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Gamification of digitized sporting devices and transformation of public spaces in French metropolises

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Résumé : cet article concerne la gamification de dispositifs sportifs digitalisés par des acteurs publics et leurs effets transformatifs sur l'espace public des métropoles françaises. Une revue de la littérature articulant espace public et dispositif sportif digitalisé est couplée à une approche conceptuelle de la gamification du sport – à partir de ses trois marqueurs : autonomisation ; enrichissement ; ludicisation – et de ses contextes d'usage. Une étude de cas multi-sites synchronique des métropoles arme une taxinomie de ces dispositifs puis une grille d'analyse et d'aide à la décision aux fins de transformation de l'espace public sportif urbain. Si ces dispositifs sportifs digitalisés et gamifiés dans l'espace public accompagnent en effet une tendance générale de libéralisation sociale, spatiale, temporelle ou même financière des activités physiques, ils ne bouleversent pas pour autant les usages sportifs et ludo-sportifs urbains. Répondant à des enjeux et des demandes d'usage simplifié, fluidifié et accéléré des équipements et services sportifs publics, ces dispositifs visent à satisfaire de manière toujours plus adaptée les besoins de l'utilisateur. Les plus innovants, les moins répandus et les plus ludicisés (e.g. réalité virtuelle, offres immersives) tendent même à être co-construits avec l'utilisateur au moyen de médiations innovantes et digitalisées contribuant, à leur mesure, à l'essor d'une gouvernance partagée de l'espace public.

Mots-clés : gamification du sport ; espace public ; métropoles françaises ; dispositifs sportifs digitalisés ; transformation des usages sportifs ; sport ; loisirs sportifs.

Abstract: This article deals with the gamification of digitized sporting devices by public actors and their transformative effects on public space in French metropolises. We combine a review of the literature that shows the relation between public space and digitized sporting devices with a conceptual approach to the gamification of sports - based on its three markers: empowerment, enrichment, "ludicization" - and the contexts in which it is used. A multi-site synchronous case study of metropolises provides a taxonomy of those devices and an analytical and decision support tools for the transformation of urban public sports spaces. While these digitized and gamified sports devices in the public space accompany a general trend towards a social, spatial, temporal or even financial liberalization of physical activities, they do not disrupt urban sports and recreational activities. Responding to challenges and demands for public sports infrastructure and services that are more user friendly, faster and more fluid to operate, these devices aim to meet users' needs in an increasingly tailored manner. The most innovative, least widespread, and most *ludicized* of them (e.g., virtual reality, immersive offers) even tend to be co-constructed with users through innovative and digitized means of exchange which, in their own way, contribute to the development of a shared governance of public space.

Key words: gamification of sports; public space; French metropolises; digitized sports devices; transformation of sporting practices and uses; sport; recreational sports.

The urban world has undergone two simultaneous processes in the past five decades: the digitalization of public spaces and the technologization of physical activities and recreational sports. The first is part of the major technological changes that the advent of computerization has generated. The second has raised questions among scholars about its social dissemination (e.g. Mignon 2015), its comprehensibility by participants (e.g. Pharabod et al. 2013) or the uses of connected objects (e.g. Whitt and Wilson 1974). While the convergence of these processes has not received scientific consideration, it has been on the political agenda (Padioleau 1982), given the importance and changeability of digitized physical activity and recreational sporting devices (called "digitized sports devices" in the article), which have potentially strong transformative effects on urban public space. In the early 1980s, urban public space was only a place in which the first runners equipped with a heart rate monitor could run; today, public space offers a variety of digitized sports devices that are available to everyone (connected playgrounds, street workout, etc.).

The catalyst for this convergence is a third process - still in its preliminary stage and hardly perceptible as yet - that of gamification. Defined as "the use of game design elements in non-ludic context" (Deterding et al. 2014: 18), this recently established term (media industry: 2008; scientific research: 2011) takes its meaning from "the game-play, the interactions that take place in order to play, [...] and] the suffix 'fication' (facere) [which marks] the idea that it is possible to transform the situation into a game" (Sanchez et al. 2015: 363-364). The advent of a "*régime du jeu*" (game regime; Savignac 2018) fosters more individualized, personalized, liberalized, and connected sports practices (Müller 2018) in the public space. As a support for any urban planning policy, public space is "a key to the urban project, (...) a place that makes mixed use and urbanity possible (...) [, that] reveals conflicts between different interests and social groups [and that constitutes] an interface between the sphere of power and that of intimacy as a condition for the political" (Beaucire and Desjardins 2014). Thus our article deals with the gamification of digital sports devices by public actors and the territorial and political transformations of the urban public space that it brings about. Our goal is to understand the

rationale behind the implementation of such devices, the needs and demands to which they respond and the gamification models they generate.

Places of urbanity (Lévy 2003a) and innovation (Offner 2003) *par excellence*, the 22 metropolises that have resulted from the 2014 Maptam law (Law for Modernization of Public Territorial Interventions and Establishment of Metropolitan Areas) are likely to be receptive to these devices and constitute *a priori* relevant study sites for this empirical-inductive research. We combine a review of the literature articulating public space and digitized sporting devices with a conceptual approach to the gamification of sports. We then present and justify the methodological framework for this study, which consists of a multi-site synchronous case study of French metropolises. The digitized sports devices set up by the metropolises are analyzed through a new taxonomy. Finally, the configurations of public space resulting from the gamification of these devices are revealed and serve as a grid for analyzing the territorial and political transformations of urban public space. The empirical-inductive framework we have adopted allows for a generalization of these results and a theorization, which, in turn, contribute to contemporary reflections on the issue of digitalization of public spaces and recreational cities (Martouzet and Miaux 2014)), from the perspective of gamification, in a context of the 'sportivization of society' (Callede 2001).

1. Digitization of urban public spaces and gamification of sport: theoretical framework and state of the art

From a heuristic point of view, the joint analysis of the processes of digitization of sport in the public space, of the gamification of sport and its contexts of use aims to grasp their effects of territorial and political transformations on French metropolises.

