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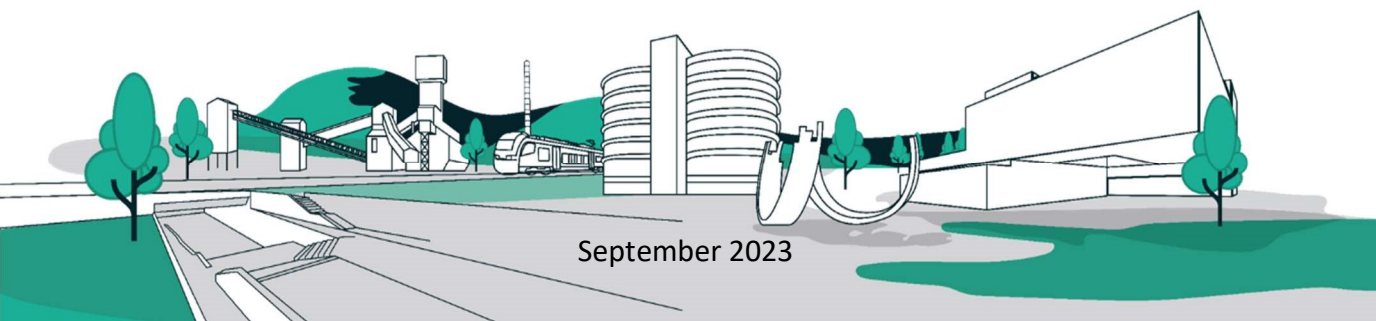
Improving Residents' Relationship to Public Urban Green Spaces in Precarious Districts

A Psychosocial Action Research Project

Doctoral Thesis submitted to the University of Liège, in partial fulfillment of the requirements for the Degree of Doctor in Psychology

Tania Noël

Under the supervision of Professor Benoit Dardenne

September 2023

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This thesis will be defended on September 14, 2023, before the following jury:

Dr. Christophe Blaison (University of Paris)

Pr. Fabien Girandola (Aix-Marseille University)

Pr. Anne-Marie Etienne (University of Liège)

Pr. Michel Hansenne (University of Liège)

Pr. Benoit Dardenne (University of Liège)

THESIS ABSTRACT

This Ph.D. work provides a comprehensive overview of psychosocial action research conducted within a multidisciplinary urban redevelopment project, aimed at improving the quality of life within the economically and socially precarious downtown area of Seraing (Belgium).

Public urban green space (UGS) interventions are recognized as cost-effective public health interventions, yet optimal implementation methods to maximize benefits and minimize side effects remain under-researched. Many UGS interventions focus their investments on the structural aspects of these spaces, neglecting to recognize the impact of more psycho-socio-environmental variables. Following the iterative process inherent to action research, this Ph.D. work examines the relationship between residents and UGSs to better understand how to implement effective UGS interventions in this specific area, while aiming to produce an analysis, based on theory and practice that can be applied to other territories experiencing similar urban challenges.

Action research remains a rarely used approach in social and environmental psychology (SEP) and is mostly considered as a heterodox idea. Therefore, this Ph.D. work has also to be seen as an attempt to field-test this approach. While it seems challenging to claim both a high degree of scientific validity and significant field impact, including some experimental methods in the process, makes this approach still appropriate in a project being primarily problem-focused.

This pilot project highlights the importance of moving beyond day-to-day urban management solutions, to a long-term perspective. This means taking the time to invest in a proper field analysis, where SEP has his place by allowing a better understanding of the issue before committing public funds to potentially ineffective or even counterproductive interventions.

RÉSUMÉ DE LA THÈSE

Ce travail de doctorat offre un aperçu complet d'une recherche-action psychosociale menée dans le cadre d'un projet multidisciplinaire de réaménagement urbain, visant à améliorer la qualité de vie dans le centre-ville économiquement et socialement précaire de Seraing (Belgique).

Les interventions sur les espaces verts urbains (EVU) sont reconnues comme des interventions de santé publique rentables, mais les méthodes optimales de mise en œuvre pour maximiser les avantages et minimiser les effets secondaires demeurent peu étudiées. De nombreuses interventions EVU concentrent leurs investissements sur les aspects structurels de ces espaces, négligeant de reconnaître l'impact de variables plus psycho-socio-environnementales. Suivant le processus itératif inhérent à la recherche-action, ce travail de doctorat étudie la relation entre les résidents et les EVU afin de mieux comprendre comment mettre en œuvre des interventions EVU efficaces dans cette zone spécifique, tout en visant à produire une analyse théorique et pratique, applicable à d'autres territoires confrontés à des défis urbains similaires.

La recherche-action demeure une approche peu utilisée en psychologie sociale et environnementale (PSE) et est souvent considérée comme une idée hétérodoxe. Ce travail de doctorat est donc une tentative de tester cette approche sur le terrain. Bien qu'il semble difficile de revendiquer à la fois une grande validité scientifique et un impact significatif sur le terrain, l'inclusion de certaines méthodes expérimentales rend cette approche cependant pertinente pour un projet principalement axé sur l'impact de terrain.

Ce projet pilote souligne l'importance de dépasser les solutions de gestion urbaine au jour le jour pour adopter une perspective à long terme. Cela implique d'investir du temps dans une analyse approfondie du terrain, où la PSE a sa place, permettant une meilleure compréhension des problèmes avant d'engager des fonds publics dans des interventions potentiellement inefficaces ou même contre-productives.

ZUSAMMENFASSUNG DER DOKTORARBEIT

Diese Doktorarbeit bietet einen umfassenden Überblick über eine psychosoziale Aktionsforschung, die im Rahmen eines multidisziplinären Stadterneuerungsprojekts durchgeführt wurde. Das Ziel war die Verbesserung der Lebensqualität im wirtschaftlich und sozial prekären Stadtteil von Seraing (Belgien).

Interventionen in städtischen Grünflächen (SG) werden als kosteneffiziente öffentliche Gesundheitsmaßnahmen anerkannt. Dennoch sind optimale Umsetzungsmethoden, die den Nutzen maximieren und Nebenwirkungen minimieren, noch wenig erforscht Viele SG-Interventionen konzentrieren ihre Investitionen auf die strukturellen Aspekte dieser Gebiete und vernachlässigen die Auswirkungen der eher psychosozialen und umweltbezogenen Variablen. Gemäß dem iterativen Prozess der Aktionsforschung, untersucht diese Doktorarbeit das Verhältnis zwischen Bewohnern und SG, um zu verstehen, wie wirksame SG-Interventionen in diesem speziellen Areal umgesetzt werden können. Dabei zielt sie darauf ab, eine Analyse auf Grundlage von Theorie und Praxis zu erstellen, die auf andere städtische Flächen mit ähnlichen urbanen Herausforderungen angewendet werden kann.

Die Aktionsforschung in der Sozial- und Umwelt Psychologie (SUP) bleibt ein selten genutzter Ansatz und wird meist als heterodoxe Idee betrachtet. Diese Doktorarbeit ist daher auch ein Versuch, diesen Ansatz in der Praxis zu testen. Obwohl es herausfordernd erscheint, sowohl eine hohe wissenschaftliche Validität als auch eine signifikante Feldwirkung zu beanspruchen, macht die Einbeziehung einiger experimenteller Methoden diesen Ansatz in einem primär problemorientierten Projekt dennoch relevant.

Dieses Pilotprojekt betont die Wichtigkeit, über tägliche städtische Managementlösungen hinauszugehen und eine langfristige Perspektive einzunehmen. Dies bedeutet, Zeit in eine gründliche Feldanalyse zu investieren, in der die SUP ihren Platz hat und ein besseres Verständnis der Probleme ermöglicht, bevor öffentliche Gelder in potenziell ineffiziente oder sogar kontraproduktive Maßnahmen investiert werden.

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Nancy, thank you for your expertise of course, but also and especially for your incredible patience and all the encouragement you gave me. This literature review has been so much more enjoyable thanks to you! And Marie, thank you since this review probably would never have been achieved without your help. Clara, even if the study we conducted is finally not part of this work, all the discussions we had contributed to shaping this Ph.D. work much more than you can imagine. Thank you for reminding me how beautifully exciting research can be when shared with passionate people. Of course, thanks also to you, Luc, for the "crash course" you gave me on the management of outliers! Many thanks also to all the students who contributed in any way to this project and to everyone who took the time to participate in the different studies.

Thanks also to all my wonderful colleagues from B32 or B33, from the university or the APTB project, from Belgium or France! Ninon, thank you for sharing the B32 hallway with me when I started this journey (and all the associated ups and downs!), and Coline, thank you for always welcoming me so warmly in your B33 office when I

LIST OF ABBREVIATIONS AND ACRONYMS

ACT	Affect Control Theory
AJ-Space	Theory of Affective Judgment in Spatial Context
APTB	A Place to Be-Come
EPA	Abbr. for the dimensions "Evaluation", "Potency" and "Activity"
EU	European Union
HS	Hotspot
PA	Place Attachment
PO	Psychological Ownership
SEP	Social and Environmental Psychology
SES	Socio-Economic Status
SLPPES	Service de lutte contre la pauvreté, la précarité et l'exclusion sociale (engl. Service to fight against poverty, precariousness and social exclusion)
UIA	Urban Innovative Action
UGS	Urban Green Space
WHO	World Health Organization
WP	Work Package

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION: HOW TO READ THIS DOCUMENT

This thesis is meant to be a complete overview of the psychosocial intervention carried out for the project "*A Place to Be-Come*", and is intended to serve as a final report. Therefore, this document is to be considered and read as a part of the overall, multidisciplinary project. However, it has been written so that it can be understood without knowledge of the actions of the other project partners.

The written structure was adapted to meet the funding requirements of the project, as well as to meet the requirements for the Degree of Doctor in Psychology. Therefore, the present document follows, in chronological order, the different stages specific to psycho-socio-environmental action research, while including research papers at some key stages of the process. **Chapter 1** presents the context and the objectives of the project, and introduces the methodology. **Chapter 2** presents the diagnostic and reconnaissance phases, highlighting the reasons behind the research question guiding the intervention, as well as setting the baseline of the indicators required for the evaluation of this intervention. **Chapter 3** presents the planning, acting and evaluation phases, providing the theoretical background that supports the intervention, developing its application in the field, and discussing the results. **Chapter 4** presents the monitoring phase, focusing on combining the results of the action research with the results of the research papers, before discussing practical implications based on the theoretical background. **Chapter 5** provides a more general discussion of the methodology used, its strengths and limitations. **Chapter 6** concludes the enoverall thesis project.

One main limitation of action research is that it takes place in a "real-world" environment, making it difficult to control many confounding variables. Therefore, chapter 2 and chapter 3 also include three research papers, presented in boxes, aiming to support the action research methodology at some key moments of the process. **Box 1** presents a paper intend to support the choice of the research question. **Box 2** presents a narrative review intend to a better understanding of the role safety perception can play in the present project. **Box 3** presents an experimental research and aims to allow a better analysis of the results of the field intervention. Papers are presented in boxes for easy reading and can be skipped without interfering with the reading of the rest of the present document.

CHAPTER 1: PROJECT OVERVIEW

1.1 Context of the project

The past 50 years have seen a rapid increase in urbanization rates all over the world (Ritchie & Roser, 2018). Presently, over 70 % of the total European Union (EU) population lives in urban areas (cities, towns, suburbs, and their surroundings), and this growth is set to continue in the upcoming years (UIA, 2022).

This rapid and massive urban development brings several complex social, economic and environmental challenges, many of which have an urban dimension (UIA, 2022). The most common challenges cities are facing can be grouped into 12 main topics: air quality, innovation and responsible public procurement, circular economy, integration of migrants and refugees, climate adaptation, jobs and skills in the local economy, digital transition, housing, energy transition, sustainable use of land, urban mobility and urban poverty (European Commission, n.d.).

Launched in 2016, the Urban Agenda for the EU aims to improve the way EU policies are designed and implemented at a local level by setting specific objectives aligned to these topics and, more importantly, a working method better adapted to cities and which takes urban stakeholders' opinion and practices into account (European Commission, n.d.). In the context of this Urban Agenda, the initiative "Urban Innovative Action" (UIA) was initiated by the EU to support urban authorities in their efforts to ensure sustainable urban development, by launching calls for proposals to finance innovative and sustainable urban solutions within these 12 themes, while fostering a bottom-up approach (UIA, 2022).

The project "A Place to Be-Come" (APTB), conducted under the UIA project call, was initiated as a result of various observations made in the city of Seraing, Belgium. Like most cities, Seraing presents several of the 12 issues highlighted by the European Commission, including the urban poverty challenge.

The beginning of this issue of urban poverty can be traced by looking at the history of the city. Seraing experienced significant growth through industrialization in the early 1800s (Verdin, 2020). Besides the coalmines, the steel industry (Cockerill) and the glass industry (Val-Saint-Lambert) had a direct impact on the economy of Seraing and its demographic expansion, mainly due to migration linked to this industrial development (Pasleau, 2001). The steel industry in Seraing ranked among the best in the world between 1890 and 1914 (Lemaire, 2017). This industrial development regressed however from the mid-1970s onwards (Verdin, 2020). Even though the

steel industry was placed under public ownership in 1978 (Accords de Hanzinelle), the situation continued to deteriorate (Verdin, 2020). The re-privatization from 1989 onwards, and the following restructuring plans, definitively signed the beginning of the deindustrialization (Verdin, 2020). The economic fate of Seraing being almost totally linked to its industries, the deindustrialization resulted in mass layoffs (Verdin, 2020).

In 2005, in response to this industrial decline and the associated economic and social impact, the city launched a *Master Plan* [1], an urban requalification action plan aimed at rebuilding a post-industrial city, attractive and generator of new professional opportunities (Ville de Seraing, 2016). In 2018, this urban requalification strategy shows some positive impacts in terms of infrastructure, public services, job opportunities and the urban landscape (Ville de Seraing, 2016). However, the economic and social impacts remain limited, especially for the most deprived population mainly concentrated in the downtown area (Ville de Seraing, 2016).

The APTB-Project focused on this still as economically and socially precarious considered downtown area (Fig. 1; Ville de Seraing, 2019), which encompasses the train station district and the Molinay district (± 6,000 inhabitants, i.e. about 10 % of the city's population).
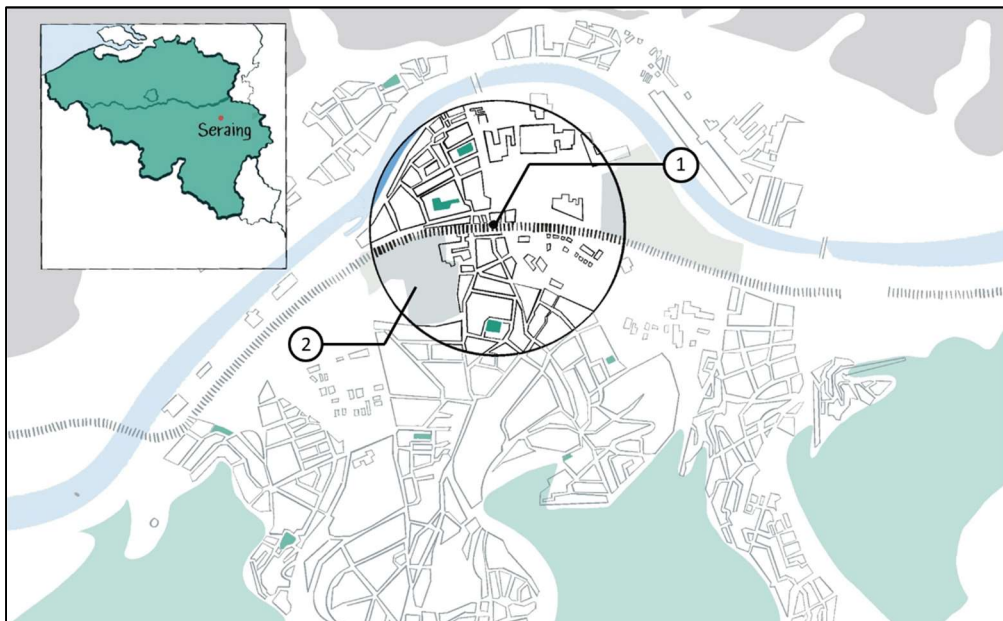
Figure 1. Localisation of the city of Seraing in Belgium and the project area in the city, with the train station (1), and the blast furnace (2), a trace of the historical past.

