed by PUSH https://www.wepush.org/, which we thank for their kind support of our research.
[2] Asphyxia was created by Jolijn Friederichs, Amy Goris, Sofia Tsalidou, and Sven ten Voorde, students of the M.Sc. program in Digital Design at the Amsterdam University of Applied Sciences. We are thankful for their help in documenting their creative process.

in practice by many city residents. As demonstrated by numerous popular movements such as the French “yellow vests,” there is a rift between what is deemed to be ecologically important and what is acceptable for a sizable portion of the population. Of course, these are a set of problems whose solution is complex and requires careful policymaking. Nevertheless, here we tease out specifically the need to motivate and inform citizens about environmental issues, a strand of a bigger and manifold general strategy towards making cities more liveable and less polluting.

Games and play have been successfully adopted to persuade and raise awareness in a multitude of domains. In the last decades, educators have leveraged games with learners of all ages and levels. Moreover, games have been used rhetorically in political discourses, as data-collection devices in scientific research (Ponti et al. 2015), and in many more fields, such as health (Salen 2007) or civic engagement (Glas et al. 2019). It stands to reason to examine them as promising tools to inform city residents about their environment and to motivate them towards better ecological behaviours.

There are, however, still many gaps in our design knowledge hindering the use of playfulness as a resource for cities. There are misconceptions about which forms and genres of play are more suitable, and they reflect on the types of intrinsic and extrinsic motivations that are targeted by games for cities. To investigate them, here we will focus on two outputs from the EU H2020 project *Mobility Urban Values* (MUV). Rather than focusing on infrastructure, MUV combines technology, gamification, and co-design to promote sustainable and healthy mobility choices. Several communities across Europe have been involved in co-creating and testing the MUV app, a “gamified mobile application” to motivate people to adopt environmentally-friendly modes of transportation. Asphyxia is a device that visualizes air pollution with tangible, embodied and sensory-rich movements, and was also produced within the MUV project. We will propose a comparative analysis of these two artefacts and their design rationale. They embody two radically different approaches to urban play and, by analysing them, we will present our critical standpoint on the current understanding of persuasive gamification. We postulate that gamification and playful interventions would be more effective if they were bottom-up, critical, truly participatory and non-directive - that is, if the balance between the system of rules and the agency and choices of the players does not favorise the former (as it is often the case) but the latter. In sum, we support an agenda for research and design that favours playfulness to basic gamification, and we offer our analyses as a critical contribution to (game) design for more sustainable cities.

Sustainable cities between top-down and bottom-up initiatives

The concept of sustainability is manifold and often integrates ecological considerations with social and economic perspectives. In this overview, we will not attempt an exhaustive description of this concept. Instead, first we connect it with urban spaces, then we tease out two of its components (smartness and playfulness) and we observe how they can be articulated in top-down (e.g. institutional) or bottom-up (e.g. grassroots) initiatives.

As a paradigm, the “sustainable city” takes into consideration several challenges (climate change, resource depletion) to enable residents to live within the “planetary boundaries”, that is, the safe space in which humanity can operate without altering irremediably the ecological balance (Rockstrom et al. 2009). For instance, Kate Raworth’s famous “doughnut” visualization points at the boundaries within which humanity should strive to live in, between a “floor” composed by social well-being factors (equity, inclusiveness, health, education etc.) and a ceiling determined by the planetary boundaries (CO2 emissions, biosphere integrity, land-system change etc.) (Raworth 2017, Börjesson Rivera et al. 2020). Indeed, the path towards a more sustainable society must also consider the social and economic well-being of the human population. Several

approaches towards designing and measuring urban sustainability have been developed during the years, while ambitious (and so far mostly unmet) goals such as those set by the Paris Agreement of December 2015 are increasingly addressing national and supranational policies (Phillis & Kouikoglou 2017).