1.1 Public space and digitized sports devices

Often seen as the ideal type of agora, citizenship and democracy (Lussault 2003), public space is a dual concept. On the one hand, it expresses a metaphorical philosophical-political conception of places of collective deliberation (Birkner and Mix 2014) and designates a space for debate that brings life to democratic practice (Habermas 1978). On the other hand, it materializes the places of collective living. It is, "*in the strict sense, one of the possible spaces for the social practice of individuals, and is characterized by its public status*" (Lussault op. cit.: 333), "*accessible to all [and] summarizing the diversity of populations and functions of an*

urban society as a whole” (Lévy 2003b: 336). The freely accessible space which Lévy calls the “*public domain*” and uses to refer to streets, squares or parks, constitutes the highest expression of public space, a “*concentrate of urbanity*” (ibid.: 337); the individual reserved access space, “*private space*” (housing, cars, etc.), represents its antithesis. Between the two, different categories of public space exist: normed access (“*semi-public domain*”: train stations, shopping centers, etc.) or restricted access (“*semi-private domain*”: taxis, shops, etc.) societal space; regulated access (buildings ‘entrance halls) or restricted access (private streets) collective spaces. Examining this taxonomy in more detail, Beaucire and Desjardins (op. cit.) highlight how much Perce “*brings to light [in Espèces d'espaces] the social values and cultural referents that are expressed in the sharing and composition of public spaces*” (ibid.). Using eclectic sources, they draw a reasoned portrayal of this “*place of sedimentation of urban memory*” that is being diluted by privatization. The antagonistic visions that it gives rise to (e.g., the Right to the City versus the rationalist and technicist work of engineers) make it a perfect ground for political expression. In these conditions, does this notion of the public space - a relatively blurred notion (Tomas 2001) - keep all its explanatory power in a world where digitization is progressing, particularly in the physical activity and recreational sports sector?

Indeed, the increasing monitoring of sports activities by means of on-board (e.g., connected watch) or resident (e.g., on-site, or remote-control platforms) computer-assisted applications has turned public space into a perfectly plastic playground and has blurred its border with private space. On the one hand, public space is a place for physical activities, as well as individual and collective recreational sports of a private nature (e.g., connected running courses). On the other hand, the devices proposed in 2020 by the Ministry of Sports and some public institutions (Insep; Inserm; AP-HP) in partnership with providers of applications (Be Sport; My Coach; Goove app) during the “BougezChezVous” operation, has extended the public space into the domestic sphere by means of free downloadable sessions making it possible to monitor the behavior of the general public. This supervision of physical activities through artificial intelligence applies to health, well-being, and recreational sports in the urban public space. It is extending into the public sector of domestic services through the transfer of sports technologies, such as movement sensors that signal any prolonged inactivity of dependent people. Moreover, digitized sports practices (e-sport, video games) and activities bring together participants who, from their home (LAN: Local Area Network), attend e-sport events organized in connected (Global Area Network) public spaces (LAN Party).

The dissemination of digitized sports devices in urban public space raises questions among elected officials, agents, users, and private operators, about the territorial and political transformations resulting from the links between sports activities and their clickable environments (de Rosnay 2006) and prompts them to take action in this regard. Since the mid-1990s, the digitization of sport in public space is no longer limited to the dissemination of information via unidirectional (sport 1.0) or interactive (sport 2.0) channels between public actors and users. Technological advances and the rise of a digital culture are driving the co-construction of services for users (sport 3.0), from a so-called smart perspective (sport 4.0) (Kanemura 2009) in line with the current emergence of the gamification of sport (Schoeny and Chaboche, 2022, forthcoming).

1.2. The gamification of sport: conceptual approach and contexts of use

The concept of gamification is embedded in the canonical literature on games (Mauss 1934; Huizinga 1938; Caillois 1958) and stems from the game design, a term that can be used to describe a process of designing urban public space through play (Prévoit and Buyck 2019). However, gamification “*extends beyond games and gamified services, and (...) applies to almost any interactive system [that] enhances the social and experiential dimensions of play*” (Deterding et al. op. cit.: 12). It aims at “*entertainment [...], which is users’ main expectation when they use games [...], pleasure of use, engagement and, more generally, improvement of the user’s experience*” (ibid.: 9-10). Characterized by a transfer of game mechanics into a non-game domain, it “*has multiple facets that exceed [its] purely functionalist framework*” (Waltz and Deterding 2015) and its applications “*cannot be limited to digital technology*” (Deterding op. cit.). It strongly differs from the world of video games (Ter Minassian et al. 2021) and reveals “*an ‘introduction’ of play into all human activities*” (Lavigne 2014 quoted by Siegle 2015: 3) because “*it is the mechanics of a game – not the theme – that make it fun*” (Zichermann and Cunningham 2011: 3).

In a world invaded by gaming (Zimmerman 2015) and connectivity, the rise of a “*ludic society*” (Stenros et al. 2007: 32) fosters the digitization of physical and recreational sports activities. This digitization combines the markers of sport (e.g., quantification: Guttmann 1978; regulation: Eichberg 1998) with game mechanisms (confrontation, cooperation, imagination, etc.: Taylor 2009) to make the gamification of sport a reality. This gamification of sport is based on three markers derived from those that structure the general concept of gamification (Deterding op. cit.): empowerment, enrichment, ludicization (Schoeny and Chaboche op. cit.).

The concept of *empowerment* refers to the “*experiential and behavioral aspect of the game*” (Deterding et al. op. cit.), of an organic, existential, and processual nature for the individual who feels the vibrations of his or her connected watch or gets excited about the badge s/he receives when a personal goal or a collective performance is achieved. At the individual level, empowerment makes it possible to implement organizational elements of the game to facilitate the player’s analytical and decision-making capacities. At the individual level, it promotes a degree of expertise in one’s own health, through self-quantification (Dumez and Minvielle 2017)), self-reinforcement, and self-determination of one's sport practice (Boudokhane-Lima 2018) in order to record one's own activity according to a goal of self-knowledge (Vigarello 2014) that can be shared with anyone. Sports organizations offer services that promote the empowerment of the participant and the spectator. The latter are eager for novelties and activities with less technical, temporal and spatial constraints, and create or use material (connected objects) or symbolic (e.g., virtual peer groups) artefacts that are highly visible in urban space and give them access to the experiential and behavioral aspect of connected sport.

Related to the artefacts that give access to the experiential and behavioral aspect of gamification (Deterding et al. op. cit.), *enrichment* refers to the design of products or services aimed at improving the rendition of the game’s environment to enhance the user’s experience thanks to virtual reality (which gives a sense of immersion in a 3D world), augmented reality (which complements reality by introducing virtual information) or mixed reality (which combines realistic 3D images with real world objects). Thus, enrichment takes the form, for example, of running applications which, over and above their purely sporting function, respond to the neoliberal objective (Harvey 2005) of optimizing the body (Catoir-Brisson 2015), behavior (e.g., a timetable partly governed by sporting activity: Burlot et al. 2016) and space-time (e.g., the home as a space for sport or adapted physical activity: Bigot et al. 2019) for performance purposes.

Related to the process of “*contagion and mutation of games*” (Deterding et al. op.cit.), *ludicization* maximizes the users’ engagement by extending beyond the traditional boundaries of a game to ensure uninterrupted operation (Genvo 2013), before, during and after the sporting event (e.g., rating of the match and the players). It improves the user’s experience by transforming practices previously perceived as austere or spartan thanks to the introduction of connected game elements (e.g., indoor rowing using an ergometer), or augments the experience

by enabling users to share and compare data with a view to cooperating or competing (e.g., e-sports).