Hereunder, a few facts about the project areas cited in the application form written for the project (Ville de Seraing, 2019), and highlighting the urban poverty issue this district is facing:

- About 25 % of the inhabitants of Seraing receiving the social integration income (representing an income below the poverty line) live in this area. This part is rising by 10 % per year at city level. In comparison, Belgium counts 147,034 persons receiving RIS, which represents less than 2 % of the Belgian population (SPP integration sociale, 2020).
- In just two years, from 2015 to 2017, the number of visits to the day shelter increased from 6500 to 8748.
- From 2015 to 2017, the number of visits to the social restaurant increased from 5575 to 7420.
- Also highlighted in the application form of the project, is the high number of recorded antisocial behaviors and crimes in the district, and the associated safety concern.
- Finally, yet importantly, the application form put the accent on the scarce access to UGSs within the project area.

1.2 Objectives of the project

Most of the problems seen in urban contexts are complex and often make technical or political solutions insufficient. What is currently happening in the project area shows that physical investments do not automatically reduce poverty nor improve the quality of life in the target district, which is representative of the complexity of regeneration projects of deprived neighborhoods (Ville de Seraing, 2019).

Therefore, the challenge is to ensure that the urban requalification (or redevelopment) strategy benefits everyone including the most socially and economically deprived groups of inhabitants, which also means ensuring that gentrification [2] is avoided. Given this complexity, several partners were involved in the present project, working towards a common objective within different work packages (WP). The first two WPs focused on general project management and the overall communication strategy. The other WPs focused on three types of intervention and combined place-based and people-based approaches.

- *AXIS 1 - Nature-based technical training (WP4):* improving competencies of specific target groups;
- *AXIS 2 - Citizenship and soft skills development (WP5):* experimental and iterative approaches derived from cognitive and behavioral psychology, to improve the relationship between residents and their local environment;
- *AXIS 3 - Planning for and with residents (WP6):* innovative participatory design processes aimed at taking advantage of shared spaces for supporting the social, economic & environmental development of the central station district.

The project methodology is designed to trigger a process of social, human, economic and entrepreneurial development, together with the improvement of the urban environment. In response to the priority challenge to make urban regeneration benefit all, the main objective of this project is to decrease social exclusion and create quality spaces for all.

This Ph.D. work is part of the *Work package 5 – Citizenship and soft skills development* (WP5) and aims at a better understanding of the relationship between residents and their local environment, to make this environment a resource that contributes to the quality of life within the territory of Seraing. Centered on the human factor, and more specifically on the relationship between an individual and his environment (Joule et al., 2015), the role social and environmental psychology (SEP) can play in addressing these objectives can easily be understood.

1.3 Action research in social and environmental psychology

To be eligible for the UIA funding, submitted projects have to meet certain criteria such as being innovative (i.e. the project has never been implemented anywhere else and is therefore experimental), measurable (i.e. the project defines measurable and quantifiable indicators of results) and transferable (i.e. the project addresses an urban challenge which can be relevant to other European cities). These criteria have to be respected while focusing on the previously identified main objective (see section 1.2., p. 6), with an impact-oriented approach.

Initially, theories from social and environmental psychology (SEP) are intended to apply to the social world outside a laboratory, in open systems (Simon & Wilder, 2018). However, for a long time, a distinction has been made between laboratory experimental SEP (i.e. fundamental research), field experimental SEP (i.e. applied research), and action-research SEP.

Fundamental SEP research (also called "basic" research by some authors) aims to discover relationships between social variables and to test hypotheses derived from theories of social behavior (Simon & Wilder, 2018). Applied SEP research then uses these empirical findings and derived theories to address social problems outside the laboratory (Simon & Wilder, 2018). Finally, action research in SEP necessitates a collaborative approach between the researcher, who possesses a theoretical and methodological background, and the targets of the investigation, to address a social issue (Simon & Wilder, 2018, p. 2).

In this pilot project, there are by definition many unknowns, and we have no expertise concerning the territory in which we have been asked to intervene. With this in mind, to claim the impact-oriented approach required by the UIA funding, action research seems to be the most suitable methodology for the present project.

The action research methodology allows for bringing together theory and practice, in the pursuit of practical solutions to specific field issues (Reason & Bradbury, 2001). This approach works towards practical outcomes while allowing to enhance theoretical understanding (Reason & Bradbury, 2001). To be qualified as research action, the methodology needs minimal requirements, namely (Peters & Robinson, 1984):

(1) being problem-focused;
(2) showing some form of collaboration between researchers and their participants;
(3) consisting of a systematic series of procedural steps.

These steps follow a cyclical process consisting of clearly defined study phases: diagnosing, reconnaissance, planning, acting, evaluation, and monitoring (Ivankova & Wingo, 2018; Lewin, 1948). These phases follow one another sequentially within a cycle, while also interacting with one another in multiple ways (Fig. 2), depending on the study purpose and the need for action/intervention (Ivankova & Wingo, 2018; Lewin, 1948).
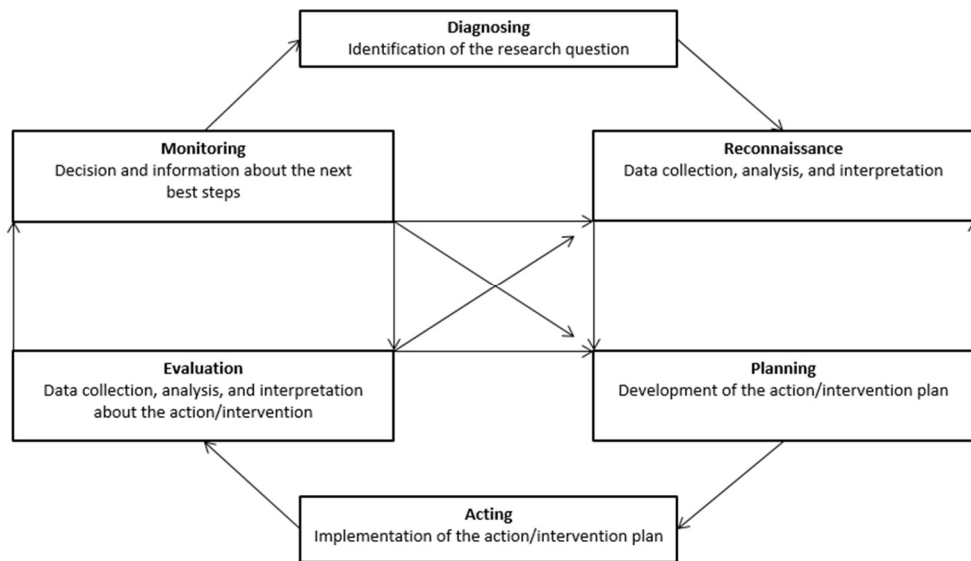
Figure 2. Action research framework (inspired from Ivankova, 2015).

As previously mentioned, action research is to be distinguished from laboratory and field experimental SEP (Simon & Wilder, 2018). Experimental SEP takes place in close systems like laboratories or highly controlled environments and aims to find causal networks, whereas action research takes place in real-world open systems and primarily focuses on solving a particular problem at a specific point in time (Simon & Wilder, 2018).

Even if experimental SEP and action research in SEP have fundamental differences in their approach to research, they gain to be seen as complementary (Simon & Wilder, 2018). Not only can action research be seen as a proving ground to test predictions from social psychology theories, but can also be used as a source of ideas (Simon &

Wilder, 2018). A notable difficulty in experimental SEP is that researchers have to know in advance, which extraneous variables need to be controlled; a closed system is always at risk of being influenced by extraneous variables that have not been properly taken into account, thus invalidating any causal interpretation (Lynd-Stevenson, 2007). Action research can therefore serve to identify these variables and their interactions, and therefore can help generate new hypotheses and observe how theory plays out in real-time situations (Simon & Wilder, 2018). The other way around, action research also benefits from being nourished by experimental psychology, whether by incorporating experimental findings and theories to approach specific field problems or by being inspired by methods used in experimental SEP (Simon & Wilder, 2018).

For quality impact-oriented psychology, it would therefore be of interest to combine action research with laboratory experiments and methods. Combining both approaches allows to test the relevance of the causal-based laboratory findings with the outside world, and yoking action research to experimentation enhances generalizability (Simon & Wilder, 2018).

In this Ph.D. work, it has therefore been decided to use the action research methodology, which allows for developing a better understanding of the territory we were working on while being problem-focused. However, as recommended by some authors and to meet the criteria of transferability, the intervention tried to include experimental methods as much as possible, and included more controlled studies at some key stages of the process.

CHAPTER 2: DIAGNOSTIC AND RECONNAISSANCE PHASES

2.1 Diagnostic phase

2.1.1 Research question

Considering the action research methodology, the first step consisted in formulating the research question. This research question was determined both by scientific literature and by the specificities of the project and therefore depended, concurrently, on a literature review and regular interactions with the project area, the project population and field experts.

The main objective of the WP5 was to improve residents' relationship to their local environment. To conceptualize the problem and to help formulate the research question, it is necessary to specify all concepts, i.e. the population, territory and relationship. These concepts were defined in accordance with the objective formulated for the UIA funding.

Residents. All people living in the project area (i.e. within the 800 m perimeter around the train station) are considered as the target population. People who regularly attend the area, but do not live there (e.g. people who attend the area for professional reasons) are not considered as a target population.

Territory. The project area covers a radius of 800 m around the train station, this encompasses the main deprived areas of the city of Seraing. This represents, however, a territory too large to allow specific interventions. In addition, urban areas are made up of many different living spaces (e.g. private and public spaces, residential areas, recreational areas, road networks, pedestrian precincts...), not all of which are of equal public health/social justice interest. Based on a literature search and considering that these areas are of particular interest in projects taking place in deprived neighborhoods, it was decided to focus the intervention on public UGSs. For the justification of this choice, see point 2.1.2, pp. 13-17. The project areas, also called downtown area by inhabitants, includes 3 main UGSs: the Bernard Serin Park, the Marêts Park and the Morchamps Park (Fig. 3 and Fig. 4).
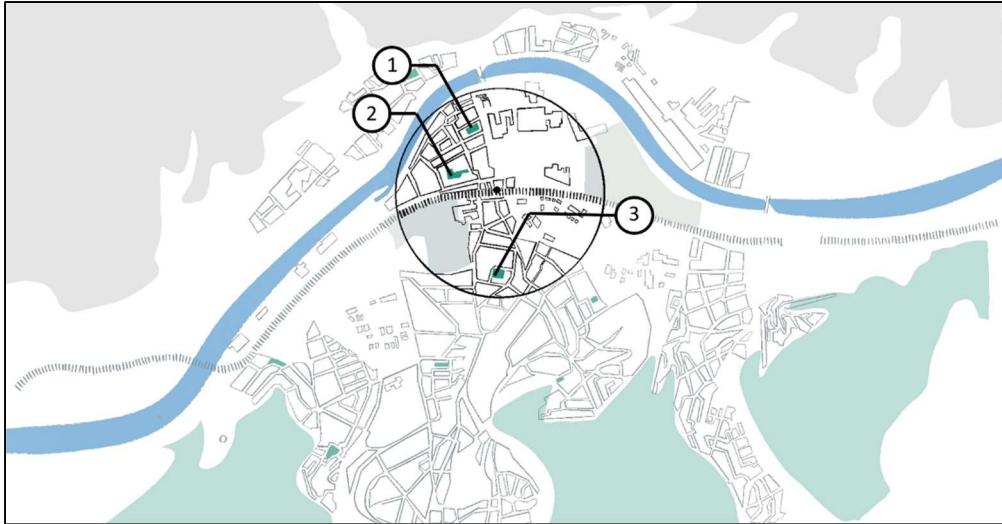
Figure 3. Localisation of the project area in the city, including the Bernard Serin Park (1), the Marêts Park (2) and the Morchamps Park (3).

Figure 4. Pictures of the three UGSs, i.e. the Bernard Serin Park (1), the Marêts Park (2), and the Morchamps Park (3).

Relationship. A relationship refers to a connection or involvement between two or more targets (Cambridge Dictionary, n.d.), and can be conceptualized in different ways. A relationship can therefore represent a rather emotional involvement (e.g., emotional attachment to the place), as well as an involvement of time, energy, or any other type of resource. In the present project, the relationship was chosen to refer to the involvement through the investment of time and was conceptualized in terms attendance rate of the target UGS. This choice was made because it allows a measurement of the exposure to the target UGS, which provides physical, psychological and social benefits (see point 2.1.2, pp. 13-17). Attendance measures can be objective (e.g. observed UGS attendance) or self-reported (e.g. based on visit surveys). Both kinds of measurements were included.

Given the definition of the different concepts, the research question that guided the diagnostic and intervention phases was formulated as follows:

"*How to increase public UGS attendance by inhabitants of the project area?*"

In order to delve deeper into the reasons that raised the research question, section 2.1.2 will provide a better understanding of the importance of focusing on public accessible UGSs and on their attendance rate in projects concentrating on deprived neighborhoods, public health and social justice. This section will also present a cross-sectional study conducted as part of this project and intended to support the choice of the research question (Box 1, pp. 19-50).

Given the importance the city administration attached to safety issues, section 2.1.3 will briefly discuss important aspects to be considered when including safety perception in projects trying to enhance nature exposure and the possible role it can play in UGS attendance. The narrative review included in this section (Box 2, pp. 55-97) will develop this reflection even further.

2.1.2 Urban green space attendance, public health and social justice

A growing body of research suggests that nature exposure is associated with many health benefits (e.g. Braubach et al., 2017; Jimenez et al., 2021; Lackey et al., 2021; Reyes-Riveros et al., 2021; Twohig-Bennett & Jones, 2018). Throughout this work, the notion of health refers to the definition given by the World Health Organization (WHO) and therefore encompasses physical, mental and social aspects, and can be seen as a state of complete physical, mental and social well-being (WHO, 2022). Physical health benefits of nature exposure range from reduced diastolic blood pressure, salivary cortisol, and heart rate, to a decrease in the incidence of diabetes, cardiovascular and all-cause mortality (Twohig-Bennett & Jones, 2018). Psychological benefits range from decreased depression, anxiety, and stress state rates (Taniguchi et al., 2022), to affective benefits like a decrease in negative emotions and an increase in well-being and positive emotions (Bratman et al., 2021), while passing through an improvement of social connections and prosociality (Goldy & Piff, 2020 – see also Box 1, pp. 19-50).

Presently, more than half of the world's population lives in urban areas, a number that has continually grown over the past 50 years (Ritchie & Roser, 2018). In Wallonia (the region of Belgium where the project area is located), 49.1% of the population lives in an urban area (IWEPS, 2019). In urban areas, nature exposure can be mainly done through semi-natural spaces, also called urban green spaces. To date, there is no consensus regarding the definition of UGS (WHO Regional Office for Europe,

2016). The UGS included in studies encompass a large variety of sometimes very eclectic urban greenery settings, ranging from parks to other open spaces like (semi)private gardens and roof gardens, woodlands, playgrounds, non-amenity areas such as roadside verges etc. (WHO Regional Office for Europe, 2016).

In the present work, an UGS is considered as any delimited outdoor space with a recreational or leisure purpose, containing vegetation and located in an urban area, accessible to the public without any admission fees or other entrance restrictions.

Many benefits associated with nature exposure seem also to be found with exposure to semi-natural spaces, like UGSs (Reyes-Riveros et al., 2021; Sugiyama et al., 2018; WHO Regional Office for Europe, 2016). These benefits include, non-exhaustively: improvement in mental health and cognitive functions, decrease in cardiovascular morbidity and type 2 diabetes, improvement in pregnancy outcomes like birth weight, and decrease in overall mortality (WHO Regional Office for Europe, 2016).

Although there does not seem to be a consensus at this time (Markevych et al., 2017; Mears et al., 2020; Zhang et al., 2020), several hypotheses have been suggested to explain the direct and indirect effects of UGS exposure on health. These pathways have to be seen as not mutually exclusive and, more than likely, as interacting (WHO Regional Office for Europe, 2016). Pathways linking UGSs to health are generally explained through (Mears et al., 2020; WHO Regional Office for Europe, 2016):

(1) the mitigation of harmful results (e.g. decreased exposure to air/noise pollution and localized reduction of heat),
(2) the restoration of depleted capacities through the reduction of stress, the increase in positive emotions and the facilitation of recovery from attentional fatigue, and
(3) the building of physical and social well-being by increasing physical activity and social interactions

Despite the growing body of research about UGS exposure and health, there is comparatively little evidence about which specific characteristics of UGSs (e.g. quality, size, accessibility, facilities, "greenness"-perception) are linked to which specific health outcomes and which level of exposure or interaction is needed to maximize the impact.