At the crossroads between sustainability and cities, the idea of automating and optimizing some urban functions through the use of algorithms has spread significantly in the last decade. Since the early 2000s, the term “Smart City” has been broadly adopted as a popular label to identify and cluster technology-driven approaches to urban development and renewal. Bowerman et al. (2000) characterize smart cities through their ‘use of advanced, integrated materials, sensors, electronics, and networks which are interfaced with computerized systems comprised of databases, tracking, and decision-making algorithms’ (Bowerman et al. 2000, 1). Potentially, smart city technologies could address the issues of sustainability and efficiency in cities: continuous monitoring, geo-tracking, and ubiquitous computing offer tools for engaging citizens, influence their behaviour and measuring its impact on the city. In fact, sustainability is one of the main narratives that are used to promote ideas and specific projects of smart cities (See Halpern,et al. 2013). These tools, however, remain under-utilised: while smart cities are often imagined to be sustainable, the current practice seems to have important shortcomings. Yigitcanlar et al (2018) underline how smart city policies are often technocentric and institutionally top-down, failing to incorporate progressive and genuine agendas for overreaching sustainability goals. Top-down approaches to sustainable smart cities have been criticized as they potentially ‘kill creativity’ by allowing corporate giants to monopolize smart sustainable city development thanks to their economic strength (Höjer and Wangel 2014, 12). Further, commentators and scholars have raised concerns regarding privacy, instrumentalist urban planning and technological lock-in (Greenfield 2013, van Zoonen 2016). If universal and consistent principles are needed to coordinate efforts towards urban sustainability, the decentralized nature should be used as a resource, a ‘city-wide swarm intelligence’ capable of influencing, from the bottom-up, collective behaviour (Kenneally et al 2014, 14).

Playability might offer a counterpoint to top-down smart technologies and an alternative path towards urban sustainability, as recently argued by Börjesson Rivera and colleagues (2019). Indeed, they argue that sustainable cities should be playable cities too (cf Lange 2015, Nijholt 2017). If we go back to the definitions of sustainability including social aspects, the positive effects of urban play come into focus: many of the characteristics of a playable city - such as space to play away from traffic - fully resonate with ecological sustainability (Börjesson Rivera et al. 2019, 88). Indeed, we align with Börjesson Rivera and colleagues (2019, 96) finally claim that: ‘playable cities and sustainable cities can and should be aligned in their opposition to the smart city as an efficient machine. We would not want to propagate visions of playable-but-unsustainable cities, nor do we want our cities to become sustainable-but-unplayable.’ The two artefacts examples that we will analyse in this chapter, the MUV app and Asphyxia, are both examples of bottom-up playful interventions despite their radically different design rationales. They both address themes related to sustainability through different ways of “calling citizens to play,” and they do so while rejecting the logic of top-down gamification and its often directive and solutionist (Morozov 2014) approach. Instead, they explore alternative strategies for engaging citizens in sustainable behaviours: in what follows, we will provide an analysis of their design characteristics.

Methodology

Our analytical methodology is threefold and is composed of a close reading of the artefacts, followed by a designer interview that we use as a counterpoint to our interpretation, and finally by

a critical reflection and generalization where we tease out broader implications for further design. In what follows, we detail the main concepts that informed our analysis, the protocol we followed, and finally the data we accessed in our study.

Analysing games and play: key concepts

As discussed above, recent research developments make the case for playable urban spaces to also be sustainable. For this reason, we will produce an analysis of the MUV app and Asphyxia, two interventions that articulate bottom-up playfulness in different ways: the former by providing a complex system to support and encourage players in their daily mobility choices, and the latter by confronting them with an eerie sculpture representing levels of air pollution in a playful way. However, the theoretical vocabulary for analysing games and play requires careful framing, as key terms are sometimes used contradictorily or have multiple definitions.

First, gamification is a trend that has been popular in public discourse for almost a decade. Its most common conceptualization is the use of game-design elements in non-game contexts to increase user-engagement by making them more game-like (Deterding & Walz 2015). The main assumption behind it is that intrinsic motivation (i.e. a feeling of autonomy, competence, and relatedness enjoyed during a task, cf. Deci & Ryan 2008) is more effective than extrinsic motivation (i.e. the use of unrelated rewards). Gamification, then, can be defined as the attempt to imitate or hijack the intrinsic motivation created by games for tasks, services or products that are not, per se, games.

This idea of gamification has been criticized, however, for focusing too much on rules (Fuchs et al 2015), for being inherently top-down (Thibault 2019a) and for having an essentialist approach to game elements or, in other words, for implicitly arguing that “gamefulness” is an intrinsic property of specific objects or mechanics (Bonenfant & Genvo 2014). In this chapter, therefore, we prefer to adopt conceptualizations that identify the core of gamification in the “gameful” quality of the experience of the user (Huotari & Hamari 2017), or, better, in its playfulness. Thus, we define as gamification the design strategies that aim, through the implementation of different techniques, at providing to their users affordances that elicit playful responses. In other words, gamification is not about imitating digital games, but about allowing playful interpretations and interactions in contexts that are not traditionally playful.