The joint rise of the digitalization of urban public spaces and a game regime leads to the gamification of sport, which requires the simultaneous presence of these three markers of rarely equal intensity. The aim is therefore to develop a methodological framework for understanding how the gamification of digitalized sports devices generates territorial and political transformations of urban public space.

2. Research objective and methodological approach

The scientific approach we have adopted is empirical-inductive. It is based on a multi-site synchronous case study (Hlady Rispal 2002) conducted from April 2019 to May 2019 in 22 French metropolises and concerning the territorial and political transformations brought about by digitized sports devices in the public space. Despite the innovative nature of this research objective, the aim is not simply exploratory. In accordance with the expectations of grounded theory (Glaser and Strauss 1967), this work pursues a twofold: Generalization and theorization. Indeed, the exhaustiveness of the sample we have investigated meets the traditional sampling criteria (Hlady Rispal op. cit: 64): *theoretical representativeness*, thanks to the homogeneity of the population (here, the metropolises) in terms of characteristics that are relevant to the research; *variety*, because these cases are not all at the same stage of the phenomena under consideration; *balance*, thanks to a variety of different situations; *potential for discovery* through the selection of cases that provide rich data on the phenomenon studied, with actors who are open to a process of in-depth investigation; *keeping the research objective in mind*.

The research was conducted in three successive phases of data gathering, fishing, and hunting, a method of public policy analysis explained by Padioleau (op. cit.). The *data gathering phase* enabled us to build a corpus of heterogeneous documents (scientific references relevant to the object of the research; Internet search, during the pre-research stage, for documents relating to dynamics of transformation of public spaces through the implementation of digitized sports devices and services, a time during which the researcher discovers and familiarizes him/herself with his/her object of study, with a view to assessing the state of knowledge on the theme studied (Martineau and Plard 2016)). The *fishing* stage consisted of scanning through articles published from 2009 to May 2019 in *Terrains de Sports*, a leading monthly journal for professionals of public sports management in France. Fewer than ten articles relating to digital

sports systems were identified, and none on the gamification of sport. This is an indication that these themes occupy a marginal position in public policy. Finally, *data hunting* consisted in conducting “*open and focused*” (Mucchielli 1994: 28) interviews aimed at providing an indication of the respondents’ understanding of the effects of the digitalization of gamified sports devices on the political and territorial transformations of urban public space.

The method chosen was that of the “*first breath interview*” (or first contact interview; Bongrand and Laborier 2005: 75), recommended when analyzing public action instruments. It enables the researcher to assess the interviewee's clinical reasoning on his/her activity: professional practice, conception of his/her own role, organization of his/her work with collaborators. The public actor verbalizes his/her representations of the modes of production and government of the research object so that the researchers can grasp them. “*Cunning*” and “*intuition*” guide the analyst (Bongrand and Laborier *ibid.*: 78), who is forced to collect heterogeneous, diffuse and non-exclusive data, using an interpretive approach whereby understanding practices and customs takes precedence over the meaning that the interviewees give to their actions (Lascoumes 1994). The interview guide was loose – as per the methodological recommendations regarding “*non-directive - active interviews*” (Mucchielli *op. cit.*: 30) - and was inspired by Chourabi's et al. (2012) eight elements of conceptualization of the intelligent city: management and organization; technology; governance; political context; persons and communities; economics; infrastructures; environment. The telephone interviews were conducted with the heads of metropolitan sports directorates (n=9) – which, in the absence of a dedicated metropolitan body, are either municipal (city center; n=4) or shared between the metropolis and the city center (n=4) - and were “*often informative rather than in-depth interviews*” (Bongrand and Laborier *op. cit.*: 78). Some of the respondents who, from the start of the interview, felt that they were at a loss, referred the authors to other administrative officials, which is a research result in itself. This first-hand data comes from 17 of the 22 French cities (Appendix; refusals to answer: 1; no responses despite several contact attempts: 4), i.e., a margin of error of 12% to be put into perspective, given the small size of the sample, for a 95% confidence level. In total, 20, often dense interviews lasting between 5 and 40 minutes (average: 21 minutes), were conducted by one author and transcribed by the other, representing seven hours of oral material originating from urban communities representing a total of 10,072,000 inhabitants in 2019 (15% of the French population).

This *in-situ* ethnographic investigation (Dodier and Bazanger 1997) aims to dissociate the data on the installation of digitized sports devices in public space from any contextual effect, “*in order to reach, from the outset, a universal human level*” (ibid.: 41) through the study of ordinary language. Drawing from empirical observations, the objective is to reveal regularities between facts and to deduce a spatially and temporally situated model, if not a general rule. Configured according to the specificity of the fields of investigation and of the research object (Perera & Beldame 2016), this methodology aims to analyze the gamification of digitized sports devices at a specific level of public action, that of French metropolises.

3. Metropolises as operators of digitized sports devices: a taxonomy attempt

The interviewer's introductory question (“*what actions is the metropolis taking to digitalize sport?*”) elicited hesitant responses (“*that's a good question... err... connected sport? (laugh)*”: Metropolitan Sports Directorate (SD)), categorical answers (“*we're not doing anything. (...) That's not on the agenda for now*”: municipal SD); “*there is no action at city level and the metropolis has no competence in matters of equipment and facilities*”) or astonishment, or even offended reactions (“*we don't do that! (...) The tasks are carried out by people and not by computers*”: shared SD). The further information provided by the interviewer made some respondents aware of the presence of digitized sports devices: connectivity of the Kindarena in Rouen [a multifunctional, modular and connected facility with 6,000 seats] as an “*object of vigilance because there are events that are not yet mature and are run by young leaders of big potential projects (...) [without there being] that many requests for it*”; online registration for municipal sports activities (two municipal SD; one shared SD)); computerized control of access to certain sports facilities; connected sports tracks; funding of an R&D program in a velodrome (timing; self-quantified tools). Feeling helpless on the subject, some respondents (two metropolitan SD) immediately referred the authors to colleagues specialized in digital technologies. A number of fruitful interviews took place, but they revealed a lack of shared culture between the administrative departments of the metropolitan organization concerning these digital sports devices.




Elsewhere, the latter seem to be better perceived and understood even when only “*sporadic actions in the form of metropolitan wellbeing/health workshops*” (metropolitan SD) are taken. In some cases, the city-center's action surpasses that of the metropolis where, it is said, “*there is nothing. No stadium management. A future swimming pool in relation to which we will have to work on the notion of connection*” (shared SD). Conversely, other respondents mention

ambitious metropolitan objectives (e.g. Clermont-Ferrand and Lille, metropolitan SD; Strasbourg shared SD). In Lyon, sport is part of a “*highly transversal smart metropolis approach*,” which has resulted in an “*atlas of sports facilities cross-referenced with practices, with open data, which is unique in France*,” in one-stop shops and e-ticket offices that promote collective mobility and facilitate access to events, or in a connected metropolitan PDIPR (Departmental Map of Short Hiking Trails). In Dijon (metropolitan SD), a respondent talked of a proactive strategy, adding that the smart city “*“On Dijon” is a global project, but sport is on the sidelines because we are ahead of the game*”.