Regarding the link between specific UGS characteristics and health outcomes, the perception of UGS accessibility (e.g. proximity to home) and quality (e.g. maintenance) are probably the most studied characteristics. Studies mostly show that an increase in accessibility and quality perception is linked to increasing UGS

attendance and improvement in health outcomes (WHO Regional Office for Europe, 2016; Wood et al., 2017). In a systematic review, Reyes-Riveros and colleagues (2021) showed that a higher number and a larger size of UGSs, but also biodiversity and naturalness rates, improved people's physical, psychological and social health.

Besides the structural aspects of UGSs, the way people interact with these spaces will also affect the nature-health relationship. Some research suggests that people do not have to spend a lot of time in nature to get some benefits out of it, and that the "minimum dose of nature" to see some results is relatively small. As little as 10 min of sitting in or looking at nature may already have a significant and positive impact on some psychological and physiological markers of well-being, like for example the decrease of the heart rate and of cortisol levels or the improvement in mood (Meredith et al., 2020). This is consistent with studies showing that even exposure to indoor nature (i.e. house plants, photos or videos, or a view through a window) can improve mood, feeling of comfort, or even task performance and attention (Mcsweeney et al., 2015). More recently, a study showed that 6 min of outdoor nature exposure and 6 min of exposure to a 360-degree virtual reality nature video both significantly increased physiological arousal and restorativeness compared to an indoor setting without nature, while controlling for demographic characteristics and participants' personal preferences (Browning et al., 2020).

However, some studies also found no significant relationship between natural settings availability and health (in this case, mental health), but a significant relationship between natural settings attendance and health (Triguero-Mas et al., 2017), suggesting that interacting with the environment is still important, at least for some health outcomes.

In any case, as for many health behaviors, to obtain more important and long-lasting effects, the key will probably be regularity. In a cross-sectional study analyzing data from an 18-country survey, the positive significant association between nearby green settings and positive well-being disappeared when the frequency of visits was controlled (White et al., 2021). The frequency of recreational visits to green spaces in the last 4 weeks was positively associated with positive well-being and negatively associated with mental distress (White et al., 2021). To date, there is no real consensus on the "minimum dose of nature" and the type of interactions needed to see some beneficial effects of nature exposure. In this sense, it seems judicious to favor real-life nature exposure (rather than virtual exposure or exposure through pictures), as regularly as possible.

Finally, yet importantly, individuals' socio-economics also interact with the nature-health relationship. There seems to be accumulating evidence suggesting that UGS may be "equigenic" (Mitchell et al., 2015), i.e. that the "UGS exposure-health benefice" relationship may be stronger among low socio-economic status (SES), as opposed to high SES groups. According to Mitchell and Popham (2008), health inequalities related to income deprivation in mortality from circulatory diseases, but also all-cause mortality, are lower in populations living in the greenest areas. Based on large-scale medical record data giving the annual prevalence rates of a variety of diseases, analyses also suggest a more important relationship between the amount of green space in people's living environment and a bunch of different diseases (e.g. coronary heart disease, depression and anxiety disorder, asthma, migraine, diabetes) for low SES groups (Maas et al., 2009). Some findings also suggest that the relationship between UGS access and reduced mortality can only be observed in the most deprived areas (Lachowycz & Jones, 2014). Another study showed that if "social characteristics" of UGSs (i.e., place belonging, levels of neighborhood trust, loneliness) ranked most highly as predictors of general health for white British people, the quality of, access to and actual use of UGSs were significant predictors of general health for low SES groups only (Roe et al., 2016). More specifically, in a study evaluating the associations between surrounding greenness and pregnancy outcomes, an increase in 1 interquartile range greenness was associated with a statistically significant increase in birth weight and a decreased risk of low birth weight, with a stronger association among low SES groups (Agay-Shay et al., 2014). A previous study showed similar results, with a significant increase in birth weight only amongst low SES groups with more surrounding greenness (Dadvand et al., 2012). For mothers-to-be, higher residential greenness seems to be linked to a reduced likelihood of depressive symptoms, especially among more disadvantaged groups (McEachan et al., 2016). Concerning mental health, studies also suggest that interacting with natural settings is associated with better mental health, with a stronger relationship for low-educated groups (Triguero-Mas et al., 2017; van den Berg et al., 2016). The fact that UGSs seem to have the potential to reduce health inequalities makes these environments essential parts of resilient communities and particularly interesting in public health and social justice interventions. These spaces should therefore be fairly distributed, and accessible to everyone.

If the benefits linked to UGS exposure or attendance, as well as the relevance of these places to public health and social inequalities reduction, seem to be mostly accepted, the access to such spaces still is unequal. Academic evidence increasingly highlight their unequal distribution between low- and high SES neighborhoods. If

findings seem inconclusive concerning UGS proximity, low SES neighborhoods almost consistently have access to less UGS acres, which also usually appear to be of lower quality and maintenance, and less safe (Rigolon, 2016; Rigolon et al., 2018; Williams et al., 2020).

Belgium is no exception to these observations, as related in the biennial reports from the "Service to fight against poverty, precariousness and social exclusion" (SLPPES, 2019, 2021). In Belgium, as elsewhere, green spaces are increasingly under threat, partially explained by the urban extension and the increase of artificial land (i.e. land that is no longer in its natural state, whether or not it is built on and whether it is paved or not; IWEPS, 2019). Low SES groups are the most affected by this lack of UGSs (SLPPES, 2019). Due to problems related to spatial planning, public places' [3] privatization [4], social barriers, etc., the poorest populations have little or no access to UGSs in Belgium, even though these spaces are managed and maintained with public funds (SLPPES, 2019). These public UGSs are all the more important for these populations, given that they can generally only rely on public UGS for regular nature exposure, as they rarely have access to private green spaces, like gardens, balconies, or rooftops (SLPPES, 2019). In addition, it seems that many social housings (French: logement social) suffer from prohibitions of flowering the façades, growing vegetables on the balconies, or creating common gardens on parts of the lawns (SLPPES, 2019), thus removing the rare opportunity to introduce nature into the direct living environment. The COVID-19 pandemic has brought this lack of access to UGSs for low SES groups back to focus (SLPPES, 2021).

In summary, the health benefits of nature, and more specifically of semi-natural settings such as UGSs, seem mostly accepted. The fact that UGSs have the potential to reduce health inequalities makes these spaces particularly interesting for public health, but also for social justice interventions. Interacting with these spaces, for example through regular attendance, seems to be a safe way to take advantage of the benefits. However, access to UGS is still unevenly distributed across the population, with low SES groups having the lowest access to safe and high quality UGS. This also applies to Belgium.

2.1.3 Urban green spaces as resilience infrastructures

Meaningful and high-quality relationships with others are strongly linked to happiness, well-being, and overall health (Diener & Seligman, 2002; Kemp et al., 2017; Quoidbach et al., 2019). Our relationships with others and our social network are often considered an important component of an individual's social capital [5] (Durante et al., 2023).

During time of crisis, such as the COVID-19 pandemic we faced in early 2020, people's social capital becomes even more important. Social capital is an important factor in building resilience and overcoming crises since it provides resources, information, moral support, and fosters positive recovery processes (Beggs et al., 1996; Granovetter, 1973; Nakagawa & Shaw, 2004). There is also good evidence to support the idea that social capital predicts better health, both physical and mental (Ehsan et al., 2019), and that social capital can act like a buffer on socioeconomic health inequalities (Uphoff et al., 2013). Social capital is therefore an important aspect to consider in public health and social justice interventions.

Adopting prosocial behaviors to assist others is a potential means to create, maintain, and strengthen social connections, ultimately improving our social capital (Helliwell et al., 2017). Prosociality, i.e. the tendency to care for and help others, can be directly influenced not only by people's social environment (i.e. other people), but also by the relatively "asocial" natural environment (Goldy & Piff, 2020). Various experimental studies suggest that exposure to nature can boost prosociality. For example, a field experiment showed that individuals who walked across an UGS were more likely to help someone who dropped a glove than those who were tested before entering the UGS (Guéguen & Stefan, 2016). Another study found that sitting in an UGS, as opposed to a windowless laboratory room, increased feelings of interconnectedness (Neill et al., 2019). Even incidental exposure to nature in a lab, such as looking at pictures of natural environments instead of urban ones, can enhance prosociality (Weinstein et al., 2009).

If exposure to nature can increase prosocial behaviors and if these behaviors contribute to the creation and maintenance of an individual's social capital, a good predictor of health and acting like a buffer on socioeconomic health inequalities, it is easy to understand the importance of considering UGSs as resilience infrastructures in social justice interventions.

> **Box 1 (pp. 19-50) presents a paper dealing with the nature/health relationship in time of the COVID-19 pandemic, focusing on UGS attendance and prosocial behavior. The study intends to support the choice of the research question.**

PAPER 1
Relationships between Green Space Attendance, Perceived Crowdedness, Perceived Beauty and Prosocial Behavior in Time of Health Crisis.

Tania Noël [1], * and Benoit Dardenne [1]

1 Psychology and Neuroscience of Cognition Research Unit, University of Liège, Belgium;
   tania.noel@uliege.be; b.dardenne@uliege.be
* Correspondence: tania.noel@uliege.be

ABSTRACT

An emergent body of evidence shows the impact of exposure to nature on prosocial attitudes and interpersonal relationships. This study examines relationships between green space (GS) attendance, perceived beauty of the space, perceived crowdedness of the space and prosocial behavior. A cross-sectional study with snowball sampling has been conducted in April 2020. All participants (N = 1206) responded to an online survey that included a French version of the social value orientation slider measure (used as a proxy for prosocial behavior), questions about the lockdown, and their GS attendance. After retaining only participants who had visited a GS at least once since the beginning of their lockdown (N = 610), multiple linear regressions showed that social orientation scores demonstrated associations with the interaction between GS attendance and perceived crowdedness of the GS, suggesting that attending low crowded GS is linked to increasing prosociality. These results provide insight into the roles that GS can have during a health crisis and suggest some practical implications.

INTRODUCTION

Human society and cities suffer from various crises at any time, including pandemics like the H1N1 virus, polio, Ebola, or Zika, which we face in the current century. In early 2020, the COVID-19 pandemic was declared a public health emergency of international concern by the World Health Organization (WHO), WHO's highest alarm level [1]. If pandemics have always existed, their occurrence keeps growing, and the explanation possibly lies in the environmental crisis we are currently experiencing. Studies show that the diversity of human pathogens among nations is positively associated with biodiversity, i.e., the diversity of wildlife species [2]. The loss of biodiversity in ecosystems creates the general conditions favoring and making possible disease pandemics such as COVID-19 [2–4]. A lot of factors, for example, deforestation or poorly regulated agricultural surfaces, contribute to altering the composition of wildlife communities, significantly increase the contact of humans with wildlife, alter niches that harbor pathogens, and increase their chance to come in contact with humans [3]. We probably have to be prepared for other pandemics in the next coming years. In the current context, it is important to reflect on how to improve our capacity to deal with such crises, while considering that solutions have to be sustainable, i.e., that they consider both human and environmental aspects. In this study, we would like to highlight the potential of publicly accessible urban green spaces (GS) to help face the consequences of crises such as pandemics. Public urban GS consist mainly of semi-natural areas, referring in the present study to any vegetation found in the urban environment, accessible to everyone without restriction (e.g. parks, playgrounds, walking paths, yards, plazas, peri-urban forests, road and rail networks, and their associated land, etc.). While previous studies seem to show that GS attendance is linked to an increase in prosociality, partially explained by the perception of the characteristics of the space itself [5], the present study takes place in the very particular context of a health crisis. Therefore, we not only focus on the link between GS attendance and prosociality by including perceived physical characteristics of the space as it has been designed or maintained (i.e. perceived beauty) but also by taking into account more "social" characteristics of the space by including the perception of crowdedness. This variable has not yet been included in studies investigating the link between urban GS and prosocial behavior to the best of our knowledge. The perceived crowdedness of GS was therefore of particular interest in the present study.

1.1. Green spaces as resilience infrastructures

It is already known that GS represent efficient resilience infrastructures, especially during pandemics. First, in "dense" cities (i.e. high number of people living and working in a certain area [6]), where high infection rates have often been reported [7], public open spaces like

parks allow people to avoid crowding (i.e. how close everyone is to each other at a given time and place [6]) and thus decrease disease transmission rate [8]. Secondly, urban GS also have a direct impact on citizens' resilience during pandemic outbreaks [9], particularly on marginalized groups like low-income populations [10]. Whether in a pandemic period or not, GS are linked to numerous public health benefits [11]. These health benefits are partially explained by the psychological relaxation and stress reduction, the improvement of the psychological PA, the benefits to the immune system, and the enhancement of physical activity that GS promote [11]. Thirdly, and most importantly, GS contribute to the resilience of populations in times of crisis in an indirect way by fostering people's social ties. A growing body of research suggests that natural environments play an important role in strengthening and enhancing our interpersonal relationships [5]. If a multitude of research has found that meaningful and high-quality connections with others are one of the most reliable predictors of happiness, wellbeing, and health [12–14], people's social capital (i.e. the norms and ties among and between residents in communities [15]) seems even more important in times of crisis. People's social capital represents an important resilient factor to overcome periods of crisis [16–18], given that connections with others provide information, resources, moral support [19,20], and create more positive recovery processes [21]. This third point is of particular interest to us in this research.

1.2. The impact of green space attendance on prosocial behaviors

One possible way to create, maintain and strengthen connections with others, and thus improve our social capital, would be to assist others by adopting prosocial behaviors [22]. Prosociality refers to the tendency to care for, help, and assist others [5]. As already highlighted, people's actions and behaviors, like their interactions with others, are not only influenced by their social environment (i.e., other people) but are also affected by a relatively "asocial" natural environment [5]. Some experimental studies demonstrate that nature exposure can directly increase prosociality [23–25]. In a field experiment carried out in 2014, the passers-by who just walked across a park were more likely to help confederates who accidentally dropped a glove on the ground, than passers-by who were tested before entering the park [23]. Another study found out that, compared to sitting in a windowless laboratory room, sitting in a park boosted feelings of interconnectedness [24]. Even incidental exposure to nature in the lab, by looking at pictures of nature instead of pictures of urban environments can enhance prosociality [25]. Research documents two characteristics/qualities of natural environments that drive our orientation to others and their needs: feelings of awe [26] and perception of beauty [27,28]. Awe involves positively valenced feelings of wonder and amazement and, at least in Western cultures, comes up in encounters with nature like sunsets, scenic vistas, and mountain ranges [5,29]. However,

most people do not have access to "awe-inspiring" GS on a daily basis, given that it seems almost impossible to find this type of landscape in urban environments. Fortunately, awe is not the only dimension that triggers increased social connection. The perception of beauty in natural environments can also increase prosocial tendencies [27,28]. Participants exposed to a beautiful nature report increased positivity and, as a consequence, behave more prosocial and are more willing to incur costs for the benefit of other participants [27,28]. In one set of experiments, participants who viewed beautiful nature pictures were more generous in an economic game than those who viewed more mundane nature images, and participants exposed to beautiful plants provided more help by constructing origami figures for tsunami victims than those exposed to more ordinary plants [28]. While we can assume that urban GS can hardly provide a feeling of awe, they can be perceived as beautiful and aesthetic and therefore appear to have the potential to contribute to the prosocial behaviors of individuals who attend them.

1.3. Crowdedness perception of the GS

If a lot of research suggests that social interactions are positively influenced by GS' presence and quality [30–33], such as the aesthetic and well-maintained appearance of the space mentioned before, it is important to highlight that these studies focus mostly on the physical aspects of the spaces. However, these spaces also include a whole "social" aspect due, for example, to the presence or absence of people, the interactions sought or avoided, or the activities that do or do not take place there. This social aspect seemed central to us given the pandemic situation and the resulting restrictions of social contacts. We often assume that urban GS are mainly seen as meeting places, given that they provide opportunities for people to interact with others in ways that may not occur in other settings [30]. Although these spaces are indeed important meeting places in the urban environment, it is important to highlight that, even if people tend to engage in small talk with other visitors, they generally do not visit parks with the intention to meet strangers [34]. Not seeking contact with strangers when visiting GS appeared even truer during the pandemic – with a significant reduction of activities that could be considered as high-risk activities such as meeting people [35]. A study conducted during the first COVID-19 lockdown in Croatia, Israel, Italy, Lithuania, Slovenia, and Spain, supports the importance to expand the role of GS beyond the fact of just creating and maintaining social bonds and emphasizes that parks and other urban GS have essential functions that are fundamentally different from other types of public places [35]. While urban GS can of course serve as a center of public gathering, they also meet vital needs of isolation from ambient urban stress and provide space to disconnect and relax [9,35]. In this period of a pandemic, therefore seems possible that urban GS have mainly fulfilled a function of withdrawal from stressful

environments (urban environment, family environment, overcrowded housing ...) and responded primarily to an objective of restoration, rather than to an objective of socialization. As mentioned before, natural environments can influence people's prosocial behaviors [5], but the social environment seems equally important, particularly in the very specific context of the COVID-19 pandemic and the unprecedented measures of social restrictions associated with it. In this context, it is conceivable that places with low attendance rates allow stress reduction on individuals, which allows mood improvement and thus positively impacts the attitude toward others. Contrary, overcrowded places can induce additional stress, not only because they do not allow the desired isolation, but also because of the increased risk of contamination that this represents.