Playfulness, here, is defined as an interpretative attitude, a sort of suspension of disbelief that allows individuals to explore and reinvent the meaning of the objects around them, assigning them fictional meanings, but without forgetting about their real ones (Lotman 2011). Gamification in the urban environment, then, can be understood as the adoption of playful attitudes and behaviours in public spaces of the city that are not traditionally deputed to play (Thibault 2019b).

Finally, for what pertains to the experience of interacting with the two artefacts, we turn to ludological categories (Aarseth, 2014; Järvinen, 2007) as effective tools to subdivide it into more analysable items, a method that is particularly useful to isolate and evaluate playful elements and their relationships. Ludology is a formal discipline that aims at describing the experience of play through finite sets of discrete categories. In this context, Järvinen (2007) offers a framework that is flexible enough to be applied to artifacts that, just like the MUV app and Asphyxia, allude to playfulness while not being full-fledged games: we adopt these categories to highlight similarities and differences between the cases we analyze and other mainstream games..

Analysis protocol

We followed the same analytical procedure for both artefacts composing this study, the MUV app and the Asphyxia installation. As a first step, we identified and categorized salient features related to the audio-visual components of the artefacts, and to their interactive qualities. Then, we conducted semi-structured interviews with the design teams of both artefacts. They were transcribed and analysed by two authors separately. The themes that emerged from the interview were compared with those from the artefact analysis, highlighting convergences and divergences between the two sets. The comparison between our critical interpretation and the designers' own explanation, does not pretend to identify a reading of the artefact that is more "correct" or reliable than the alternatives based on some sort of authorial authority. Instead, we aim at teasing out the intentional and reflective process at play in the creation of the design, we try to reconstruct the rationale behind precise design choices and strategies.

For our analyses, we considered primarily our first-hand experience interacting with the MUV app and the Asphyxia installation, complemented with additional background information on the MUV project. To compile our experiential analyses, we interacted at length with the two artefacts, reflectively documenting our own experience. Furthermore, we had access to the design teams, from whom we obtained documentation on their creative process (sketches, moodboards, mock-ups, schematics and early versions).

As the last step in our analytical methodology, we adopted a more reflective and critical stance, and we outlined a series of implications for design from the artefacts and their respective contexts of use. We provide these as contributions for further design and research in the field of urban playfulness.

MUV - Mobility Urban Values

In this section, we focus on the "MUV - Mobility Urban Values" software[3]: a location-based mobile app that aims at gamifying the experience of commuting and encouraging sustainable mobility. It was developed by PUSH, a design lab for social innovation and urban sustainability, with input from several participative design actions across Europe. In Amsterdam in particular, the MUV project actively addressed the residents of Buitenveldert, with particular attention to the engagement of senior people. Participants were tasked to use the app to map out their daily movements, to check their environmental sustainability, and to reflect on whether an incentive would have motivated them to choose a different mode of transportation. Four co-creation events in January and February of 2018 allowed MUV to collect these insights, and the app was tested with several "community walks" with the participating residents.

Analysis

As smartphones become more powerful and better connected, many activities previously limited to desktop computers have become accessible quite literally from the sidewalk: for browsing the Internet to look for recommendations, playing games, or checking maps. The widespread genre of "mobility apps" focuses on providing information and services related to travel and commuting, and ranges from famous services such as Google Maps to hyperlocal apps helping tourists to move around town. The MUV app, however, diverges from other mobility apps for some key characteristics. First, its primary concern is to apply game design principles to the everyday

[3] For clarity, in the rest of this chapter we will use "MUV app" to refer to the software, and "MUV project" to refer to the research initiative

activities of commuting and transportation. By doing so, the MUV app embraces the basic characteristics of gamification. Furthermore, it adopts a clear ethical stance in favour of sustainable mobility, and its stated objective is to motivate citizens to choose less environmentally detrimental means of transportation.

The MUV app opens on a home page displaying the user's name and avatar, their placement in the city-wide leaderboard, the points earned during the week, the icon of the city where the users are located, and their "rank" determined by training sessions. Next, there is a feed visualizing the user's past trips, their achievements, and a bulletin board with news and information from the app managers. Finally, the lower part of the screen contains a functions menu and a triangular "play" button. When the button is pressed, after prompting players to select a means of transportation (on foot, by bike, or by public transportation), the app begins tracking their movements. At the end of a commute, the "stop" button interrupts the tracking and shows an overview of the trip. Afterward, the MUV app suggests snapping a picture and offers the possibility to report issues such as architectural barriers, unsafe streets, or inaccessible sidewalks.