These guided interviews reveal 71 local digitized sports devices. These 71 devices – the existence of which the interviewees became aware of during the interviews – were classified into thirteen main categories by the authors. Each category falls under one of the four stages of web marketing (Kotler et al. 2020), from which is inferred a continuum ranging from sport 1.0 to sport 4.0 (Spivack 2004), or even sport 5.0 (Kambil 2008), although no main category of devices falls under it yet. The cross-ordering of the main categories of devices and metropolises using Bertin’s matrix (Bonin et al. 1977) - which allows for the position of the rows and columns to vary - reveals a significant taxonomy (table 1).

Taxonomy of the main categories of digitized sports devices set up by metropolises according to the five web models

Main type of device	Sport 1.0 (web 1.0)		Sport	Sport 3.0 (web 3.0)				Sport 4.0 (web 4.0)			Sport 5.0 (web 5.0)			
	Datas	Ticketing	Online registration	Social networks	one-stop E-shop	Control (access, flow)	Sporting courses	E-sport events	R&D	Domotics	Connected sports facilities	Virtual Reality	Immersive offers	/
Metropolis														
Aix-Marseille														
Metz														
Grenoble														
Toulouse														
Strasbourg	X	X	X	X	X	X	X			X				
Orléans														
Bordeaux			X		X	X				X	X			
Toulon			X						X					
Tours														
Dijon														
Clermont-F.														
Rouen														
Lyon														
Lille														
Brest														
Nancy														
Saint-Etienne														

-  Municipal Sport Directorate
-  Shared Sport Directorate
-  Metropolitan Sport Directorate

Design and production: Chaboche and Schoeny

Source: personal survey.

None of the metropolises surveyed confines itself to one web model, and six combinations of the main categories of digitalized sports devices can be observed: 1.0 + 3.0 (Grenoble; Lille; Lyon; Metz; Nancy; Toulon; Tours), 1.0 + 4.0 (Aix-Marseille), 1.0 +2.0 +3.0 (Toulouse), 1.0 + 3.0 + 4.0 (Bordeaux; Dijon; Rouen), 2.0 + 3.0 + 4.0 (Saint-Etienne) and 1.0 + 2.0 +3.0 + 4.0 (Brest, Clermont-Ferrand, Orléans, Strasbourg). On average, each metropolis is engaged in four of the thirteen main categories of devices identified, often in a dispersed order, since Strasbourg ticks the first seven forms of digitalized sports devices in the table out of the eight that it runs. However, in three of the four metropolises that do not have any dedicated sports directorate, the city center is only involved in two main categories of devices, often linked to the so-called "traditional web 1.0" of the 1990s.

This model connects organizations that offer services to passive consumers in a one-to-many unidirectional approach, from supply to demand, by means of information portals and static websites with limited content controlled by the public actor for a linear, decontextualized, and affectless relationship with the user (Christiane 2012). The main types of systems related to this Web 1.0 are data, ticketing and online registration. Aqua Pôle, the e-digital portal of the Greater Nancy metropolis, provides information on the schedules, facilities and accessibility of six swimming pools. It also enables the user to “*book specific fitness, hammam and jacuzzi slots*”. In Tours, this type of digital architecture informs the metropolis’ services about attendance at its swimming pools thanks to Wi-Fi hotspots installed across the public space (bus shelters, public lighting). The “*online attendance and geolocation feedback*” from users activates a “*processing of mobility and flow management data (...) which boosts the image of the city*” (interview, Director of Economic Development). For example, by identifying lifestyle trends, these data have helped to plan a 90-unit luxury housing project in the context of the implementation of a local Wi-Fi network aimed at interconnecting 117 metropolitan sites and at processing their data with a view to informing decision-making and prescriptive perspective (interview, "Information Systems" director).

Cities with autonomous or shared sports directorates are adopting not only these digital sports systems but also other more varied and interactive ones, which stem from sport 2.0. This refers to the social web 2.0 model popularized in the early 2000s. It connects people and communities sharing content and interactions in a viral mode via social networks. Sport 2.0 takes the form of interactive interfaces (dynamic sites, blogs, web services, participative web applications such as Facebook for the metropolises concerned) which are customer-service oriented according to a "many to many" model, with a view to establishing a more segmented and distributed relationship. For example, in the case of the Clermont Auvergne Métropole, social networks activate “*commercial animations that accompany the spectator’s experience at the football stadium*” and “*applications to externalize private and community practices such as the trail challenges*” that this city organizes (interview, Metropolitan SD: director).

Since the 2010s, the semantic web of sport 3.0 has been scrutinizing web service usage data to profile individuals and anticipate their needs. For cities, the main types of devices identified aim to make physical activity and recreational sports more fluid (one-stop E-shop, flow control, R&D) and fun (connected sports courses, e-sport events). Connected permanently to the internet, according to a "many to one" logic, the “*conso-actor*” (Gentina 2016: 139) organizes his/her own content (e.g. serious games, social games). Customizable software and applications that can be downloaded onto a smartphone and activated via cross-media tools (e.g. QR codes) immerse him/her in augmented, virtual and/or mixed reality (Bekele et al. 2018). At the Bordeaux ice rink or the Kindarena in Rouen, anyone can play, shoot, and broadcast their own film via smartphone on a screen, in a striking evolution of collective entertainment which is now co-produced by public space and the user, which are connected to each other. Controlled and moderated, these devices democratize the practice – without the traditional performance objective necessarily being the focus – and constantly transform the atmosphere in public spaces, which have now become places of unusual digital experiences. And “*this live statistical information is a resource for the partners of the Kindarena, a business incubator*” (interview) connected to the spectator experience and operated as a public service delegation. To avoid being digital avatars of the franchised city (Mangin 2004)), these sports personal data acquisition platforms can be used by commercial third parties and therefore require vigilance on the part of public owners. Similarly, the Lille Metropolis provides access, via its “*network of connected streets*”, to “*physical activity circuits adapted to the movements and mobility of Internet users [and] suitable for individualized coaching*” (interview) in order to get closer to the user. Although actual access to these services is a matter of free choice (users can turn off

their connected device (phone, watch, etc.) whenever they want to) this contextual relationship is potentially invasive, as walking freely without constantly receiving digital input is becoming rare in urban public space, which is scattered with interactive Wi-Fi terminals that influence behavior.