1.4. Hypotheses

The current study was designed to explore how GS attendance, perceived beauty of the GS, and perceived crowdedness of the GS, relate to social orientation during this specific time of health crisis. Specifically, we assume that the positive relationship between GS attendance and prosocial behavior will only appear when the most regularly used GS is perceived as beautiful and uncrowded.

We also included several covariates. Perception of beauty and perception of the crowdedness of the visited GS requires that the individual pays attention to the environment that surrounds her or him. Using technologies like mobile phones when walking around outside may distract people from the beauty or the crowdedness of the space they are walking through, preventing total immersion in this natural space and thus their ability to savor their surroundings. Therefore, it seems important to consider the usage habits of this type of technology when going for a walk. Also, the lockdown conditions were by far not the same for everyone. Some families were confined to small apartments without balconies or gardens, while others had homes that allowed them to find a certain balance between contact with other family members and moments of isolation. Some people experienced confinement alone, totally isolated from social interactions for a more or less long period. It seems obvious to take into account not only the number of people an individual was confined with, but also the perception of lockdown constraints, which can be experienced very differently from one individual to another, and which will more than likely affect his or her attitude towards others. Distance between home and the most attended GS was also controlled, given that it has a direct impact on the regularity of use of the GS, particularly during the lockdown [35]. Finally, we controlled participants' gender, since research documents a significant difference between men and

women in prosocial behavior, probably due to a difference in the level of empathy, which tends to be higher for women [36].

MATERIALS AND METHODS

A cross-sectional study using convenience and snowball sampling was conducted among French-speaking Europeans in April 2021.

2.1. Participants and Procedure

Data were collected in April 2020, during the first COVID-19 lockdown, using an online survey. As a reminder, in April 2020 people were asked to remain confined to their homes and only essential daily commuting was permitted. Going out for a walk was allowed, provided that you did it on your own, accompanied only by people from your "social bubble" or a maximum of one person from outside this "social bubble". Participation was voluntary and unpaid. Using Gpower we calculated the number of participants needed for a power of .90 and a small effect size (f^2 = .02, α = .05). Based on this, a minimum of 636 subjects was required. A total of 1206 participants (972 female, aged between 17 and 77 years, M_{age} = 28.74, SD_{age} = 12.87) participated in this study. Data from 610 participants (465 female, aged between 17 and 77 years, M_{age} = 28.63, SD_{age} = 12.75) were analyzed after removing those who indicated that they had not left their homes at all from the beginning of the lockdown or only for utility purposes (shopping, pharmacy, post office, etc.). Only participants who reported visiting a GS at least once (mainly urban parks, but also walking paths, shared gardens, etc.) were retained for further analysis.

An invitation message with an online link to the survey was posted on social media, explaining the objectives of the study and asking people to complete the survey and spread the message on their social platforms. Before starting the survey, confidentiality assurance was provided to the participants, who could only enter the survey after giving their online consent to participate. This study was approved by the Ethics Committee of the Faculty of Psychology, Speech and Language Therapy, and Education of the University of Liège (Ref. No. 1920-88, date of approval: 07/04/2020). The survey started with a measure of prosocial behavior. The real purpose of this measure was hidden from participants. To have a more ecological measure, participants were told that this first step was in no way related to the main objective of the study but was intended to validate a measurement tool that would be used in future studies. Participants then were informed that they were now moving on to the main study. In addition to the usual socio-demographic questions, participants

indicated the beginning of their lockdown and how restrictive they found it to be and answered questions about their GS attendance since the beginning of their lockdown.

2.2. Materials

Prosocial behavior. Prosocial behavior was assessed using Social Value Orientation (SVO), given that SVO has been validated to be predictive of real-life prosocial behavior [37–43]. Therefore, we used the Social Value Orientation Slider Measure (SVO slider measure) [44]. This measurement tool produces a continuum of SVO instead of discrete categories, which destroys valuable information about individual differences [44,45]. This continuum reflects the degree to which a decision-maker will choose to sacrifice his or her resources to benefit another [45]. The slider measure is a widely used, efficient, and simple measurement of SVO. While this measure is typically conceptualized as a measure of individual difference, instructions of the SVO slider measure do not imply anything trait-like [46], and similar measures have been shown to be context-sensitive [47]. The SVO slider measure [44] asks participants to allocate points to themselves and a hypothetical other. The measure consists of six items, each representing a forced choice of nine alternatives that vary in benefits to oneself vs. others. Collected responses allow calculating an "SVO angle" for each participant: "altruists" have very high SVO angles, "prosocials" have moderately high SVO angles, "individualists" have low SVO angles, and "competitors" have very low SVO angles. This means that the higher the score, the more prosocial the choices of participants are.

Green space attendance. Green space attendance was evaluated using the following instruction: "*How many times do you estimate that you have used a green space since the start of lockdown? Example: urban park, forest, walking path with natural features... (If you can't remember the exact number of times, give an approximate number. You can also write down an order of magnitude such as "every day", "once a week", etc.)*". Participants who had visited a GS at least once were then asked the same question about the most attended GS using the following instruction: *"Think about the green space you visited most regularly. Since the beginning of the lockdown, how many times have you been to this green space? (If you can't remember the exact number of times, give an approximate number. You can also write down an order of magnitude such as "every day", "once a week, etc.)*. Since the data collection software provided the exact day of the participants' response and since they were asked to indicate the start date of their confinement, it was possible to calculate the number of GS attendances per participant, for their entire lockdown. To make the data comparable between participants, the following formula was used: *(GS attendance/lockdown length) * 100* with "GS attendance" representing the number of times the participant attended a GS since the beginning of their confinement and

26

"lockdown length" representing the number of day participants were confined. This variable is named "GS (all)" for further analysis. The same ratio was applied to the most frequented GS: *(GS attendance/lockdown length) * 100* with "GS attendance" representing the number of times the participants attended their most visited GS since the beginning of their confinement and "lockdown length" representing the number of day participants were confined. This variable is named "GS (main)" for further analysis.

Perceived beauty. Participants were asked to rate the GS they had visited most regularly since the beginning of the lockdown. Beauty perception was assessed by 3 items, using bipolar scales ranging from -3 (unpleasant; ugly; inhospitable) to +3 (pleasant; beautiful; welcoming). The median value represents a neutral opinion. Internal consistency was sufficient (Cronbach α = 0.73).

Perceived crowdedness. Participants were asked to rate the GS they had visited most regularly since the beginning of the lockdown. Attendance rate perception was assessed by 3 items, using bipolar scales ranging from -3 (calm; quiet; lightly frequented) to +3 (lively; noisy; heavily frequented). The median value represents a neutral opinion. Internal consistency was sufficient (Cronbach α = 0.77).

Covariates. Distraction, number of people confined with, perceived lockdown constraint, the distance between home and the most attended GS, and gender were controlled statistically in our analyses. Distraction was assessed by asking participants to indicate whether they consulted their phones while visiting GS during this lockdown period. The frequency with which they consulted their phone while walking outside was measured on a 7-point Likert scale, with 1 indicating that they never used their phone and 7 indicating that they always used their phone while visiting urban GS. The number of people confined was measured by asking one single question: *"Without counting you, how many people are confined with you?"* Perceived lockdown constraint was assessed by asking participants to indicate, on a 7-point Likert scale, how restrictive they perceived the lockdown measures, with 1 indicating that they perceived the measures as being not at all restrictive and 7 indicating that they perceived the measures as being extremely restrictive. Distance between the most attended UGSs and place of residence was assessed by one single question: *"Approximately how long does it take you to walk to this location? (Note the time in minutes)"*. Looking at the actual distance in meters would have been less relevant in the context of the current study, given that the time to walk the same distance depends on age and physical condition, among other things, and thus greatly influences accessibility to the space (the actual data we are interested in).

2.3. Statistical Analysis

Statistical analysis was performed using Jamovi (version 2.2.5). After analyses allowing to describe the sample, Spearman's correlations were applied to examine the bivariate correlations between GS attendance, GS beauty perception, GS crowdedness perception, and prosocial behavior. The associations of GS attendance, GS perception (beauty and crowdedness), and prosocial behavior were further analyzed using regression models, which controlled potential cofounders. Specifically, SVO slider measure score (prosocial behavior) was entered as a dependent variable; beauty perception, crowdedness perception, the interactions between beauty perception and GS attendance, and the interaction between crowdedness perception and GS attendance were entered as independent variables; distraction, number of people confined with, perceived lockdown constraint, the distance between home and the most attended GS and gender were treated as confounding variables. All variables were mean-centered and the significance level was set at p-value < .05.

RESULTS

Our sample consists of two sub-samples, participants who have visited at least one GS since the beginning of their confinement and those who have not (Table 1). There is no significant difference in social orientation scores between participants who report having visited a GS at least once since the beginning of their lockdown and those who have not ($U_{mann-whitney}$ = 175028, p = .26). A more in-depth analysis of these samples reveals a general significant difference in the use of GS according to the type of lockdown dwelling (χ^2 = 12.37, p = .002, df = 2). There is a significant difference between the group of people who have access to a private garden and the group of people who have no private outdoor space (W = -4.15, p = .009), with people owning a garden attending GS more ($M_{GS\ attendance}$ = 21.99, $SD_{GS\ attendance}$ = 32.03) than people without outdoor space ($M_{GS\ attendance}$ = 13.33, $SD_{GS\ attendance}$ = 25.99). In addition, a general significant difference in the use of GS can be observed according to the level of education (χ^2 = 13.24, p = .004, dl = 3). There is a significant difference between participants whose last obtained degree was the "CESS" (= "Certificat d'enseignement secondaire supérieur" - certificate of higher secondary education) preparing for advanced studies and participants whose last obtained degree was a restrictive professionalizing "CESS" giving access to technical or manual professions (W = -4.22, p = .015). Participants owning the professionalizing "CESS" attend GS less ($M_{GS\ attendance}$ = 14.20, $SD_{GS\ attendance}$ = 27.79) than participants owning the "CESS" preparing for advanced studies ($M_{GS\ attendance}$ = 21.16, $SD_{GS\ attendance}$ = 34.96). There is also a significant difference between participants whose last obtained degree was the professionalizing "CESS" and participants who went to

college or university (W = 4.76, p = .004). Participants whose last obtained degree was the professionalizing "CESS" attend GS less ($M_{GS\ attendance}$ = 14.20, $SD_{GS\ attendance}$ = 27.79) than participants who went to college or university ($M_{GS\ attendance}$ = 23.09, $SD_{GS\ attendance}$ = 32.77). Finally, when taking the overall sample, a general significant difference in GS attendance can be observed between people who were confined alone and people confined with at least one other person ($U_{mann\text{-}whitney}$ = 32720.5, p = .022). Participants confined alone attended GS less ($M_{GS\ attendance}$ = 17.17, $SD_{GS\ attendance}$ = 34.09) than participants confined with at least one other person ($M_{GS\ attendance}$ = 21.00, $SD_{GS\ attendance}$ = 33.08).

Table 1. Participants' characteristics.

Participants attending GS (N = 610)		Participants not attending GS (N = 596)	
Characteristic	M ± SD or *n* (%)	Characteristic	M ± SD or *n* (%)
Age (year)	28.63 ± 12.75	Age (year)	28.85 ± 13.0
Gender (female)	465 (76.23)	Gender (female)	507 (85.07)
LD area (urban)	183 (30.0)	LD area (urban)	275 (46.14)
LD residence		LD residence	
Garden	514 (84.26)	Garden	464 (77.85)
Balcony	38 (6.23)	Balcony	54 (9.06)
No outdoor space	58 (9.51)	No outdoor space	78 (13.09)
Job		Job	
Student	389 (63.77)	Student	380 (63.76)
(Self-)employed	184 (30.16)	(Self-)employed	165 (27.68)
Unemployed	12 (1.97)	Unemployed	11 (1.85)
Unable to work	1 (0.16)	Unable to work	9 (1.51)
Retired	16 (2.62)	Retired	16 (2.68)
Other	8 (1.31)	Other	15 (2.52)
Degree		Degree	
No CESS	29 (4.8)	No CESS	40 (6.7)
CESS for HE	245 (40.2)	CESS for HE	215 (36.1)
CESS profess.	65 (10.7)	CESS profess.	94 (15.8)
HE	271 (44.4)	HE	247 (41.4)
PPL conf.	2.58 ± 1.42	PPL conf.	2.47 ± 1.69
LD constraint	4.22 ± 1.44	LD constraint	4.13 ± 1.54
SVO	29.29 ± 16.3	SVO	30.99 ± 14.90
GSA			
GSA (all - ratio)	41.09 ± 36.57	.	.
GSA (main - ratio)	10.53 ± 9.57	.	.
GSA (all – raw)	11.99 ± 10.76	.	.
GSA (main – raw)	36.10 ± 32.34	.	.
PB	6.3 ± .77	.	.
PC	2.36 ± 1.35	.	.
Distance	9.57 ± 13.91	.	.
Distraction	2.73 ± 2.1	.	.

LD area = area where participants were confined (urban; rural); LD residence = residence where participants were confined (with garden; with balcony without garden; no outdoor space); no CESS = no certificate of higher secondary education; CESS for HE = certificate of higher secondary education preparing to college or university; CESS profess.= certificate of higher secondary education preparing for technical or manual professions; HE = graduate or undergraduate; PPL conf. = number of people confined with; LD constraint = perceived lockdown constrain; SVO = prosocial behavior; GSA = green space attendance; GSA (all- ratio) = green space attendance using the ratio of all attended green spaces divided by the length of lockdown multiplied by hundred; GSA (main- ratio) = green space attendance using the ratio of the most attended green spaces divided by the length of lockdown multiplied by hundred; GSA (all - raw) = green space attendance of all attended green spaces; GSA (main - raw) = green space attendance of the most attended green spaces; PB = perceived beauty of the most attended green space; PC = perceived crowdedness of the most attended green space.

Spearman correlation was performed, given that none of the variables of interest was normally distributed. Table 2 shows Spearman's rho and the significance of all tested bivariate correlations. None of the variables was significantly correlated to prosocial behavior. GS attendance was significantly correlated to the perceived beauty and to the perceived crowdedness of the place. Perceived beauty of the GS and perceived crowdedness of the GS were also significantly correlated.

Table 2. Correlation matrix between prosocial behaviors, GS attendance, perceived beauty of the GS, and perceived crowdedness of the GS.

	SVO	GSA	PB	PC
SVO	-			
GSA	$r_s = -0.001$ $p = .971$	-		
PB	$r_s = 0.028$ $p = .488$	$r_s = 0.145$ $p < .001**$	-	
PC	$r_s = -0.028$ $p = .483$	$r_s = -0.086$ $p = .034*$	$r_s = -0.392$ $p < .001**$	-

SVO = prosocial behavior; GSA = attendance rate of the most visited GS; PB = perceived beauty of the most visited GS; PC = perceived crowdedness of the most visited GS.

Multiple linear regressions (Table 3) show that the interaction between GS attendance and perceived crowdedness of the place was significantly associated with prosocial behavior, after controlling for distraction, number of people confined with, perceived lockdown constraints, distance between home and the most attended GS, and gender. Number of people confined with and gender are also significantly associated with prosocial behavior. An increase in the number of people confined with is associated with fewer prosocial behaviors and female participants ($M_{prosocial}$ = 30.47, $SD_{prosocial}$ = 15.36) show more prosocial behaviors than male participants ($M_{prosocial}$ = 25.49, $SD_{prosocial}$ = 18.56).