Players participate in "training sessions," simple missions like cycling on a weekend, and obtain virtual coins and ranks from "newbie" to "star". Virtual coins and ranks are needed for unblocking more activities and functions of the app. The time spent moving, the distance travelled, the position on a map, as well as the calories burned, are all logged and used to assign points. According to their total score, players are ranked by city, among friends, and overall. Occasionally, challenges take place between cities and, during those periods, the points of all players are pooled in a total score, and winners are awarded both digital trophies and real ones, such as restaurant coupons or theatre tickets.

By applying Jarvinen's ludological categories (2007) to the MUV app, the following emerge:

1) The MUV app a location-based game, the most important of its *components* is the users' movement through the city. Specifically, its main function is to track and log it, and to compare players' behaviours providing in-game feedback;
2) The *environment* is delimited to the cities of the MUV consortium;
3) As for the *rulesets*, the MUV app mainly proceeds by goal setting: it offers different goals such as the city weekly challenges, and the goal ladders set by the training sessions;
4) The main *game mechanic* is moving through the city to earn points. All the other actions are either optional and out-of-the-game (celebrating with pictures, reporting issues) or made by the app by elaborating the data from the tracking.
5) The main *theme* of the app is based on the relationship with the language of sports. Although it is usual for gamification design to borrow many terms from sports, the MUV app explicitly attempts to turn commuting into a sport.

The category of *game mechanic* teases out the "gamified" nature of the MUV app: the main mechanic is an action (move throughout a city, possibly as part of a daily commute) that users would arguably perform regardless of the app, which aims to influence *how* that action is performed. As it is often the case in gamification, significant effort has been put in creating the goal-setting and feedback mechanisms. Indeed, with respect to a list of recurring elements in gamified apps as listed in the meta-study by Hamari et al. (2014), the vast majority is present in the MUV app.

Points	Accumulated by moving in the city in a sustainable way.
Leaderboards	Both compared with friends, in cities and worldwide

Achievements/Badges	Trophies awarded for the competitions between cities
Levels	Four levels (Newbie, rookie, pro and star) according to training
Story/Theme	The “sport” theme
Clear goals	Generally simple and clear goals both in training and competitions
Feedback	Feedback includes: continuously keeping track of your points, a feed that announces your trips and achievements
Rewards	Training tasks are rewarded with a currency, city challenges with trophies and real-life objects
Progress	Tracked through the training and the leaderboards
Challenge	City challenges and competition in leaderboards

Follow-up interview

The MUV app was developed by PUSH, a design lab based in Palermo, Italy, in cooperation with stakeholders from the MUV project network. In what follows, we will explore the designers' rationale, as reconstructed through a follow-up interview.

At first glance, the MUV app does not seem to deviate significantly from the dominant format of gamification revolving around the inclusion of game elements in non-game contexts. Following our initial analysis, we reached out to PUSH to investigate what process and considerations brought the designers to adopt this type of perspective. The interview revealed that the experience of living and working in the city of Palermo, where the designers are based, had a role in this decision. In their context, the developers argue, it is difficult if not impossible to promote structural changes towards sustainable mobility practices or to raise significant funds towards similar projects. Instead of intervening on infrastructure, with all the political and administrative overhead, the design team argues for investing on changing the bad habits of Palermo’s residents. This is the main rationale for which they focused on behaviour change techniques and ultimately decided to leverage gamification.

The initial concept was framed differently from the final product and focused exclusively on only extrinsic motivation. The guiding metaphor was a connection between steps and currency: after having accumulated enough, users could use them to purchase goods at partner stores. However, our designer interview reveals how subsequent iterations progressively reduced the emphasis on extrinsic motivation (e.g. the possibility to use “steps” as a real-world currency), as co-creation workshops with local university students proposed to include games and game elements in the app. As extrinsic motivation was relegated in the background, a follow-up iteration recalibrated the MUV app design in terms of a more canonical gamification strategy. As user research confirmed that the game experience was a primary motivator for people to use MUV, the PUSH design team decided to root it in the metaphor of sport. In the words of Toti di Dio, managing director at PUSH: *‘*we imagined urban transportation as a sport made up of different disciplines: walking, biking and using public transportation*’*.