Sport 4.0, a variation of the emerging smart web, promotes interaction between "individuals and (connected) objects"; it values the singularity of the user, proposes intelligent filters, and interconnects the real and the virtual. The user is attuned to his/her smart environment, according to a "one in many" model, in order to receive the right message at the right time in the right place. From this point of view, the main types of devices put in place by metropolises concern domotics, connected equipment and virtual reality and immersive offers. Those two types of system are close to Web 5.0 (the so-called emotional web), which has already been theorized but whose know-how has yet to be designed and produced. In setting up digital sports devices in the public space, cities are supporting private initiatives, engaging into public partnerships or implementing their own strategy. Whatever the approach adopted, the objective is to bring about territorial, political and organizational transformations.

In Saint-Etienne Métropole, for example, in pauperized neighborhoods "*where there are no [commercial] sports halls, [social] networks of sports enthusiasts - such as "Vammos.club" (a company that "designs and installs nomadic and connected sports clubs, thanks to a second-hand container" according to its homepage) - are the digital links streaming [workout] pods.*" Developed with public funds by 1D Lab, a "*smart-up [and] territorial laboratory for social innovation*" according to its homepage, these "*experimental sports mediation pods support integration, socialization through sport in neighborhoods and participative and immersive sports projects*" (interview) for associations and schools. Initiated by disadvantaged people and supported by the city as part of an experimental social and urban engineering approach, this "*interconnected project [adopts] a design thinking approach [centered on users through sustainable practices and action projects] towards sport and health in particular, [the activities] taking place in containers used as sports halls*" (interview) and in former industrial wastelands thus transformed into venues for physical activity and recreational sports.

In Brest, the city's director of sports indicates that it is mainly the direct "*political order*" that leads to using social networks to "*accompany a culture of recreation and sharing of digital entertainment*" situated at the heart of "*digital issues*" in the public space. This strategy is

activated within the Campus Sport Bretagne - a public interest group founded by the State and the Brittany Region, comprising fifteen other members including Brest Métropole, through the Liv-Lab Breizh Digital Sport. As a “*place of experimentation, it aims to reinvent sport for people most remote from its practice, namely, young people with a sedentary lifestyle, and/or from underprivileged neighborhoods or areas lacking in sports facilities (...) [by means of] virtual reality, connected sport, [to] gradually guide them towards a more traditional sports practice*” (Liv Lab Breizh Digital Sport 2018). These innovative and interconnected ecosystems constitute R&D incubators fueled by users' sports and recreational activities.

Dijon Métropole seems to be driving an autonomous strategy for the development of public space through digitalized sports devices. This strategy is aimed at human resource management (“*we are assigning more value to the role of security guards by increasing their skills*”: interview, Metropolitan Sport Directorate), assistance, control and sustainability (“*the PC Sports controls 95% of the equipment; for the past four years, we have been developing domotics for maintenance and to reduce energy costs*”: *ibid.*), user knowledge (“*we have databases on how the facilities are used, and combining sports and cultural data... with use that are shared between sports and culture, with a 10% reduction of HR costs*”: *ibid.*), intermediation (citizen portal for information on associations) and networking (connected interface between clubs). The objective of the public actor is to influence the management of local sports organizations to rationalize its partnerships with them. Thanks to the development of the local Wi-Fi network, other projects are envisaged: heritage enhancement through sport and health, urban courses connected via social networks, development of tourism, free access to sports facilities. Regarding the latter objective, however, progress seems to be hampered by a lack of transversality between departments (interview).

These initiatives preceded the "On Dijon" smart city, inaugurated in 2019 following the award of a contract to a consortium charged to build and operate a connected and centralized control center for the facilities of the 24 municipalities of the metropolis for twelve years, but excluding the sports facilities. The relieved sports director calls for “*channeling private intervention*” in the smart city. This transfer of big data and competence to the private sector could, indeed, reduce the smart city to a “*variant of the neoliberal city*” (Géoconfluences *op. cit.*) where the rise of governance by numbers (Supiot 2015) tends to diminish the role of politics.

The inclusion of digitized sports systems on the political agenda is uneven and varies according to the interest the elected representatives have in this issue. Very few of them had it on their

roadmap for the 2014-2020 electoral term. Many are now accelerating the pace on this front. In a metropolis of South-West France, for example, “*the city wants to further develop the fiber network to reinforce the work of the operators on the installations. (...) For outdoor and street workout activities, we don't want to further reinforce connectivity for the time being. A plethora of start-ups have developed a fitness coaching market and tend to privatize public space, sometimes arriving with 40 clients to the detriment of individual users, but we can't do anything to ban them. (...) There should be regulations, conventions and controls. We haven't got there yet. There is a risk of congestion and user conflicts. We are thinking about these digitized spaces and how to secure them. (...) But elected officials are putting pressure on us to do even more to respond to the demands of sports communities*” (interview) at the risk of losing control over public space. It is therefore necessary to complement this analysis of the development of digitized sports devices with an analysis of the effects of their gamification on the territorial and political transformation of public space.

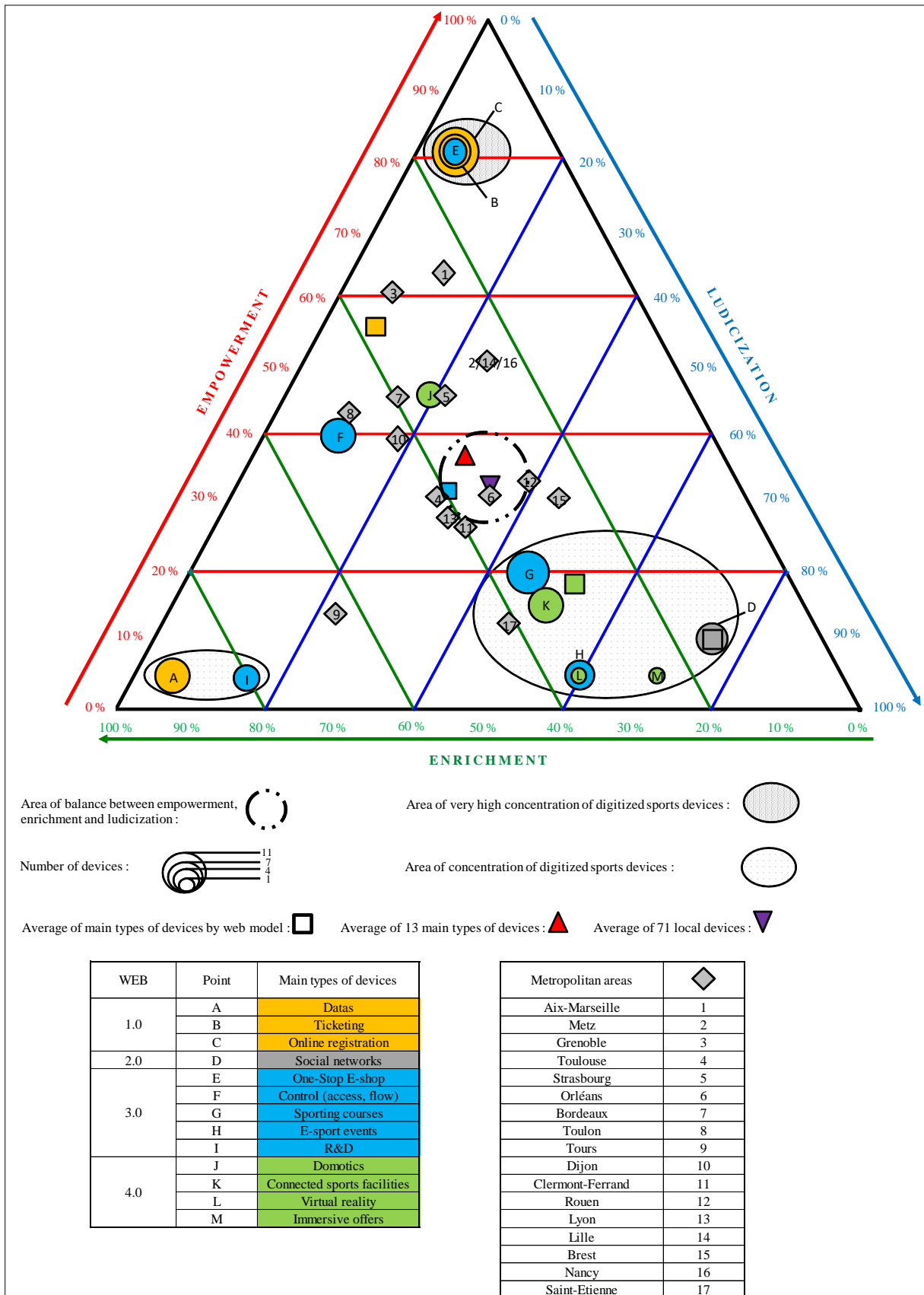
4. Modelling the gamification of digitized sports devices