Table 3. Multiple linear regressions assessing associations between GS attendance, GS perception, the interaction between both, and prosocial behaviors (dependent variable), while controlling for distraction, number of people confined with, perceived lockdown constraint, distance, and gender.

| | b | SE | 95% IC | | β | df | t | p |
			Lower	Upper				
(Intercept)	27.75	0.770	26.24	29.26	0.000	599	36.06	< .001
GSA	0.018	0.021	-0.023	0.060	0.036	599	0.860	.390
PB	-0.817	0.924	2.632	0.999	-0.039	599	-0.884	.377
PC	-0.413	0.520	-1.435	0.609	-0.034	599	0.343	.732
GSA*PB	-0.003	0.030	-0.063	0.057	-0.005	599	-0.104	.917
GSA*PC	-0.034	0.017	-0.066	-0.001	-0.090	599	-2.040	.042 *
Distraction	-0480	0.310	-1.088	0.128	-0.062	599	-1.549	.122
Nb people	-1.390	0.461	-2.294	-0.485	-0.121	599	-3.017	.003**
LD constraint	-0.576	0.453	-1.467	0.314	-0.051	599	-1.271	.204
Distance	0.016	0.047	-0.076	0.108	0.014	599	0.343	.732
Gender	-5.288	1.550	-8.332	-2.244	-0.324	599	-3.411	< .001 **

GSA = attendance rate of the most visited GS; PB = perceived beauty of the space; PC = perceived crowdedness of the space; GSA*PB = interaction between green space attendance and perceived beauty; GSA*PC = interaction between green space attendance and perceived crowdedness; Nb people = number of people confined with; LD constraint = perceived lockdown constraint. * $p < .05$; ** $p < .001$.

Table 4 shows that the association between GS attendance and perceived crowdedness of the place is only significant at low crowdedness perception. We ran a second separate regression model including both the main effect of covariates and two-way interactions between the covariates and the two moderators (i.e. perception of beauty and perception of crowdedness) to avoid bias in the estimation of interaction effects [48]. This second regression model is outlined in the appendix (Table A1 and Table A2). If the interaction between the crowdedness perception and attendance rate of the GS is no longer statistically significant, it should be noted that the pattern is maintained (*b* = -.029, *SE* = .016, *t* = -1.74, *p* = .082).

Table 4. Simple effects of GS attendance on prosocial behaviors at high, middle, and low perceived crowdedness of the place.

Moderator levels			95% IC					
PC	b	SE	Lower	Upper	β	dl	t	p
Mean – 1.SD	0.064	0.029	.006	0.121	0.126	599	2.174	0.030*
Mean	0.018	0.021	-0.023	0.060	0.036	599	0.860	0.390
Mean + 1.SD	-0.027	0.032	-0.090	0.036	-0.054	599	-0.850	0.396

PC = perceived crowdedness of the space. * $p < .05$.

DISCUSSION

The current study was designed to explore how GS attendance, perceived beauty of the GS and perceived crowdedness of the GS relate to social orientation in this specific time of health crisis. We assumed that the relationship between GS attendance and prosocial behaviors would be stronger when the most attended GS was perceived by the respondent as beautiful and uncrowded. Regression analyses revealed that the interaction between GS attendance and the perceived attendance rate of the place was significantly associated with prosocial behavior. After decomposition of the interaction, our results suggest a significant relationship between GS attendance and prosocial behavior but only when the attendance rate of the most visited GS was perceived as low. Contrary to the hypothesis, results did not show a significant relationship between beauty perception, attendance rate, and prosocial behavior. Finally, according to our regression analyses, female participants significantly scored higher on the prosocial measurement.

It seems important to take into account the variable of attendance rate perception as the interaction between low attendance rate perception and GS attendance is significantly associated with prosocial behavior. This result seems consistent with the latest theoretical advances on the subject and the results of previous studies. A growing number of research appears to support the fact that our use and perception of urban GS are influenced by external events, like cultural background or environmental factors, such as most probably the COVID-19 pandemic. The debate about whether human perception of nature is innate (evolutionary theories) or learned (cultural theories) is certainly far from being closed and future theories would benefit from combining evolutionary and cultural approaches [49]. Nevertheless, more and more studies underline the central role of external events on our perception of nature. This can be highlighted by studies showing that differences in perception and use exist between localities [50–53], or, for instance, by studies showing the influence of events such as the COVID-19 on people's GS perception and use [35]. The

33

use people make of GS changed during the pandemic, with a reduction of activities that possibly increase infection risk, like meeting people [35]. It underlines the importance of seeing GS not only as meeting places but also as places that offer disconnection and relaxation [9,35]. In addition, it seems that positive moods positively impact prosocial behaviors [54,55] and even reinforce mutually one another [56]. Positive mood refers here to feeling relaxed, energetic, enthusiastic, content, calm, or cheerful [56]. Low crowded GS provide a better opportunity to disconnect than crowded, noisy parks and represent, in this very specific time of the pandemic, fewer infection risks. Therefore, given that the motivations for using GS changed during the pandemic and were probably primarily aimed at allowing a disconnection and a moment of relaxation in this very stressful period, low crowded GS possibly helped to maintain positive moods, which may positively influence prosociality.

This reasoning is also supported by Samuelsson and colleagues [9], who argue that the absence of physical confinement combined with positively contributing factors of natural environments possibly help to provide relaxation and stress reduction. A complementary reading of this result can be made according to the *Self-Categorization Theory* [57,58]*, which suggests that people have multiple social identities, which vary in salience depending on context. According to this theory, the way we perceive ourselves will therefore shift from a more personal to a more collective/social identity (and vice versa) depending on the situation [58]. Our responses and our desire for crowds can indeed vary greatly from one context to another and crowdedness can sometimes be experienced as very pleasant and even actively sought [59]. *Self-Categorization Theory* explains that our response to a crowd will vary according to our psychological proximity to the people in that crowd, i.e. whether or not those people are part of our in-group [59]. On the other way, the more the members of this crowd are perceived as "other", the more people will seek a spatial distance or, if this is impossible, will experience the situation as stressful or unpleasant [59]. It would not be surprising that the lockdown and its associated social distancing, as well as the risk of infection represented by other individuals, accentuated the psychological distance we have with other people, thus making promiscuity undesirable and even extremely stressful. In this context, the presence of crowds generates negative emotions and stress, whereas sparsely populated spaces are associated with positive mood which, as we saw earlier, impacts positively prosocial behaviors [54,55].

The presumed link between the perceived beauty of the place and prosocial behavior was not supported. Results did not show a significant relationship between beauty perception, attendance rate, and prosocial behavior. This is not in line with previous studies, which showed that beauty perception can trigger increased social connection [27,28]. However,

the impact of beauty perception on prosocial behavior seems to be mediated by a positive mood [27,28]. A first possible explanation for this difference in results lies in the setting of the study itself. In the studies quoted, participants were confronted with pictures of nature and the prosocial behavior was measured directly afterward. In the case of the present study, a cross-sectional design rather than an experimental study, there is no manipulation of GS exposure. Participants started with the social orientation measure and only afterward rate the GS they visited most since the beginning of the lockdown, so they were not confronted or primed with it right before answering the survey. No significant relation was found, perhaps because the effect of the beauty of the space does not hold over time. Another possible explanation is based on the results of previous studies highlighting that the impact of beauty on prosocial behavior seems mediated by positive feelings (happiness, joy, satisfaction, pleasure, fun…) [37]. In times of health crisis, it is possible that the beauty of the space is not sufficient to significantly impact this type of feeling, the average mood of the individuals being most probably lower than usual (floor effect).

Our results also highlighted a significant relationship between the number of people with whom participants were confined and prosocial behavior. The higher the number of people with whom participants were confined, the lower the SVO scores. It is conceivable, that being confined almost 24 hours a day with other people, depletes the "social energy" of an individual, who will then tend to show less prosocial behaviors. If during the lockdown, GS have mainly been visited to find places of isolation, allowing to "recharge one's social battery", then we should observe a less important attendance rate of GS among participants living alone, considering that they would not need to recharge this "social battery". This reasoning is consistent with our results, as our analyses show less GS attendance among participants living alone. This, again, emphasizes the importance of not only seeing these spaces as meeting places but also as spaces of isolation.

In addition, our results highlighted a significant difference in prosocial behaviors between men and women, with women scoring higher on the SVO than men. This result is consistent with recent findings in this field, which seem to support that a difference in prosociality between genders would be due to the difference in empathy, higher in women [36]. However, it is important to note that Kamas and Preston's study is specifically based on economic games, which is congruent with the type of measure we used in the present study (SVO slider measure [44]). Seeing this behavior as complex and multidimensional allows to take into account different types of prosocial behaviors [60], as well as how prosocial behavior varies as a function of the target of the behavior (e.g. strangers vs. family members…) [60,61]. When prosocial behavior is seen as unidimensional, items tend to represent behaviors that are in line with the female stereotype of care [60]. Items

representing behaviors that are more in line with masculine stereotypes, like physical assistance and helping behavior in case of emergency, are often not included in prosocial behavior measurements even though they are still valid prosocial behaviors [60]. Although the SVO slider measure is neutral in its formulation and does not explicitly convey the idea of empathy, kindness, and caring for others, it probably comes even less close to a formulation that might be considered as typically "masculine", as the behavior measured is neither risky, public, strength intensive, nor collectively oriented.

Finally, it seems important to go back to the descriptive statistics of the sample. Various observations were made regarding GS attendance. Counter-intuitively, people without access to a private GS used public GS significantly less than people having a private garden. However, this observation makes sense, since we know that it is often the low-income groups that live without access to private GS [62]. In the same way, lower education level is generally used as an operationalization for low socioeconomic status [63], and our observations show that people whose last obtained degree was a diploma preparing for college or university or people who currently attend college or university use GS significantly more than people whose last obtained degree was a restrictive professionalizing degree preparing to a manual or technical profession. Low economic status thus seems to be linked to lower GS attendance. The real question then is, why do people with low socioeconomic status use GS less during their lockdown. These observations are actually in line with previous studies. Low-income groups mostly concentrate in certain neighborhoods [8]. In many parts of the world, studies observe lower accessibility and quality of urban GS in low socio-economic neighborhoods, compared to urban GS in high socio-economic neighborhoods [64–67]. Not using urban GS during the lockdown, even though one does not have access to a private garden, can therefore potentially be explained by the fact that these people did not have access to such spaces or that these spaces were of poor quality.

Practical implications

Our results show a very small effect size for the interaction between crowdedness perception and GS attendance on prosocial behavior. However, small effects may have direct real-world consequences [68,69] and this is particularly true for effects that accumulate over time and at scale [68,70]. Thus, while small effects may not matter much for a single episode or a single individual, small effects matter in the long term and on a large scale [68–70]. Presently, more than half of the world's population lives in urban areas and this number is continually increasing, leading to the estimation that in 2050 this will be the case for more than two-thirds of the world's population [71]. Therefore, increasing the

presence of urban GS will benefit a large population (large-scale consequence). Furthermore, given the many positive impacts of GS, prevention policies should aim to increase the regular use of GS by individuals, not just a "once in a while" use. The impact, even minimal, is therefore an impact that a single individual can accumulate throughout his or her whole life (long-term consequence). Given the large-scale consequences and the long-term consequences GS can have, this effect might therefore be highly consequential from a public-health perspective. It is also important to remember that, like many psychosocial phenomena, prosocial behaviors are complex and obviously multifactorial, which makes them unlikely to be explained by a few strong predictors with large effect sizes [72].

As described previously, people's social relationships represent an important resilient factor to overcome periods of crisis [16–18]. Based on the results of this study, the opportunities for isolation and disconnection offered by GS seem to be related to the prosocial behaviors of their users, and thus probably contribute to the development of their social capital. If this may seem contradictory, offering oneself moments of isolation would possibly enable people to recharge their "social batteries", allowing them to act in a more prosocial manner with others and so, on a long time, increase their social capital through quality interactions. Indeed, as mentioned before, assisting others through prosocial behaviors helps to improve our social capital [22]. The role GS have as places of isolation and disconnection seems particularly interesting to foster caring behaviors and a sense of community, which are crucial in times of crisis. Based on historical records, crisis situations seem to be a breeding ground for prosocial behaviors and feelings of a community [73–75], but providing individuals with an environment that allows the best conditions to encourage even more this type of behavior, can only be a benefit to both the individual and the society. According to scientific predictions [2–4], we probably must expect an increase in pandemic outbreaks and, going with them, other periods of social distancing. In such a context, it seems important to invest in the multiplication of GS within urban landscapes, as well as thinking about their design. A well-thought-out design would probably reduce the feeling of overcrowding, even in very small GS.

As already highlighted, the results of this study, which are in line with many other studies pointing out the potentially positive impact of GS on populations, can have concrete implications for urban planning and management policies and so have a significant impact on public health. It seems currently accepted that COVID-19 is hitting the hardest lower-income groups [8]. During the pandemic, poverty and wage inequality raised in all European countries [76]. Bearing this in mind, cities need to find ways to function during these disturbances and to provide their most vulnerable populations with the necessary

tools to cope as best as possible with such crises. Maintaining or increasing spaces for nature, while keeping it accessible to the public, seems to be part of it [9]. Creating urban landscapes that promote contact with nature, while allowing social distancing, can be achieved by a well-designed spatial organization [9], for instance by avoiding mono-functional high-density areas and increasing accessible natural spaces [77]. However, it is also important to keep in mind that property-rights arrangements are equally important to consider [78]. Currently, public accessible GS are not equally available to all population groups [79,80], and the average distance to access them increases with the poverty of a district [65]. This lack of access to quality publicly accessible GS among disadvantaged populations is all the more problematic since some studies seem to show that these populations would benefit the most from regular GS attendance [81–83]. Enabling low-income groups to access quality GS while maintaining social distancing will thus not only depend on whether such spaces actually exist in their neighborhood and how they are designed, but also on the fact that these spaces are private, public, or common ownership [9], and, therefore, will mainly depend on political decisions. Current privatization schemes can therefore lead to a gradual loss of opportunities or nature experiences for lower-income groups and, this way, result in undesirable societal outcomes [78]. On the contrary, investing in existing GS and creating new public GS in disadvantaged neighborhoods can have a variety of beneficial societal outcomes and seems to be an attractive strategy for health equity in pandemic recovery [10,84].

Study limitations and Future research

This study has several limitations, which open up possibilities for future research. First, given the cross-sectional design, the present study cannot make causal inferences. Ideally, an experimental study manipulating a green space's vs. urbanized space's attendance rate should be conducted in addition. Second, as suggested in the discussion part, prosociality should be seen as multidimensional [60]. The SVO slider measure is one-dimensional and cannot account for the multitude of prosocial behaviors that exist. Therefore, it is possible that a measure that considers the multidimensionality of prosocial behaviors would produce more nuanced results. Moreover, prosocial behaviors vary depending on the target person [61]. In the case of the present study, the results only concern prosocial behavior towards a stranger and therefore cannot be extended to a situation with friends or family members.

CONCLUSIONS

In times of crisis, social ties can literally be a lifeline. A way to create, maintain and strengthen connections and links between people is by assisting others by adopting prosocial behaviors. The present study contributes to a better understanding of the resilience role GS can play in times of crisis. Our results show a significant relation between GS attendance and prosocial behavior if the most visited GS was perceived as sparsely crowded. This study shows the importance of increasing the availability of GS and allows concrete recommendations for public policies.