Further co-creation and participatory design initiatives took place across Europe as part of the broader MUV project. Through our conversations with MUV project partners, we have information about the app being reappropriated in emergent ways. For instance, Waag: Technology & Society, the Dutch node of the MUV network, adopted the app as a support tool for organizing

“community walks” in neighbourhoods at the periphery of Amsterdam. The designers at PUSH report that, following this and other similar experiences, they realized that urban gamification could do more than just creating valorisations around mobility and decided further iterations, more in the direction of games rather than simple gamified systems. They decided to make the experience more complex and to motivate users to use the app also outside their daily commute. In other words, the last iteration shows the designers’ attempt to frame the MUV app also as a game in addition to being a tool for activism and awareness-raising. This marked a second shift away from extrinsic motivations (still present in the app as prizes for the “tournament” function) and a re-focusing on intrinsic ones. Ultimately, the objective became making the experience so engaging that users would be well-disposed to walk just for earning points and progressing in the game.

Tying together the strands of our designer interview, we see coming into focus different elements supporting the argument that the standard, dominant format of gamification makes a rather reductive use of playfulness and that often it functions only slightly better than extrinsic motivations (i.e. real-world prizes). The PUSH design team moved away from these soon in their iterative process, in an ongoing search for more bottom-up kinds of gamification, allowing players to reappropriate the artefacts and to (self)direct their play[4].

Critical perspective

At its core, gamification is a strategy to modify habits and it operates by reorienting expectations on everyday life and adding a new, gameful layer to it: this is where a considerable part of its efficacy derives from. If we go back to the MUV app and consider the list of game elements implemented around urban mobility, it is easy to recognize it as an almost-textbook example of gamification applied to a societal challenge. In this sense, it is not surprising in itself and follows a series of tried-and-true design principles, from the direct correlation between tasks (e.g. moving) and rewards (e.g. points) to the social leaderboards comparing various players’ performances, to team events pitting city versus city. Indeed, the MUV app faithfully implements most of the game elements described by Hamari et al (2014) - namely points, leaderboards, achievements/badges, levels, story/theme, clear goals, feedback, rewards, progress and challenges - without deviating from the canonical examples. This type of gamification projects does not necessarily modify how an activity (e.g. movement through a city) is experienced itself but creates a form of artificial value, expressed in points and rewarded with levels and trophies, which has meaning within the app and among its users.

As we have mentioned, this kind of gamification has often been criticized. Theorists have suggested that gamification should be centered around the user experience (Huotari & Hamari 2017), that “game elements” do not really exist (Bonenefant & Genvo 2014, Thibault 2019a) and that the playful element has been generally underestimated (Fuchs et al. 2015). However, it is interesting to consider the *evolution* of the MUV app by carefully following what emerges from the interview. In the beginning, the concept was simply using extrinsic motivation to incentivize walking, directly transforming steps in currency (an idea that has some dystopian affinities with the *Fifteen Million Merits* episode of the *Black Mirror* series, Lyn 2011).

Only afterward, having analysed the users’ feedback and the output of various co-design workshops, the development team began realizing that extrinsic motivation was not truly

[4] In the interview with PUSH emerged also their intention to use the app to collect data generated by citizens as players and use it as a resource for mobility managers so to make better policies. As this feature does not emerge from the app nor from its use and as it makes use of play only tangentially we decided not to focus on this particular aspect.

sustainable or effective in the long term. We find it particularly significant that the design team at PUSH reported that, at the current stage of development, their aim is to transform the app into a full-fledged game, and we interpret this as an indirect acknowledgment of the limitations of classic gamification and an attempt at rethinking it in a more experiential and playful way. Indeed, since the last development milestone, the app underwent a shift towards intrinsic motivation. While the core idea of measuring and tracking urban mobility and create a system of feedback around this measurement is still the same, the attention has increasingly moved towards the experience of the users.

Asphyxia

In what follows, we analyse the Asphyxia installation, and then we complement our critical reading with a designer interview. Developed as a spinoff of the MUV project, Asphyxia is a device that makes numeric information (e.g., data pertaining to air quality) not only visible but also physically "embodied," as it translates sensor readings into kinetic patterns, movements, and rhythms.

Analysis

Like a lamp, Asphyxia is a device composed of a vertical stem holding a flexible canopy made of white, smooth, partially folded fabric. The canopy is arranged in a geometric structure similar to an irregular kaleidocycle, a shape composed by numerous polyhedrons arranged in a sphere-like structure that can partially fold over itself and "flatten." On the stem, hidden under the fabric, there is a LED-strip that can light up the structure from the inside, and change its brightness and hue smoothly. The canopy, the stem, plus some technical components (a microcontroller, a stepping motor, cabling and connectors and power supply) are enclosed in transparent plexiglass housing. Asphyxia is, at the time of writing, in a functional prototype stage, and the device that we consider in this analysis has a height of approximately half a meter: however, future versions will scale up to be bigger, up to four meters tall.