This proposed taxonomy represents a “*“set of empirical data”*” (Bichindaritz 1995 (...)) *constituting [a] unit of analysis*” (Leplat 2002: 2). The qualitative analysis focuses on actors' discourses (Mucchielli et al. 1998) on the implementation of digitized sports devices (Paillé and Mucchielli 2016) to identify possible transformative effects on public space. These carefully recorded materials form a discursive whole (ibid.). Aiming at a joint construction of the study, and therefore at a “*cooperative process of transformation of points of view on reality*” (Foudriat 2014: 229), the authors discussed this discursive set and amended it by complementing it with documentary sources in order to analyze it from the angle of the gamification of sport. They then assessed the relative share of the three gamification markers (*empowerment; enrichment; ludicization*) in each of the thirteen main categories of devices and compared their results to establish a joint assessment. Within this epistemological and methodological framework, these “*qualitative statistical data*” (Paillé and Mucchielli op. cit.: 21-23) constitute secondary analytical data that informs on the overall meaning (Paillé 1997) of the gamified nature of each of the thirteen main types of devices that cover the 71 local devices identified during the interviews. These data were then computer-modelled on an Excel spreadsheet (Vaillé 2005) in the form of a ternary diagram, the design of which is explained below.

Each of the 13 main types of sport gamification system is characterized by the respective percentages of its three markers, the sum of which is invariably 100% (e.g., Web 1.0 'data' system = 5% (empowerment) + 90% (enrichment) + 5% (ludicization). As Vaillé, the designer

of the ternary graph, clearly specifies, each main type of system “*depends in fact on two [markers], which makes it possible to plot the points on a plane. But instead of using two orthogonal axes, the points are placed in an equilateral triangle so that the three percentages are represented*” (ibid.). By plotting the percentages of two out of three markers of a system on the diagram, its location point is automatically obtained by triangulation. Thus, these 13 types were positioned according to the average of their three markers for the 17 metropolises in order to determine the extent to which each system contributes to empowerment, enrichment and ludicization. Similarly, each metropolis was positioned on the diagram according to the respective average of the three markers of all the systems present within its area in order to profile each of them: for example, the metropolis of Aix-Marseille focuses much more on a strategy of empowerment (62.5% on average for the two main types of systems it is engaged in) than Saint-Etienne does (12.5% on average for four types of systems). This results in a cloud of points which is more or less concentrated from one sector of the diagram to the other and is significant and should be analyzed (Fig. 1).

Gamification of digitized sports devices in French metropolises



Design and production: Chaboche and Schoeny

Source: personal survey.

Interpretation of the triangulation:

- The position of point A “data” expresses a form of gamification of a main type of digitalized sports system that is very much linked to the enrichment marker (oblique green line). The empowerment (horizontal red line) and ludicization (oblique blue line) markers are almost absent.
- Grey diamond n°1 represents the average of the three markers of each form of gamification identified for the Aix-Marseille metropolis. It expresses a gamification process mainly linked to the empowerment marker (horizontal red line), while the enrichment marker (oblique green line) and the ludicisation marker (oblique blue line) are weakly and very weakly represented, respectively.

This ternary diagram allows us to analyze the gamification of the main types of digitized sports devices identified for each web model (sport 1.0 to sport 4.0), bearing in mind that the web 2.0 model must be considered with caution as it only includes social networks. Regarding the variation in the relative share of the three markers between the first four web models, that of enrichment does not exceed ten percentage points (web 4.0: 32.5%, web 1.0: 43%). Moreover, the fact that the share of this marker is always very close to the arithmetic mean of the three results from the technological nature of any digitized sports device. On the other hand, the relative shares of the empowerment and ludicization markers for each type of system vary greatly according to the models of digitized sport. The share of the empowerment marker falls from 55% (sport 1.0) to 17.5% (sport 4.0) while that of the ludicization marker rises from 5% (sport 1.0) to 50% (sport 4.0). The gamification of digitized sports devices set up by the metropolitan public actor therefore seems to be organized around a relatively fixed point, that of enrichment, while the other two markers often tend to be mutually exclusive. And incidentally, none of the main forms of digitized sports devices currently fall within the area of equilibrium of the three markers, at the barycenter of the ternary diagram, each with its own specificities:

- empowerment characterizes online ticketing and registration systems (web 1.0) as well as the one-stop e-shop (web 3.0). Their high concentration in the north part of the graph is due to the maturity of the technologies required, which are well mastered by the public operator and respond to contemporary urban consumption trends, which generally begin with an online search for information to support decision-making.
- On the other hand, in the south-east part of the graph, the most “*ludic*” forms of sport 3.0 (connected sporting courses; e-sport events) and sport 4.0 (connected equipment),

including those that are less widespread (virtual reality; immersive offers) and closer to Web 5.0, “a quasi emotive web that is more aware of your feelings” (Kambil op. cit: 4) are characterized by ludicization. Social networks are the most ludicized of these devices and enable the public actor to engage with users - under the guise of aiming to maximize their practice of sport - in a continuing and preferably shared relationship (the user then becomes an ambassador for the city), a relationship scripted, if possible, within the framework of so-called 360° communication strategies. These strategies are aimed at enhancing the image of the territory among residents by means of online mini-videos and, in so doing, at boosting its attractiveness, and are sometimes based on storytelling, as in Orléans or Tours.