PATENTS

APPENDIX A

Table A1. Multiple linear regressions assessing associations between GS attendance, GS perception, the interaction between both and prosocial behavior (dependent variable), while controlling for distraction, number of people confined with, perceived lockdown constraint, distance, and gender. This regression model also includes both the main effect of covariates and two-way interactions between the covariates and the two moderators (i.e. perception of beauty and perception of crowdedness).

	b	SE	95% IC Lower	95% IC Upper	β	dl	t	p
(Intercept)	27.75	0.770	26.24	29.26	0.000	599	36.06	< .001
GSA	0.014	0.021	-0.028	0.055	0.027	589	0.646	.519
PB	-2.582	1.119	-4.781	0.384	-0.122	589	-2.307	.021*
PC	-1.424	0.596	-2.594	-0.253	-0.118	589	-2.389	.017*
GSA*PB	0.010	0.031	-0.050	0.071	0.016	589	0.337	.736
GSA*PC	-0.029	0.016	-0.061	0.004	-0.076	589	-1.741	.082
Distraction	-0483	0.308	-1.088	0.121	-0.062	589	-1.570	.117
Nb people	-1.389	0.460	-2.292	-0.486	-0.121	589	-3.021	.003**
LD constraint	-0.574	0.455	-1.468	0.320	-0.051	589	-1.260	.208
Distance	0.081	0.054	-0.025	0.188	0.069	589	1.494	.136
Gender	-5.231	1.553	-8.280	-2.181	-0.321	589	-3.369	< .001 **
Gender*PB	-5.056	2.137	-9.253	-0.860	-0.239	589	-2.366	.018*
Nb people*PB	-1.649	0.689	-3.002	-0.296	-0.111	589	-2.394	.017*
LD constraint*PB	-0.116	0.663	-1.418	1.187	-0.008	589	-0.174	.862
Distance*PB	-0.133	0.123	-0.376	0.109	-0.088	589	-1.081	.280
Distraction*PB	-0.130	0.450	-1.015	0.755	-0.013	589	-0.288	.773
Gender*PC	-4.008	1.182	-6.330	-1.686	-0.331	589	-3.390	<.001**
Nb people*PC	-0.292	0.380	-1.038	0.454	-0.034	589	-0.768	.443
LD constraint*PC	-0.710	0.341	-1.379	-0.041	-0.084	589	-2.085	.038*
Distance*PC	0.041	0.054	-0.064	0.147	0.047	589	0.765	.444
Distraction	.500	246	.984	-0.016	-0.087	589	-2.030	0.043*

GSA = attendance rate of the most visited GS; PB = perceived beauty of the space; PC = perceived crowdedness of the space; GSA*PB = interaction between green space attendance and perceived beauty; GSA*PC = interaction between green space attendance and perceived crowdedness; Nb people = number of people confined with; LD constraint = perceived lockdown constraint. * p < .05 ; ** p < .001.

Table A2. Simple effects of GS attendance on prosocial behaviors at high, middle and low perceived crowdedness of the place.

| Moderator levels | | | 95% IC | | | | | |
PC	b	SE	Lower	Upper	β	dl	t	p
Mean – 1.SD	0.052	0.029	-0.005	0.109	0.103	589	1.785	0.075
Mean	0.014	0.021	-0.028	0.055	0.027	589	0.646	0.519
Mean + 1.SD	-0.025	0.032	-0.087	0.038	-0.049	589	-0.782	0.434

PC = perceived crowdedness of the space. * p < .05 ; ** p < .001.

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2.1.3 Safety concerns as barrier to UGS attendance

As seen in section 2.1.2 (pp. 13-17), UGSs can play an important role in residents' health and well-being. However, to maximize the positive impact UGSs can have on local residents, it is worth getting people to interact with these spaces, i.e., to actually attend them.

Attendance will depend directly on the accessibility of the UGS. A common approach to measure the accessibility of UGSs is to take into account the geographic proximity of these spaces (Logan et al., 2019; WHO Regional Office for Europe, 2016). However, while proximity is an important component of access to UGS, accessibility seems to be considered multi-dimensional (Penchansky & Thomas, 1981; Saurman, 2016), and also take into account for more psychological factors seems to be increasingly recognized (Moulay et al., 2018; Williams et al., 2020).

Safety concerns are often cited as being an important barrier to UGS attendance (Jones et al., 2009; Williams et al., 2020), especially in high-poverty neighborhoods (e.g. Cohen et al., 2010, 2016; Han et al., 2018). Not only do low SES neighborhoods usually have access to UGSs of lower quality, but these spaces usually also appear as being less safe (Rigolon, 2016; Rigolon et al., 2018; Williams et al., 2020).

As highlighted in the project overview, concerns about safety are reported on a regular basis in Seraing, and this is especially true in the project area and in the vicinity of the UGS.

In this work, we are particularly interested in individuals' perception of safety, rather than in the objective dimension of safety. The objective dimension of safety, here referring to actual crime rates, can be described as behavioral and environmental factors measured against external criteria, whereas the subjective dimension refers to the internal feeling or perception to be safe (WHO, 1998).

Three main reasons lead us to focus on the subjective dimension of safety, rather than on the objective one. First, the subjective feeling of not being safe does not always correspond to actual crime rates (e.g. Mancus & Campbell, 2018; Paydar et al., 2017; Pérez-Tejera et al., 2022) and seems to be more widespread than crime itself (Miceli et al., 2004). Indeed, if individuals can be very accurate in estimating risks of certain adverse events like job loss, they tend to largely overestimate criminal risks (Quillian & Pager, 2010). In addition, the feeling of safety goes far beyond the fear of crime (see, for example, safety concerns provided by participants in Krenichyn, 2006; Loukaitou-Sideris & Sideris, 2010; Sonti et al., 2020; Willemse & Donaldson, 2012). The feeling of safety in public places can also be related to

concerns about traffic, wildlife (e.g. fear of being stung or bitten), risks of falling due to a lack of maintenance, or the fear of getting lost, to name just a few examples. The fears linked to the attendance of a public place can be diverse and sometimes very different from one population to another, and from one context to another, the fear of crime representing only a part of individuals' concerns. This suggests a potentially stronger impact of safety perception than of actual safety on individuals' public space attendance behavior. Moreover, if the actual crime rate does not always relate to the number of UGS visits or the duration people stay in these places, perceived safety seems to be strongly linked to fewer and shorter UGS visits (Cohen et al., 2019).

However, the relationship between perceived safety and the use of public places is complex and far from being established (e.g. Han et al., 2018; Lapham et al., 2016), and seems to vary according to the way these variables are conceptualized and measured. For example, when distinguishing between observational measures of UGS attendance (e.g. counting the number of UGS users) and self-reported UGS attendance (e.g. subjective estimation people have about their UGS attendance), results about the relationship between perceived safety and attendance of UGSs vary from one study to another. If some studies find a significant relationship between perceived safety and self-reported attendance (Aliyas & Masoudi Nezhad, 2019; Cohen et al., 2015, 2017; Derose et al., 2018; Lapham et al., 2016), other find more mixed results (Cohen et al., 2012; Türkseven Doğrusoy & Zengel, 2017), or even no significant result at all (Cohen et al., 2009). To the best of our knowledge, there is presently no study using observational measurements of attendance rate that report a statistically significant relationship between perceived safety an attendance. It is also worth noting, that the comprehension of the safety perception and attendance rate relationship is mainly based on correlational and cross-sectional studies, lacking experimental studies and making causal inferences impossible.

Finally, the potential mediators and moderators of this relationship should be investigated. It is not impossible that this relationship is significant only for certain times of the day (e.g., at night, or in the evening), for certain populations (e.g., women or older people), or for certain types of activities practiced on the site (e.g., solo activities). It is also possible, that significance varies according to the length of the stay. Perceiving the UGS as unsafe will potentially not stop people from walking through the space if it is a shortcut connecting two key urban spaces, but will probably prevent people to linger in the place. To date, it seems difficult to draw any conclusions concerning the perceived safety and the UGS attendance rate relationship, due to the diversity of measures and conceptualizations of the variables

of perceived safety and attendance rate, but also due to the lack of experimental studies allowing causal conclusions.

Although the relationship between perceived safety and the use of UGSs has not been established, safety concerns remain important in this project. The primary objective of action research is to be problem-focused and integrate the expertise of field actors through regular interactions. These interactions confirm the importance of considering safety concerns in the next steps of the process. Thus, while designing a psychosocial intervention solely based on increasing safety perception to enhance UGS attendance may have limited value and will therefore not be considered in the present project, it is still crucial to consider safety aspects in the next steps of the process.

> **Box 2 (pp. 55-97) presents a narrative review dealing with the safety/UGS attendance relationship and provides a better understanding of the important aspects to consider when including safety perception in the present project.**

PAPER 2
Perceived Safety and Urban Green Space Attendance: a Narrative Review

Tania Noël[1]*, Nancy Durieux[2]** and Benoit Dardenne[1]**

1 Psychology and Neuroscience of Cognition Research Unit, Faculty of Psychology, Speech and Language Therapy, and Education, University of Liège, Liège, Belgium.
2 Research Unit for a life-Course perspective on Health & Education – RUCHE, Faculty of Psychology, Speech and Language Therapy and Educational Sciences, University of Liège, Liège, Belgium

* Correspondence: tania.noel@uliege.be
** The two last authors contributed equally to this work

To be submitted.

ABSTRACT

A growing amount of studies suggest the importance of nature-related health benefits. In urban areas, nature exposure can mainly be achieved through semi-natural spaces, so-called urban green spaces (UGSs). However, many UGSs remain underutilized. Safety concerns have often been considered as playing a major role in UGS attendance. However, the relationship between UGS' safety and UGS' attendance is far from being unanimously accepted and seems to vary according to the way attendance and safety are conceptualized and measured. To offer a first overview of the current state of knowledge, this paper reviews research that bears on the relationship between UGS' perceived safety and UGS' attendance rate. This review highlights many conceptual and methodological challenges and offers some suggestions to improve the methodology of future studies to foster the generalization of results.

Introduction

A growing amount of studies suggest the variety and importance of nature-related health benefits. The notion of health refers hereafter to the definition given by the World Health Organization ([WHO], 2023) and therefore encompasses physical, mental and social aspects, and can be seen as a state of complete physical, mental and social well-being. Indeed, nature-related health benefits range from physical aspects (e.g. decrease in the incidence of diabetes, cardiovascular and all-cause mortality; Twohig-Bennett & Jones, 2018), to psychological aspects (e.g. decreased depression and anxiety, increase in well-being and positive emotions; Bratman et al., 2021; Taniguchi et al., 2022), to more social aspects (e.g. improvement of social connections and prosociality; Goldy & Piff, 2020). In urban areas, nature exposure can be mainly achieved through semi-natural spaces, like for example parks, playgrounds, or yards. These settings can be grouped under the notion of urban green spaces (UGSs). Currently, many UGSs remain underutilized (Moulay et al., 2018), which limits their potential positive impact on populations living in the surrounding areas. While much attention has been focused on the physical attributes of UGSs to explain this underutilization, taking into account psychological factors seems equally important (Moulay et al., 2018). Safety concerns have often been considered as playing a major role in UGS attendance, especially in high-poverty neighborhoods (Cohen et al., 2010, 2016; Han et al., 2018). However, the relationship between UGS' safety and UGS' attendance is far from being unanimously accepted and seems to vary according to the way attendance and safety are conceptualized and measured. In a general way, it seems that the results are mixed concerning the relationship between safety and UGS attendance. Perceived UGS safety seems to predict self-reported UGS attendance (Cohen et al., 2012, 2013; Echeverria et al., 2014), but does not always relates to observed UGS attendance (Cohen et al., 2012, 2013). To date, findings are still inconclusive (Han et al., 2018; Lapham et al., 2016).

1.1. Urban green spaces

In 2016, in a review of evidence about the positive impacts on health of UGSs, the WHO acknowledged that there is, to date, no universally accepted definition of UGS. This review highlights that in different research, UGS usually include public parks and gardens, but may also refer in some studies to a range of other areas such as street trees, recreational facilities and sports pitches, private and semi-private gardens, roof gardens, urban agriculture, commercial forests, vegetated wasteland or any place, where there is a natural surface (WHO, 2016). Therefore, definitions used by

the WHO in later reports, such as in their brief for action (2017) or in their review exploring the most effective ways to deliver UGS interventions to maximize environmental, social and health benefits (2017), remain very general and include any urban space covered by vegetation of any kind. This encompasses vegetation on both private and public land, regardless of size and function, and may include small water bodies (WHO, 2017). If the WHO sometimes includes private spaces in its definition (e.g. WHO, 2017), it also highlights the importance to focus on UGSs which are open to the public, with regard to social justice concerns (WHO, 2016). Essentially, research on the topic is conducted on spaces with various forms, sizes, functions and designs, publicly accessible or not, and most authors do not define UGS in their studies (Taylor & Hochuli, 2017).

1.2. Attendance of UGS

To date, studies dealing with the UGS/health relationship have used a variety of different measures and indicators to assess UGS exposure, ranging from the availability of these spaces (e.g. density or percentage of UGS by area), to the measurement of their accessibility (e.g. proximity of UGS using linear or walking distance) or usage (WHO, 2016). If some benefits related to UGSs do not necessarily need individuals to physically use the UGS (e.g. mood improvement by simply viewing natural settings; Mcsweeney et al., 2015), several of the pathways linking UGS to health and well-being seem to require, however, that individuals actually spend time in the UGS to gain the benefits (Mears et al., 2020; WHO, 2016). One of the limitations of using availability or accessibility indicators is that they do not reflect real exposure to UGS (WHO, 2016), but are rather to be considered as proxies of UGS exposure. Indicators related to usage, conversely, can account for actual exposure. Based on the WHO review of evidence (2016), measures of usage can be objective (e.g. counting of individuals) or self-reported (e.g. based on surveys and peoples' subjective attendance estimation). It should also be noted that while actual behavior can be studied (e.g. Cohen et al., 2009, 2010, 2013), a lot of research is also based on behavioral intention (e.g. Yen et al., 2017).

1.3. Perceived safety in UGS

There are numerous perspectives and interpretations regarding the definition of safety (WHO, 1998). According to the definition of the WHO (1998), objective safety has to be distinguished from subjective safety. The first one refers to the actual crime

rate of a place and can be measured using behavioral and environmental factors against external criteria, whereas the second one refers to the internal feeling or perception of individuals to be safe (WHO, 1998). Perceived safety, therefore, refers to any subjective feeling/assessment of the safety of the place, and is also seen by some authors as the personal level of comfort in a given situation/place (Mouratidis, 2019). Perception of not being safe does not necessarily correspond with actual crime rates (e.g. Mancus & Campbell, 2018; Paydar et al., 2017; Pérez-Tejera et al., 2022; Zhang et al., 2021), potentially has a bigger impact on people's subjective well-being (Manning et al., 2022), and seems to be more widespread (e.g. Ambrey et al., 2014) than crime itself. Moreover, if the actual crime rate does not always relate to the number of UGS visits and the duration of the stay, perceived safety seems to be (Cohen et al., 2019).

Perceived (un)safety also has to be distinguished from fear of crime. Even if these concepts are sometimes used interchangeably, they remain different and should not be used as proxies for one another (Hinkle, 2015). Definitions of fear of crime tend to vary from study to study, with sometimes conflicting definitions leading to inconsistent measurement (Collins, 2016; Etopio & Berthelot, 2022). Studies often report measuring fear of crime when they are actually measuring perceived safety (Yang & Hinkle, 2012). In an attempt to clarify and improve the measurement of fear of crime, a new definition, based on theory and precise methodology, was recently proposed: "the tendency to experience an affective or emotional response to crime (or the possibility of crime) that can include fear, concern, anxiety, worry, nervousness, paranoia, panic, vulnerability, and uneasiness" (Etopio & Berthelot, 2022, p.15). This definition, like most definitions and measurements of fear of crime, specifically focuses on emotions related to crime (Camacho Doyle et al., 2022; Etopio & Berthelot, 2022; Hinkle, 2015).

Safety perception in UGS extends beyond concerns about crime and encompasses other types of fear, such as fear of getting lost, accidents, threatening weather, or animals (Fig.1). Therefore, some researchers suggest that studying safety issues related to UGS should have a broader scope, including more than just the fear of crime (Türkseven Doğrusoy & Zengel, 2017). Also, one main limitation of the concept of fear of crime and the way it is measured, is that the results are likely to vary depending on how fear of crime is operationalized (e.g. general or specific, and therefore what the notion of crime spontaneously evokes in participants or the specific type of crime measured in the study). Measurement of fear of crime generally includes items assessing worry about crime in general (e.g. "I'm afraid of a crime happening to me"; Etopio & Berthelot, 2022), or assessing worry about one or

more specific crimes (e.g. get robbed, Camacho Doyle et al., 2022). On the other hand, perceived safety seems to be mostly measured with way more general items, and, according to some authors, measured through more standardized and general questions ("How safe would you feel walking alone at night in…"; Hinkle, 2015). Quality research depends on precise and standard measurement, and the inconsistency observed in fear of crime research potentially jeopardizes the meaningfulness of fear of crime research (Etopio & Berthelot, 2022).

Figure 5. Schematic representation of the relationship between fear of crime and safety perception.

In light of these conceptual challenges, little is known about the relationship between UGS' attendance rate and UGS' perceived safety. The goal of this article is to review studies that have investigated the relationship between UGS' attendance rate and UGS' perceived safety, by attempting to answer the following questions:

a. How do studies investigating the relationship between safety perception and attendance define and characterize UGS?
b. What indicators are used to evaluate UGS attendance?
c. What indicators are used to assess perceived safety?
d. How is the relationship between UGS' safety perception and UGS' attendance rate measured and characterized in the literature on this subject?