Asphyxia is designed to integrate into a network of air-quality sensors and, as part of the MUV project, visualize data in a more tangible and almost embodied way. To do so, the device is programmed to correlate numeric values (the proportion of pollutants in an air sample) with patterns of breathing movements and light. This kinetic installation acts by combining different components. The canopy expands and contracts (component: rhythm), it lights up (components: colour, intensity, dimming speed), and it produces a mechanical buzz as it moves (component: noise). The rhythmic breathing is made possible by eight movable ribs inside the canopy, similar to those in a common umbrella: a ring slides up or down the stem, causing the ribs to expand or contract the canopy's fabric. However, while an umbrella's ribs open fully to tense the fabric, Asphyxia's movements are more subtle and cyclical. Indeed, the canopy appears to inflate and deflate with a smooth, organic rhythm comparable to breathing lungs, or to a jellyfish swimming in the sea. In describing the lighting components of Asphyxia, we need to consider three variables: the intensity of the light emitted by the LEDs (from no light to full luminosity), its colour, and the speed with which the light changes. The light emitted from the device can be synchronous with its "breathing" movements (e.g., the luminosity is at its peak when the canopy is fully extended, then diminishes at it deflates) or, in other circumstances, it can work independently. Finally, the audible features ("buzzing") of Asphyxia are a direct consequence of its mechanical structure. The stepping motor, the joints of the ribs, and the canopy's fabric vibrate slightly as they move, producing a faint but perceivable rhythmic sound in sync with the device's other behaviours.

As we tie together all the strands of this initial description of the Asphyxia artefact, we may propose three initial observations. First, the various kinetic and audio-visual components of the device produce are aesthetically rich: taken together, the rhythmic movement and the pulsating lights and sounds produce a multisensory experience. On the other hand, Asphyxia does not seem adequate at providing precise and quantifiable information, as there are no numbers, scales, gauges, or precise guidelines on how to interpret its colours and breathing patterns. We call “Absent instructions” this first design strategy. Secondly, Asphyxia may be interpreted metaphorically, following constructions such as ‘the machine is breathing’ or ‘the sensors are like lungs.’ This brings forwards follow-up interpretations, of which ‘if the air quality is bad, lungs (both Asphyxia’s and the interpreter’s) struggle to breathe’ and ‘if the air quality if fine, lungs breathe easily’ are particularly significant. We may call “metaphoric reading” this second design strategy. Finally, and more generally, Asphyxia supports multiple interpretations. Does the canopy represent a pair of lungs? If so, whose? What do the various rhythms represent? Choking, or maybe excitement? As it expressly rejects clarity and ease of use, Asphyxia aims at eliciting dialogue, discussion and reflection. We may call “open interpretation” this final design strategy.

Follow-up interview

We now turn to a follow-up interview conducted with the team responsible for the Asphyxia artefact, with which we aim at reconstructing the designers' rationale. In our own close reading, we teased out the lack of specific cues orienting users’ interactions with the device. Now, the interview offers further hints at the rationale behind this strategy. The designers mention that, over the iterative process of ideating and shaping Asphyxia, further concepts were experimented with, including a pufferfish’ capacity to inflate its body, butterflies, blooming flowers, beating hearts and swarms of bees. The process was exploratory and aesthetically driven (‘We liked how, for example, squids move [and we asked ourselves] “Can we make that?” and see how it would look’). This significantly underlines the aesthetic and kinetic qualities of these concepts, all emphasizing concrete, bodily movements that are easy for a viewer to grasp and conceptualize. In other words, we point at how the designers focused on movements that are rooted in tangible, bodily experiences that are instinctively understandable (gasping for air, being out of breath…), thus sidestepping the need for detailed instructions.

Secondly, we pointed at how Asphyxia can be read metaphorically. Indeed, the overall aesthetic concept has been inspired by living creatures since the beginning, but our interview reveals that the overall guiding metaphor has changed over time. As further iterations added more kinetic elements, including origami-like structures and the flexible canopies, the concepts moved away from whole animals towards slightly more abstract ones. As the designers themselves articulate: ‘we had the idea of the lungs of the city where a flower would grow.’ Here, we see two distinct metaphors at play: first a pair of lungs to show air quality, and then a blooming flower for noise pollution. In the designers’ own words: ‘the lungs were very literal, [connecting] air pollution [and] struggle to breathe, but the flower was more [...] abstract,’ as it would close if the noise level exceeds a certain threshold. While the lung metaphor fits the context, the flower was problematic. The logical connection between one part (noise) and the other (a flower) is tenuous, and the proposed behaviour would have been somewhat arbitrary: in a model viewer’s experience, which flowers bloom only in silence? Furthermore, the proposed conceptual blend of lungs and flowers might have evoked more horror-themed human/plant hybrids rather than a peaceful representation. This was solved in the following iteration: in our analysis, we hypothesized a design strategy centred around a metaphorical reading, and the designers’ interview supports our