- Finally, enrichment mainly concerns data, flow control (e.g., data on instantaneous attendance at a swimming pool) and R&D (e.g. Living Lab). Fueled by the observation of user activity, these systems are part of the economic intelligence and foresight work conducted by cities to secure, enhance, and transform individual and collective practices in public space with a view to ensuring service quality.

Beyond these differences between markers, the diagram indicates a result that was totally unexpected by the two co-authors: the averages of the relative shares of the three markers of each of the 13 main types of devices, on the one hand, and of the 71 local devices identified in the 17 metropolises, on the other hand, are almost at the barycenter of the figure. Six metropolises among those with the largest number of digital sports devices in the public space, are located in or very close to this equilibrium area. This surprising result is probably linked to the need for arbitration between demands for simplified and user-friendly practices and planning and management issues. This necessity leads politicians - who are more or less sensitive to the digitalization of sport but always seek efficiency - to balance their actions intuitively, empirically and through experimentation (Dumont 2015), according to the three markers of a gamification of sport that brings about transformations in public space that we shall discuss below.

Discussion and concluding remarks

The gamification of digitized sports devices in public spaces in metropolises accompanies a general trend towards a social, spatial, temporal or even financial liberalization of physical activities but does not fundamentally transform sports practices and recreational sports. These are considered “*in the broad sense of the various physical and bodily engagements, whether the*

outcome is well-being, health and/or more or less serious leisure (not excluding the search of performance” (Marchant et al. 2021). On the other hand, the cross-referencing between gamified devices and web models reveals the diversity of configurations of digitized public sports spaces (table 2).

Configurations of the public space digitalized by the gamification of sport

Public space	Sport 1.0 (Web 1.0)	Sport 2.0 (Web 2.0)	Sport 3.0 (Web 3.0)	Sport 4.0 (Web 4.0)	Sport 5.0 (Web 5.0)
Nature	Transactional	Community	Contextual	Personalized	Sensory/Emotional
Organizing principle	Order	Effervescence	Networking	Interconnection	Immersion
Political scope	Informative	Consultative	Concerted	Participative	Integrative
Planning logic	Proximity	Shared	Proxemic	Systemic	Symbiotic
Dominant use	Guided	Cooperative	Coordinated	Intelligent	Libertarian

Design and production: Chaboche and Schoeny.

Sport 1.0 extends the public space to the domestic bubble with an objective of *proximity*, or in other words, with the aim to bring sports activities "within a click's reach" of the user, in a purely *informative* manner. The public space is gamified by means of digitized devices promoting enrichment and empowerment by interpreting the data on the users' browsing activity on the local authority's website to better understand their needs and respond to them through a simple "question and answer" type of exchange. This characterizes the *transactional* nature of this public sports space. In the pragmatist perspective of Dewey and Bentley's political philosophy, the transactional approach to action and exchange gives rise to a partnership economy founded on “*the emergence of common worlds or 'shared knowledge worlds' [...] that allow for inter-comprehension*” (Dewey and Bentley 1949, quoted by Renault 2007: 142), the community acquires data on the user who, in turn, learns about the facilities and services it provides. This public space is governed according to a principle of *order* aimed at the acquisition of data as well as the availability, immediacy and clarity of information (e.g. ticketing; online registration) for the user, who is *guided* in his/her choices but is nevertheless

kept at a distance due to a lack of latitude with regard to devices that are totally controlled by the public actor.

In contrast with this technician and dehumanized model, the public space of sport 2.0 is gamified according to a "ludicized" social *community* principle. In the context of a centuries-old rise in individualism that calls for the creation of communities of belonging to compensate for the breakdown of social bonds observed by Tönnies (Lachaussée 2017), this social community approach is the result of new, more *cooperative*, *shared* and inventive practices promoted by the public actor in the form of posts, tweets, online consultations, online events or live broadcasts with a *consultative* value. However, its bustling activity on social networks seems to be met with indifference by users. At best, they read or view these vertical and politicized communication messages without generally "liking" them or even relaying them. While these communication messages help to structure communities (*Gemeinschaft*), they are not, in essence, intended to be addressed to everyone with a view to promoting society building (*Gesellschaft*). And yet, that is the essential objective of the public actor, according to Weber's distinction between community and society (Colliot-Thélène 2019). This explains why social networks are rarely used to promote the digitalization of public sports spaces and services.

To compensate for this lack of joint value creation between public actors and users, sport 3.0 favors a *contextual* approach "in which artificial intelligence is combined with human intelligence to create new insights" (Kambil op. cit: 2). The objective of the public actor is to facilitate a more relevant, timely and accessible practice for the user through a gamification of digitized sports devices in the form of e-sports events or connected sports courses or with the help of flow control mechanisms that enrich the public space and link it to a local network or the World Wide Web. This *networking* offers forms of *coordinated* use of public space between the metropolis and the user and is more ludicized than in sport 1.0. It gives rise to *concerted* action by the public player towards the stakeholders. This proxemic development of public space is based on multi-actor and multi-scale R&D partnerships involving digital incubators.

Sport 4.0 is practiced in a public space that can be *customized* by the user him/herself thanks to technological solutions often developed by living labs. These solutions allow for a more *participatory* relationship between the citizen and the design/evaluation (Benoit and Picard 2018) of his/her gamified practice in a primarily ludicized manner and make it possible to *smartify* an already existing space (domotics, connected equipment) or a space to be created

(virtual reality, immersive sports offers). This “*mobile space where users and real and virtual objects are integrated together to create value*” (Kambil op. cit.: 3) is organized according to a double *systemic* principle - characterizing the relationship between objects (e.g. a video screen in a connected sports facility) and their attributes (e.g. atmosphere) - and of *interconnection* - e.g. between institutions: during the World Sabre Cup in Orleans, the metropole broadcasts content (images, videos, data, refereeing) addressed to stakeholders (spectators, internet users, referees, officials, etc.) in streaming and in conjunction with the International Fencing Federation and the French Fencing Federation.

Finally, sport 5.0 originates from a digitized public space whose *emotional* and *sensorial* dimension will foster - according to a *symbiotic* and *immersive* logic already imagined in science fiction films such as Matrix - a *libertarian* sport practice. Under the pretext of integrating the human into the system following an *integrative* approach, it could quickly take a “*(libertarian) path to (transhumanist) servitude*” (Caré 2019) that those seeking to increase human capacities by means of chips and implants are already taking, which leads to the evasion of politics (Dévédec 2019). Transferring the management and control of public space to “*machines [whose ability to manipulate individuals must be] monitored [requires] that individuals determine, from now onwards, the ethical and regulatory limits that must frame the human-machine interfaces*” (Devillers 2019: 51-52).