Literature search

To be included in this review, studies had to investigate the relationship between UGS attendance and the perceived safety of the space. Any outdoor/open-air space (public or private), accessible to the public without fees or other entry restrictions, located in urban areas, and containing vegetation of any kind was considered as valid. Studies explicitly stating that they did not meet the following criteria were not included in this review. These eligibility criteria were inspired by the definition given by the WHO (2017), but also took into account the importance of public accessibility for the sake of social justice (WHO, 2016). Any measurement of UGS attendance and any subjective assessment of the safety conditions of an UGS, ranging beyond the measurement of one or more specific crimes, were considered as valid. This review considered studies that include participants of any age, sex, nationality and health status, attending or not UGS, and without any restriction regarding geographic locations. Published studies reporting quantitative, qualitative, or mixed-method data were considered as valid. All types of review, text and opinion papers were excluded from this review. English-, German- and French language studies were examined as these are the languages spoken by the authors.

Based on the objective of this article and the definition of the concepts, a search strategy was developed for the databases PsycINFO (Ovid) and Sociological abstracts (ProQuest). The full search strategy for PsycINFO (Ovid) is accessible on osf or in the Appendix section (Fig.A1). All identified citations were collated and uploaded into Covidence (Veritas Health Innovation, Melbourne, Australia) and duplicates were removed. Following the screening of titles and abstracts, the complete texts of the chosen references were retrieved and evaluated against the inclusion criteria. The reasons for the exclusion of full-text sources which did not meet the inclusion criteria were recorded and reported (see flowchart on osf or the Appendix section Fig.A2). Other full texts have been added based on references known as being relevant by experts in this field. An overview of the references of all included studies can be seen in the Appendix section (Tab.A3).

Review findings and discussion

A total of 16 studies were included in this review. The studies were published between 2006 and 2020, in a wide variety of disciplines (e.g. social science, sociology, geography, architecture, urbanism, or ecology). Studies were conducted mainly in America, and more specifically in the US (11). The other studies were located in Asia

(3), Africa (1) and Australia (1). This is not trivial, given the existence of cultural differences. For example, UGS' safety concerns in Europe are probably not the same as those important or perceived in Asia (Huai & Van de Voorde, 2022). Participants in most studies were UGS users (4), residents living within a certain radius around the target UGS (3), or both (7). The remaining studies (2) focused on children and their parents from schools located near the target UGS. The focus of interest of the included studies was mostly overall UGS attendance (8), even if some studies focused on physical activity in UGS (3), or included both outcomes (5). See Table 1 for an overview of the included articles and their main characteristics.

Table 1. Main characteristics of the included articles.

Study	Aim of the study	Participants	Data collection country and year	UGS definition and characteristics	Perceived safety measurement method	Attendance measurement method	Relationship between perceived safety and attendance
Krenichyn (2006)	To explore women's physical activities in a specific UGS in Brooklyn.	UGS users (women) N = 41	America (US – NY)	No UGS definition provided. UGS characteristics: •) Facilities/programs: contains many facilities for athletic purposes (e.g. baseball fields, ice-skating ring, trail…). •) Size: 526-acre size. •) Neighborhood: surrounded by several communities with distinct racial, ethnic, religious and economic differences. Surrounded by a road – which involves traffic on this perimeter. Some "car-free" times are planned (e.g. on weekends). •) Landscape/architecture: contains many natural elements (e.g. water, wooded areas, open meadows, hills…). •) Visit rate: +/- 6 million visitors/year.	Open questions (e.g., concerns or difficulties in using the UGS)	Self-reported - Open questions (e.g., patterns of physical activity in the UGS).	Qualitative analysis. Participants often addressed safety aspects (e.g., physical safety with regard to traffic, harassment).

63

Study	Aim of the study	Participants	Data collection country and year	UGS definition and characteristics	Perceived safety measurement method	Attendance measurement method	Relationship between perceived safety and attendance
Cohen et al. (2009)	To assess the impact of UGS improvements on UGS use and physical activity of UGS users.	UGS users and local residents. Survey Baseline: N = 768 users N = 767 locals Follow-up: N = 712 users N = 620 locals	America (US - CA)	No UGS definition provided. UGS characteristics: •) Facilities/programs: Contained an average of 12 physical activity areas (e.g., indoor gymnasiums, multipurpose fields, picnic and lawn areas…) •) Size: from 3.4 to 16 acres (M = 8). •) Neighborhood: located in predominantly Latino and African-American and low-income neighborhoods. Served an average of 67,000 people within a 1-mile radius and 210,000 people within a 2-mile radius.	No information provided.	Observation (SOPARC). + Self-reported - Interviews with ordinal answer options (never / only once / <1 per month / >1 per month / >1 per week / daily) – no more information provided.	Quantitative analysis. Perceived safety was not significantly associated with observed attendance measures or self-reported attendance measures (significance cannot be addressed, since statistics are not provided).
Loukaitou-Sideris and Sideris (2009)	To examine the factors that bring children to UGS, and understand how UGS visitation patterns differ between boys/girls, races, ethnicities, and inner city and suburban children.	Middle-school children and their parents. Survey N = 348 parents N = 897 child.	America (US- CA)	No UGS definition provided. UGS characteristics: •) Facilities/programs: possessed at least some areas, facilities, and equipment that allow children to engage in physical activity, free and spontaneous play, and/or organized sports activities.	One single question – "Do you feel safe at the park?" (yes/no).	Observation (SOPLAY) (not used in relation to perceived safety). + Self-reported - •) "Do you [does your child] participate in physically active organized activities in the park?" (yes/no) •) "Where do you [does your child] spend most time playing sports and being physically active?" (school/park/backyard/ neighborhood street /other)	Qualitative analysis. Children and parents often addressed safety aspects (e.g., choosing one UGS rather than another based on safety perception, concerns about crime and traffic).

Study	Aim of the study	Participants	Data collection country and year	UGS definition and characteristics	Perceived safety measurement method	Attendance measurement method	Relationship between perceived safety and attendance
Cohen et al. (2010)	To assess how UGS characteristics and demographic factors are associated with UGS use.	UGS users and local residents. Survey N = 2315 users N = 1985 locals	America (US – CA)	No UGS definition provided. UGS characteristics: •) Facilities/programs: number of park programs varied from 4 to 15. All but one park also offered non-activity programs (e.g. art, after-school childcare…). Contained outdoor playground areas (e.g. basketball, soccer, tennis… courts), and 13 of the parks contained a swimming pool. •) Size: from <1 to 21 acre in size. •) Neighborhood: served between 8411 and 115,853 people within a 1-mile radius. Number of annual program participants ranged from 72 to 27,230. •) 80 % of the parks had a volunteer park advisory board (= formal source of community involvement in park management) in place.	One single question - "In general, how safe do you feel this park is?" (very safe/safe/not very safe/not safe at all).	Observation (SOPARC). + Self-reported - "How often do you come to this park?" (not used in relation to perceived safety).	Quantitative analysis. Perceived safety was not significantly associated with observed UGS use.
Willemse and Donaldson (2012)	To add to the limited literature on township UGS use by exploring the usage patterns and opinions of community neighborhood UGS in five townships in Cape Town.	Parents of children in primary and secondary schools. Survey N = 324	Africa (Cape Town)	*"Developable land with recreation facilities, which serve the needs of the local community or neighborhood and are usually accessed on foot. It includes informal recreation facilities of small scale for children such as totlots and playgrounds, seating areas, open grass lawns and gardens."* UGS characteristics: not provided.	Open- and closed-ended questions – no more information provided.	Self-reported - Open- and closed-ended questions - no more information provided.	Quantitative analysis (percentage). Safety concerns was the most frequently cited main reason for non-use of UGS.

Study	Aim of the study	Participants	Data collection country and year	UGS definition and characteristics	Perceived safety measurement method	Attendance measurement method	Relationship between perceived safety and attendance
Cohen et al. (2012)	To examine factors affecting UGS use and UGS-based physical activity, while exploring the importance of neighborhood poverty.	UGS users and local residents. Survey N = 3654 users N = 3249 locals	America (US – CA)	No UGS definition provided. UGS characteristics: •) Facilities/programs: recreation centers and at least one full-time staff member •) Safety aspects: no excessive security concerns.	One single question - Feeling the park is safe/unsafe - no more information provided.	Observation (SOPARC). (not used in relation to perceived safety). + Self-reported – no more information provided.	Quantitative analysis. Perceived safety was not significantly associated with frequency of visiting the UGS among users, but was significantly associated with frequency of visiting the UGS among locals.
Cohen et al. (2013)	To determine if neighborhood socioeconomic status relates with UGS use and UGS-based physical activity.	UGS users and local residents. Survey N = 3559 users N = 3815 locals	America (US – PA;OH;NC; NM)	No UGS definition provided. UGS characteristics: •) Facilities/programs: compared to all potential UGS available, those chosen had an average of 25 % more physical activity facilities (e.g. playground) •) Neighborhood: 12 UGS in high- and 12 UGS in low-poverty neighborhoods	Perceiving the park to be very safe/safe/unsafe - no more information provided.	Observation (SOPARC). + Self-reported - Frequency of UGS use over the last 7 days; Usual exercise (%); Meet people (%) (not used in relation to perceived safety).	Quantitative analysis. Perceived safety was not significantly associated with the number of observed UGS users.
Cohen et al. (2015)	To explore to what degree UGS renovation can encourage physical activity among youth.	UGS users and local residents. Survey Baseline: N = 503 users N = 419 locals Follow-up: N = 410 users N = 633 locals	America (US - CA)	No UGS definition provided. UGS characteristics: •) Facilities/programs: few organized or supervised activities. •) Size: from <1 to 25 acres in size •) Neighborhood: served between 9,735 and 5,715 people within a 1/2 mile radius.	No information provided.	Observation (SOPARC) - not used in relation to perceived safety. + Self-reported - Interviews – no more information provided.	Quantitative analysis. Perceived safety was significantly associated with the number of UGS visits among users and locals.

Study	Aim of the study	Participants	Data collection country and year	UGS definition and characteristics	Perceived safety measurement method	Attendance measurement method	Relationship between perceived safety and attendance
Lapham et al. (2016)	To determine how perceived safety and UGS characteristics were related to UGS visitation and types of UGS activities.	Local residents. Survey N = 3815	America (US – PA;OH;NC; NM)	No UGS definition provided. UGS characteristics: •) Size: at least 20 acres. •) The chosen UGS were considered as generally being representative of the UGS in the cities.	Perceiving the park to be very safe/safe, not very safe/not safe at all – no more information provided.	Self-reported - "How often do you come to this park?" (responses consisted of "daily" to "never") – no more information provided.	Quantitative analysis. Perceived safety was significantly associated with reporting having ever visited the UGS.
Cohen et al. (2017)	To test and compare whether additional UGS programming, an incentive system based on frequent user model, or a combination of both influence number of users and physical activity in UGS in high-poverty neighborhood.	UGS users and local residents. Survey N = 3,213 users N = 2,973 locals (half at baseline and half at follow-up)	America (US – CA)	No UGS definition provided. UGS characteristics: •) Accessible w/o fees/restriction: UGS were considered ineligible if the use by the general public was prohibited. •) Facilities/programs: UGS were considered ineligible if they only provided specialized services.	Perceiving the park to be very safe/safe, not very safe/not safe at all – no more information provided.	Observation (SOPARC) - not used in relation to perceived safety. + Self-reported – Interviews – no more information provided.	Quantitative analysis. Perceived safety/unsafety was significantly associated with the number of UGS visits in the last 7 days.

Study	Aim of the study	Participants	Data collection country and year	UGS definition and characteristics	Perceived safety measurement method	Attendance measurement method	Relationship between perceived safety and attendance
Costigan et al. (2017)	To examine the perceived importance of UGS features for encouraging UGS-based physical activity and examine differences by sex, age, parental-status and participation in physical activities.	Local residents (families with children) Baseline: N = 1487 Follow-up: N = 1288	Australia (Melbourne)	No UGS definition provided. UGS characteristics: •) Size: modified UGS = 329 hectares / not modified UGS = 120 hectares. •) Neighborhood: modified UGS = located 28 km north-west of Melbourne's central business district, in a low socio-economic status area / not modified UGS = located 22 km east of Melbourne's central business district, in a high socio-economic status area.	Ranking of the importance of 20 UGS features (e.g. well maintained, feel safe going there, relaxing, easy to get to, shade trees) for encouraging UGS-based physical activity in the next fortnight. Responses were dichotomized as "not important" versus "important"	Self-reported. •) "Have you visited a park in the past 7 days?" (yes/no) •) "In the past 3 months, on average, how often have you visited a park?" (1 = daily; 2 = 2–3 times per week; 3 = once per week; 4 = 2–3 times per month; 5 = once per month; 6 = <once per month; 7 = first time to this park). Responses were dichotomized ("At least once per week" versus "less than once per week")	Quantitative analysis (rankings). Feeling safe was the second most important feature (after "well maintained") stated by participants for UGS-based physical activity.
Yen et al. (2017)	To investigated the behavioral intention to the use of the UGS from the perspective of the young residents of Phnom Penh using the Theory of Planned Behavior (TPB)	Young residents who live in Phnom Penh. Survey N = 554	Asia (Cambodia)	No UGS definition provided. UGS characteristics: not provided.	4 items, 5-point Likert scale, from 1 (strongly concern) to 5 (no concern at all). •) Accidents •) Robbery •) Violence •) Personal safety (Total score)	Self-reported - Behavioral intention, 5-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree). •) I intend to visit UGSs if they are near my home •) I will visit UGSs if they are safe •) I will visit UGSs more often if there are facilities and green areas •) I intend to visit UGSs more often in the future	Quantitative analysis. Perceived safety was significantly associated with the behavioral intention to use UGS.

Study	Aim of the study	Participants	Data collection country and year	UGS definition and characteristics	Perceived safety measurement method	Attendance measurement method	Relationship between perceived safety and attendance
Türkseven Dogrusoy and Zengel (2017)	To examine the relationship among some important factors and perceived safety in a broader sense, as well as examine the relationship between perceived safety and UGS use.	UGS users. Survey UGS-1: N = 220 UGS-2: N = 222	Asia (Turkey)	No UGS definition provided. UGS characteristics: •) Neighborhood: UGS-1 = located in the city center, surrounded by mixed uses (e.g. shops, cafes…)/ UGS-2 = surroundings lack activities, one side of the park faces educational facilities, the other side is next to an urban transformation area inhabited mostly by immigrants with lower education and income. •) Landscape/architecture: UGS-1 = Modernist design with a clear layout, featuring an ornamental pool at the center. Sustains visibility. / UGS-2 = Organic layout design from its early garden use, with curvilinear and connected but somewhat discontinuous paths. Higher green density and wooded areas prevent clear visibility. •) Safety aspects: UGS-1 = more vivid activities during day and night, well-maintained, good lighting at night, and good visibility. / UGS-2 = less vivid activities during day and night, unmaintained, no good lighting at night, and no good visibility due to higher ratio of wooded areas and green density.	13 items, 5-point Likert scale (completely agree/ completely disagree). •) I am annoyed by the fact that unsafe people are wondering around •) It is possible to experience sexual harassment in this park •) Some disturbing circumstances can happen in this park •) Robbery and theft are unusual in this park •) I can visit this park during the night without any hesitation •) I feel safer when the park is crowded •) I recommend this park to others •) I enjoy being here •) I feel safe in this park •) I am nervous about the fact that trees obstruct my view in some places of the park •) I can find my way easily in this park •) Some hiding places disturb me in this park	Self-reported - Close-ended questions. (e.g. participants were asked how frequently they visit the target UGS).	Quantitative analysis. UGS-1 (perceived as safe) was more frequently used than UGS-2 (perceived as unsafe). However, users spent more time in UGS-2 than in UGS-1, and the most frequent visitors felt themselves safer from crime in UGS-2 than the least frequent visitors.