hypothesis. Indeed, the two metaphors were simplified and condensed into one, with the canopy's movement and lights representing the two variables of air quality and sound.
Finally, we collected all the strands of our analysis in Asphyxia's overarching characteristic of being open to interpretation. The device's form is not clear at first sight. On the one hand, there is a general tendency to connect at least two of the device's behaviours (buzzing and breathing) to functioning lungs. As the design team recalls: *'*the motor makes some sounds and [...] sometimes it would just stop. I think it worked really nicely, because people [in the audience] went like "Aww! [..] it's trying so hard to breathe…"*'* On the other one, when the prototype was first publicly exhibited, the designers noted a certain number of visitors having trouble making up their minds. They recall that *'* [if you think about] lungs, you get it right away*'* but a general ambiguity remains *'*in a nice way, [where] you have to kind of look at it for a while, to [wonder] "oh, what could this be?"*'*. Indeed, Asphyxia's foundational metaphor never solidifies to a specific domain and remains open to multiple interpretations: it holds if one thinks of lungs, but so does it if one thinks of jellyfish, pufferfish, or other critters reacting to an unpleasant stimulus. The key point is that it programmatically does not attempt to be an accurate representation: it does not provide a scale, or calibration, or a baseline to read if air quality is increasing or decreasing. On the contrary, it expressly taps into a range of embodied experiences to create an experience that is at the same time familiar (after all, we all breathe) and alien (what is this strange moving canopy?).

Critical perspective

Analysing Asphyxia is complex as it resists purely functional approaches and, instead, favours ambiguity and open interpretation. Following the seminal definitions offered by Gaver and Martin (2000) and Gaver et al. (2004), we call Asphyxia "ludic" as it expressly sidesteps task-oriented functionalities and eschews a solution-based approach. More broadly, we agree with Sengers et al. (2005) as they note how ludic design 'promotes engagement in the exploration and production of meaning, providing for curiosity, exploration and reflection as key values'. Ludic design calls for subjective and idiosyncratic methodologies, for leaving room for users to reappropriate technologies, and for prioritizing aesthetic pleasure over performance (Gaver 2009).
Indeed, Asphyxia is in line with Gaver's approach to ludicity. First, it is composed by an apparently incoherent assemblage of different parts that do not "fit" logically. The stem evokes the structure of a lamp, the moving canopy reminds of a living being, and the buzzing sound is clearly mechanical. Furthermore, it is neither ergonomic nor "usable," as it lacks clear instructions on how to read its behaviours and signals. Finally, it prioritizes an aesthetically interesting appearance over an easy-to-use interface. If we read it through the heuristics that are applied to the design of everyday objects, Asphyxia should be a failure.
Yet, Asphyxia fosters surprise, sense of wonder, the delight of finding something unexpected at one's own doorstep and of engaging in playful interaction in public spaces. By not "fitting" in specific semantic categories (Is this art? Is this a tool? Does it transmit information?), the artefact is inviting and intriguing. By evoking biological entities such as lungs or jellyfish and applying their traits to street furniture, Asphyxia plays with the magical feeling of seeing an inanimate object suddenly having a life of its own. It resists easy interpretation and, by doing so, prompts the audience to look at it from a different, somewhat unusual/unfamiliar perspective.
In sum, Asphyxia is not a game and should not be analysed with game-related categories, but is certainly ludic (Gaver et al. 2004). It does not elicit interest via game mechanics, extrinsic motivation, points, or the possibility to win, but it does so by being expressly strange, somewhat out-of-place, and difficult to frame. The competition that Asphyxia proposes is not pragmatic, as the device does not actively "play against" users, but cognitive and interpretive, as it challenges

its audience to frame it. It is exactly this interpretive challenge that makes Asphyxia ludic and motivating in the same way riddles and puzzles can be, and much more creatively stimulating.

Which playfulness for sustainable cities?