On the surface, these configurations form a continuum from sport 1.0 to sport 5.0 in the making. However, a metropolis does not need to go through each stage of digitalized sport to give meaning to its action: Jointly running operations linked to sport 1.0 and sport 4.0 is neither an aberration nor an anachronism. Far from being mutually exclusive or from annihilating each other, these configurations complement, overlap or interpenetrate one another, following the combinations identified above. The joint analysis of these combinations reveals a fundamental trend that has been ongoing for over three decades, that of a public space transformed by the gamification of digitized sports devices. This gamification process favors the intuitiveness, and therefore the ease of use, of a public space whose connectivity makes it more intelligible and multiplies opportunities for physical activities and recreational sports. It also fosters a certain degree of docility on the part of the public space, which allows for a total adaptability of sports practices that are much less standardized than before in terms of place, time and action. Finally, it makes public space more plastic by opening it up to new functionalities, "the whole world [now] becoming a playground" (Hautmont 1987). This process helps to simplify and fluidify

physical activities and recreational sports in the digitized public space, whose malleability facilitates the co-construction of the practices that take place there between sport 1.0 and sport 4.0. These practices configure and transform it, in an ephemeral or more durable manner, into as many layers of superimposable public spaces, which the metropolises combine as they wish.

The gamification of digital sports devices remains a risk for politicians in view of the need for a high-performance technological, IT and energy infrastructure, on the one hand, and of social uses that are still unknown and require financial (what is the cost for users and taxpayers), safety, legal and digital regulation (e.g., what about users' personal data?) on the other hand, or even in view of the discrepancies between political objectives and users' uses. The Orleans connected night running course, whose lights come on automatically to increase the safety of users, is used mainly by walkers and cyclists during the day (Lompo 2018). This is probably why metropolises oscillate between being disinterested and proactive in the implementation of the gamification of sport, which is still in the realm of innovation and experimentation. The aims of this gamification are diverse and often extend beyond the framework of sports. Gamification is intended to respond to challenges related to the diversification of practices (health, well-being, leisure, etc.), the complexification of lifestyles and sports consumption (abolition of constraints in terms of time, space or level of sport proficiency to practice) and to the innovation through the provision of services to individuals (music, information, coaching, etc.) and to organizations (networking: electronic arbitration, etc.). In terms of public management, the gamification of sport also generates new human resources, communication, territorial marketing, or knowledge management (data collected and analyzed, partnerships...) solutions. The gamification of sport aims to improve the efficiency of public services through a quality approach intended to bring the user closer to the administration, and even to elected officials who are increasingly active on the Web. However, it is proving to be complex in terms of skills, cross-functionality and governance, because although the perception of the issues at stake is progressing, the know-how it necessitates has yet to be developed.

Thus, our work, based on a multi-site synchronous case study, has allowed for the production of a clinical reasoning by the interviewees - all of them public agents - concerning the action of the metropolises in terms of digitized sports devices. This method of first-hand interview (first-hand data collection through interviews) has the advantage of very quickly bringing out the words of situated actors concerning the operations they are undertaking or planning. It therefore suited the aim of the study, which was to analyze a particular form of public action, that of the

development of digital sports devices in public space, the gamification methods of which are being studied. However, it does not really allow for contextualizing the political and strategic meanings of these devices and their uses. It will therefore be necessary to complement this in situ survey - carried out on the ground by the authors without physically being there - with ethnographic surveys during which the authors will then share a space with respondents over a long period of time through their supervision of student theses or research contracts. The results of the survey have already revealed 71 digitized sports devices, identified, and described by the interviewees and then classified into thirteen main categories integrated into one of the five web models. A taxonomy of the main categories of devices implemented by the metropolises as well as a model in the form of a ternary diagram allow for a generalization through the characterization of the respective configurations of sport 1.0 to sport 5.0 in the public space. This constitutes a synthetic and original interpretation grid of the gamification of public spaces for digitized sport.

Digitized sports devices are currently being implemented in public spaces at paces and in ways that are specific to local political contexts and depend on the degree of interest the issue arouses. This offer responds less to a need for modernity - although it does of course partly respond to image-related issues - than to a need for faster, more fluid and user-friendly sports facilities and services in urban public space. These public initiative systems aim to satisfy the needs of users in an increasingly tailored manner. The least common, most innovative, and most 'ludicized' of those devices (e.g., virtual reality, immersive offers) are often co-constructed with the user through innovative and digitized Living Labs. This trend should become more widespread and contribute, in its own way, to the development of shared public space governance (Theys 2003). Already, a remarkable general balance can be observed between each marker of sport gamification. This indicates a desire on the part of public stakeholders to increase the autonomy of users and to add value to public space through more ludic uses with a view to establishing a relationship with the user that is less administrative than emotional. Thus, the gamification of digitized devices leads to different configurations of urban public space and constitutes an effective lever for its political and territorial transformation. These initial results – which fit within the theoretical framework provided by Habermas' (1978) founding work on public space, continued by Paquot's (2009) work and applied to the production of public sports and recreational space (Riffaud 2018) as a place for social transaction (Gibout 2009) – were obtained using a demanding methodological and theoretical apparatus and open up interesting avenues for future fundamental and applied research. Moreover, they can serve as elements for

analysis and decision support for any public or private operator interested in the gamification of digitized sports devices in the public space.

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Appendix

Metropole	Respondent
Aix-Marseille	Directorate of Sports, city center: director
Bordeaux	Directorate of Sports, city-center – metropolis: director
Brest	Directorate of Sports - Water sports, city-center – metropolis: director
Clermont-Ferrand	Directorate of Sports, Metropolis: director
Dijon	Directorate of Sports, city-center – metropolis: director
Grenoble	Directorate of Sports, city center: director
Lille	Directorate of Sports, Metropolis: head of Sports Policy Unit

Lyon	Directorate of Sports, Metropolis: director
Metz	Directorate of Sports, city center: director
Nancy	Directorate of Sports, Metropolis: head of sports and leisure facilities
Orléans	Directorate of Sports, city center: assistant Director
Rouen	Directorate of Sports, Metropolis: assistant Director
Saint-Etienne	Directorate of Sports, Metropolis: director Directorate for Higher Education, Research and Innovation: director
Strasbourg	Directorate of Sports - Water sports, city-center – metropolis: assistant director
Toulon	Directorate of sports and leisure, city center: director Directorate of Sports, Metropolis: director
Toulouse	Directorate of sports and leisure facilities, city center – metropolis: director
Tours	Economic Development Department: project manager Information Systems Department: head of IT and Digital Services

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