As we reach a (temporary) conclusion of our research, we wrap up by synthesizing our findings and implications for future work. At first sight, the two artefacts we analysed both seem to eschew the category of “games”. However, a more careful exam reveals that, at their core, they both initiate playful interactions, although in significantly different ways. The MUV app relies on gamification and intrinsic motivation. Asphyxia, on the other hand, is expressly hard to interpret, inviting to a playful exploration of the meanings hidden in its movements. From this perspective, the two artefacts suggest a possible spectrum of playful activities related to bottom-up urban sustainability. After analysing them and considering their designers’ processes, we notice a gradual shift away from the widespread use of extrinsic motivation that characterized gamification in the past years. On one hand, we find it significant that the very first instance of the MUV app was simply providing rewards in the form of prizes and then - thanks to the input of its users - it was progressively recalibrated toward the creation of experiential value and intrinsic motivation. On the other hand, Asphyxia rejected extrinsic motivation from the beginning and appealed more to a sense of wonder and mystery to motivate users to engage with it. In both cases, we observe a centrifugal move away from extrinsic motivation (i.e. prizes) towards other forms of engagement. Despite these similarities, the two artefacts are different in their affordances and social contexts. The MUV app’s social functions are more effective when played in cities that were involved more directly and for longer in co-creating it. Similarly, younger users so far have a higher retention rate than mature adults: for example, the senior people involved in workshops in Amsterdam stopped engaging with it afterward, while the students of Palermo who followed the project since its beginning are still playing with MUV in significant numbers. The ability to reshape urban mobility through a game, instead of just reframing it, seems more achievable when the users reappropriate the game, having the designers to follow them enthusiastically. In a different manner, Asphyxia is explicitly an art-like artefact, a sort of reactive public sculpture, designed to be at odds with its urban context, a design strategy that is functional to its rhetorical structure but that also makes it a possible target of vandalism and theft. To be meaningful, it must keep a delicate balance between visibility (being present enough in the public spaces to be noticed) and normalisation (being overexposed and losing the ability to attract attention). Asphyxia’s deployment and maintenance, in sum, are probably the most problematic aspects to take into consideration.

In sum, there are three key implications that we tease out from our interpretation and we offer to (game) designers for further investigation. First, based on our analyses, we recommend focusing on the residents of a city and their experiences rather than on external rewards. We also see clear benefits in leaving open spaces for interpretation and reappropriation, rather than coercing players to “do the right thing,” which may come across as paternalistic and judgmental. Ultimately, we argue for moving past the widespread understanding of gamification based on behavioural techniques and simple transposition of game elements to everyday activities. We contribute this last point particularly in relation to designing playful and sustainable cities, where we envision play activities to be emergent from a more balanced relationship between designers and players that takes also into account co-design activities.

Conclusions

Current trends in urban game studies suggest that, in relation to cities, there is a link between

playability and sustainability. There is, however, a gap in our knowledge pertaining to *which* types of games and play are more attuned to raising awareness on sustainable urban living. As a contribution towards filling that gap, we presented a comparative analysis of the MUV app and Asphyxia. While we acknowledge that our study is exploratory and discusses projects still in development, it points to a direction in urgent need of further exploration along three different dimensions: different strategies of sustainability, different kinds of cities and different types of playful actions.

First, our case studies focused on two key aspects of urban ecological sustainability: transportation and air quality. However, there is a large number of other forms of sustainable actions that could and should be taken into consideration. Playable cities should address different forms of ecologically sustainable behaviours (e.g. energy consumption, water circles, materia/waste cycles, urban heat island effect - cf. Yannas 2001 and Rosales 2011) but also other forms of sustainability, such as the social and economical ones, that are necessary for long term implementations (Gibson 2010).

Second, it is necessary to renounce a Eurocentric approach to the urban areas and to take into account the complexity of human settlement around the world. Sociocultural conditions can change greatly the conceptual and material aspects of the cities, which will in turn influence both their needs and vulnerabilities in relation with sustainability (Dodman et al. 2012) and their receptions towards playful or gamified applications (Khaled 2015). It is important, therefore, to expand this research beyond the cities taken into consideration in this study.

The third and last expansion should be made to including different ways of implementing actions for change based on ludicity. For example, full-fledged games have been developed in game-based learning contexts to educate about green buildings (Juan & Chao 2015) or to raise awareness of sustainability issues in public spaces (Lameras et al. 2013). At the same time, we could imagine also novel ways of using playfulness for promoting or supporting sustainability, such as the use of toys or the implementation of other playful modalities.

The potential of ludicity to promote urban sustainability appears to be high and yet mostly unexplored. We hope that this research work might contribute to reframe playable cities as *intrinsically* sustainables cities.

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