Study	Aim of the study	Participants	Data collection country and year	UGS definition and characteristics	Perceived safety measurement method	Attendance measurement method	Relationship between perceived safety and attendance
Derose, Han, Williamson and Cohen (2018)	To investigate if there are gender differences in UGS use and physical activity.	Local residents. Survey N = 2,973 (half at baseline and half at follow-up)	America (US – CA)	No UGS definition provided. UGS characteristics: •) Facilities/programs: M = 20 activities •) Size: M = 8 acres •) Neighborhood: M = 52,310 individuals within 1 mile, 27 % of households in poverty •) Visit rate: Average = 3,079 users/park, 65 % male	Perceiving the park to be safe or very safe vs. not very safe or not at all safe /safe, not very safe/not safe at all – no more information provided.	Self-reported - Number of visits to parks in the last 7 days and typical duration of park visit (minutes).	Quantitative analysis. Perceiving the park as safe was consistently and positively associated with park use (number of visits and duration of stay).
Aliyas and Nezhad (2019)	To investigate which factors influence the utilization of four historical Persian gardens (UGS).	UGS users. N = 775 (+/- 200 per UGS)	Asia (Iran)	Definition: "Historical Persian garden including water and plan of gardens, divided into sectors. Walls surround these gardens to protect them from sandstorms and extreme climates, as well as to increase the feeling of privacy". UGS characteristics: •) Size: ranging from 11 ha to 12.7 ha •) all included gardens are considered as popular and famous	One single question, 5-point Likert scale – "I feel safe to walk alone in the garden'' (strongly disagree/strongly agree)	Self-reported - ''How often do you visit this garden?'', 5-point Likert scale, from 1 (a couple of days in a week) to 5 (once in a year).	Quantitative analysis. Perceived safety was significantly associated with UGS visitation.

Study	Aim of the study	Participants	Data collection country and year	UGS definition and characteristics	Perceived safety measurement method	Attendance measurement method	Relationship between perceived safety and attendance
Sonti, Campbell, Svendsen, Johnson and Auyeung (2020)	To explore differences in UGS use and motivations for UGS visitation according to site type and gender of respondents.	UGS users. N = 955 (landscaped areas: N = 723; natural areas: N = 232)	America (US – NY)	Natural areas of New York City parkland: "forests, meadows, and wetlands occurring in New York City parklands" Landscaped areas of New York City parkland: "landscaped, manicured, or programmed parkland such as lawns, ballfields, playgrounds and plazas". UGS characteristics: •) Facilities/programs: Contain between one and all of the following amenities: BBQ, Bicycling, Dog Park, Nature Center, Playground, Sports Facilities, Waterfront •) Size: A sample of UGS larger than 400 acres and a sample of smaller parks, each containing at least one natural area •) Neighborhood: Across various boroughs of NY City (Bronx, Brooklyn, Manhattan, Queens, Staten Island).	Open questions (What are you doing in the park today? Why do you choose to come here? In this park, do you ever go into the woods / wetland / trail area? If yes, what do you do there? If no, why not? Are you involved in any groups that help take care of the environment?)	Self-reported - Open questions (What are you doing in the park today? Why do you choose to come here? In this park, do you ever go into the woods / wetland / trail area? If yes, what do you do there? If no, why not? Are you involved in any groups that help take care of the environment?)	Qualitative analysis. Many interviewees (41%) said not visit UGS natural areas (most common barrier was fear or concern for safety), from which many expressed a preference for landscaped areas due to safety, comfort, and ongoing activities.

71

3.1. How do studies investigating the relationship between safety perception and attendance define and characterize UGS?

a. Review findings

The majority of the studies included in this review did not define the concept of UGS. One paper provided a detailed explanation of the studied spaces in the introduction part, but only two papers provided an actual definition of the spaces they included (Tab.1). These explanations/definitions never mentioned all of the criteria selected to consider the studied place as being valid for this review, and the choice to include the studies in the present review was therefore mostly based on the characteristics provided about the spaces, and not based on explanations/definitions. The characteristics emphasized in the included studies are very heterogeneous and depend greatly on the objective of the study (Tab.2). These characteristics can, for example, include information about UGS' size, location (e.g. socio-economic status of the neighborhood), number and/or type of included facilities (e.g. physical activity facilities like baseball courts) and/or programs (e.g. number of supervised activities), maintenance, the average number of users, or residents who live in the vicinity of the target UGS. Some studies give a lot of information about the included UGSs (e.g. Türkseven Doğrusoy & Zengel, 2017), even sometimes naming the spaces when popular (e.g. Prospect Park; Krenichyn, 2006). Other studies are much vaguer, sometimes giving no information at all about the evaluated UGS (e.g. Yen et al., 2017). For most of the studies included in this review, there was no clear indication of the amount of nature, the presence or absence of water, the quality of maintenance, and other such indicators.

Table 2. Studies including a definition or explanation of UGS and their associated definition/explanation.

Study	Associated explanation/definition
Willemse & Donaldson (2012)	"*Developable land with recreation facilities, which serve the needs of the local community or neighborhood and are usually accessed on foot. It includes informal recreation facilities of small scale for children such as tot-lots and playgrounds, seating areas, open grass lawns and gardens*". (p.223)
Aliyas & Nezhad (2019)	Historical Persian garden including water and plan of gardens, divided into sectors. Walls surround these gardens to protect them from sandstorms and extreme climates, as well as to increase the feeling of privacy.
Sonti et al. (2020)	Natural areas of New York City parkland: "*forests, meadows, and wetlands occurring in New York City parklands*". (p.1)
	Landscaped areas of New York City parkland: "*landscaped, manicured, or programmed parkland such as lawns, ballfields, playgrounds and plazas*". (p.1)

Table 3. UGS characteristics highlighted in the included studies.

Authors	Outdoor	Accessible w/o fees/restriction	Located in an urban area	Presence of vegetation	Facilities/programs	Size	Neighborhood [1]	Landscape and architecture [2]	Safety aspects [3]	Visit rate
Krenichyn, 2006	•	•	•	•	•	•	•	•		•
Cohen et al., 2009	•	•	•	•	•	•	•			
Loukaitou-Sideris & Sideris, 2009	•	•	•	•	•					
Cohen et al., 2010	•	•	•	•	•	•	•			
Willemse & Donaldson, 2012	•	•	•	•	•					
Cohen et al., 2012	•	•	•	•	•				•	
Cohen et al., 2013	•	•	•	•	•		•			
Cohen et al., 2015	•	•	•	•	•	•	•			
Lapham et al., 2016	•	•	•	•		•				
Cohen et al., 2017	•	•	•	•						
Costigan et al., 2017	•	•	•	•		•	•			
Yen et al., 2017	•	•	•	•						
Türkseven Dogrusoy & Zengel, 2017	•	•	•	•	•		•	•	•	
Derose et al., 2018	•	•	•	•	•	•	•			•
Aliyas & Nezhad, 2019	•	•	•	•		•				
Sonti et al., 2020	•	•	•	•	•	•		•		
TOTAL	16	16	16	16	11	9	8	3	2	2

1 = e.g. sociodemographic characteristics of the neighborhood, car traffic, number of people living within a certain radius… / 2 = e.g. presence of water bodies, walls, wooded areas, hills… / 3 = e.g. presence of lighting, visibility of the space, maintenance…

b. Discussion

The included explanations/definitions of UGS show how different the studied spaces can be from one another, which is also highlighted by the very heterogeneous characteristics emphasized in the included studies. Presently, the notion of UGS includes a multitude of various spaces, sometimes very different from each other. These observations show one of the difficulties related to research about this type of space, i.e. the methodological issues related to the definition and the conceptualization of UGS (Taylor & Hochuli, 2017; Zhang & Tan, 2019). The way UGSs are conceptualized has important repercussions on the result-generalization and the ability to conduct comparative studies, like systematic reviews, and is in line with previous research on the topic highlighting the multitude of UGS definitions and measurement methods (Taylor & Hochuli, 2017). This issue is accentuated by the fact that these spaces are studied by very different disciplines, each time using methods, definitions and measurement methods specific to them.

Given these conceptual challenges, it is increasingly acknowledged that incorporating operational definitions or explanations, interpretable by all sectors, which qualified and quantified the target UGS, should be prioritized (Taylor & Hochuli, 2017). This would mean to characterize and provide information as precisely as possible on the studied spaces. Among the most studied characteristics are size, accessibility (e.g., the distance between the UGS and participants' residence), and quality (e.g., maintenance). Other indicators include biodiversity and natural rates, vegetation cover or canopy cover, the presence or absence of people, the perception of the space… Although it would not be possible to assess all existing indicators every time an UGS is included in a study, the most frequently assessed indicators should at least be considered when investigating about UGSs. Providing precise coordinates of the included UGSs would also allow to visualize the spaces per satellite view and thus collect some of the information about the characteristics of the place that might not have been described in the original paper. Being more precise about the characteristics of the studied spaces should allow a better understanding of the specific aspects of the UGS influencing the safety-attendance relationship, and increase the comparability between studies.

3.2. What indicators are used to evaluate UGS attendance?

a. *Review findings*

In the studies included in this review, UGS attendance was measured through self-reported estimation of UGS use by visitors or residents (later referred to as self-reported attendance measurement), or through a combination of self-reported attendance measurement and a counting of individuals attending the UGS (later referred to as observational attendance measurement). It is important to note that, while some studies use multiple measures of attendance, not all were automatically assessed in relation to perceived safety (see Table 1).

Observational attendance measures were explained in detail in the studies using this type of measurement method. The mostly used observational measurement was the so-called SOPARC system, i.e. the System for Observing Play and Recreation in Communities. This system uses momentary time sampling and allows, through direct systematic observation, to obtain information on UGS users and their physical activity (McKenzie et al., 2006). This tool provides an estimate of users' characteristics, physical activity, and overall UGS use. It also allows translating the activity observed in the UGS in total metabolic equivalents (METs) per hour, where one MET equals the energy expended by a person at rest for 1 hour. The number of METS assigned to the observed activity varies (Cohen et al., 2013, 2015), but could look something like this: 1.5 METs for a sedentary activity like sitting or standing, 3 METs for a moderate activity like walking, and 5-6 METs for a vigorous activity like running. This SOPARC method, therefore, refers to an objective observational measure of UGS attendance. One article (Loukaitou-Sideris & Sideris, 2010) used the System for Observing Play and Leisure Activity in Youth (SOPLAY), designed to obtain observational data on the number of participants and their physical activity during play and leisure opportunities. Like the SOPARC method, this system is based on momentary time sampling, where target areas are scanned to count the number of individuals and code their physical activity (sedentary, walking, or very active), allowing to estimate energy expenditure rates (McKenzie et al., 2000). However, data on physical activity were not included in this study, only the observed number of UGS users. For both systematic observation methods, SOPARC and SOPLAY, observers were trained and inter-observer reliability was checked for. Observers visited the UGSs before data collection and each space was pre-divided into observation zones. All studies including observational methods paired this with self-

reported measures, which made self-reported measures the most used type of measure.

Regarding self-reported attendance, if some authors gave the precise wording of the questions assessing attendance rate (e.g. "How often do you come to this park?"; Cohen et al., 2010), information was mostly inaccurate and precise wording was not provided, neither for the question nor for the answer options. Sometimes, no information at all was given. Whether the wording of the question was provided or not, it was difficult to know what the authors had or had not considered as attendance. For example, simply walking through the space, i.e., using the UGS as a shortcut, may be counted by some individuals as attendance but not by others.

b. Discussion

Review findings show that, if observational attendance measures were explained in detail with well documented and replicable methods, this was not always the case for the self-reported attendance measures, where most studies lack precision on how attendance was assessed. As already mentioned, quality research depends on precise and standard measurement, and giving the precise included questions and answer options is crucial to allow the understanding and a critical analysis of the results, as well as a comparison between studies and a generalization of the results.

It is also worth noting that authors rarely stated what was or was not considered as "attendance". Sometimes each type of attendance, regardless of the reason, duration of stay, or activity done can be of interest based on study goals, while for other studies the time spent in the place may be an even more important indicator. Using the time spent in the UGS can make sense when studying safety concerns. Indeed, to save time, people will eventually cross the UGS if it is located at a strategic point, but will not linger there because of a low feeling of safety. Some authors highlight, however, the importance of taking into account the time spent in the UGS only in relationship with the ongoing activities (Türkseven Doğrusoy & Zengel, 2017). In this study which compares two UGSs, the UGS considered being the safest, despite being the most frequently used, was also the UGS where individuals spent the less time (Türkseven Doğrusoy & Zengel, 2017). Authors explain this observation by reporting that the UGS considered as being unsafe, was used especially for long lasting activities like sports and picnic during weekends, which automatically influenced the time spent within the place (Türkseven Doğrusoy & Zengel, 2017). While this explanation alone probably does not explain the full nuance of the

relationship between the time spent in a place and the associated feeling of safety, it does underline the importance of having a good knowledge of the place and coupling any quantitative information with more qualitative observations and data. Coupling quantitative and qualitative data is the best way to obtain the most accurate picture of the safety/attendance relationship of a specific place, and allows the best possible interpretation of quantitative results.

Future studies of the relationship between safety and attendance, would benefit from the distinction between objective and subjective measures of attendance. Ideally, both types of measures should be included to allow for comparison. Given that studies which collected observational measures used the SOPARC or SOPLAY measurement tool, future studies may also consider these tools to facilitate comparisons. These measurement tools also appear to be relatively accurate and well-documented. For all self-reported measures, the exact wording of the questions should be provided, given the influence this may have on how participants understand and answer the question. It is important to also clarify with respondents what is and is not considered as "attendance". To facilitate comparison, an omnibus definition defining attendance as any sort of visit, without looking at the reason, the activity done or the duration of stay could be considered. This type of definition of UGS attendance is already used by some authors. For example, Schipperijn and colleagues (2010), define UGS use as "any sort of visit to an urban green space, without looking at the duration of the stay, the reason for visiting or the activity done while visiting; e.g. passing through on the way to a destination is also counted as use". Including, in addition to the number of visits, the average time spent in the UGS during these visits, may be an interesting indicator in the context of studies looking at perceived safety, when coupling this with an observation of the ongoing activities.

3.3. What indicators are used to assess perceived safety?

a. Review findings

Most included studies gave little or even no information at all about how perceived safety was assessed, allowing only an assumption of the formulation of the questions based on the analysis of the result section and terms used in the theoretical part of the article.

Regarding articles with little information about the perceived safety measurement or the used wording, the analysis of the result section suggested that the concept

was mostly assessed through a single question, with ordinal answer options (i.e. very safe/safe/not very safe/not safe at all; Cohen et al., 2013, 2017; Lapham et al., 2016). Other studies clearly stated that perceived safety was assessed through one single question, providing or not the exact wording of the question (e.g. "Do you feel safe at the park?" – yes/no; Loukaitou-Sideris & Sideris, 2010; "In general, how safe do you feel this park is?" - Very safe/safe/not very safe/not safe at all; Cohen et al., 2010; "I feel safe to walk alone in the garden" – Likert scale ranging from 1= strongly disagree to 5 = strongly agree; Aliyas & Masoudi Nezhad, 2019). Moreover, while some authors measured safety perception through a single item, others broke it down into several factors, including items related to personal safety, but also related to accidents (Türkseven Doğrusoy & Zengel, 2017; Yen et al., 2017) or even environmental satisfaction (Türkseven Doğrusoy & Zengel, 2017). In three studies perceived safety was not directly assessed but open questions brought participants to spontaneously mention safety concerns when qualitatively describing their (non) use of the target UGS (Krenichyn, 2006; Sonti et al., 2020; Willemse & Donaldson, 2012).

   b. Discussion

Two main reasons lead us to focus on safety perception rather than on fear of crime. Not only does fear of crime represents only a part of all the safety concerns that can occur in public open spaces like UGSs, but literature also tends to show an inconsistency in how fear of crime is defined and therefore measured (Collins, 2016; Etopio & Berthelot, 2022). This makes it difficult to compare results between researches assessing fear of crime. This is also illustrated when looking at the reasons for article exclusion for the present review (see flowchart on osf or the Appendix section Fig.A2), the main reason for exclusion being that the safety perception measure did not meet the criteria established for this review. Often, these articles indicated measuring perceived safety, when they actually measured fear of crime, illustrating once more the confusion around this concept. Given that the notion of perceived safety is much broader and, according to some authors, seems measured through more standardized and general questions ("How safe would you feel walking alone at night in…"; Hinkle, 2015), we hoped to obtain more comparable measures between studies by only including the notion of perceived safety. Although some question wording is probably recurrent (e.g. "How safe do you think this park is?"; Cohen et al., 2010), the lack of clear, standardized measures also seems to be true for the notion of safety perception.

The most important for researchers will probably be to be thoughtful about the concept they want to include and the way they assess it (Hinkle, 2015), depending on their objective. For example, asking participants how safe they feel will lead to different answers than asking them how afraid they are (Yang & Hinkle, 2012), and being aware of this is an important first step. Moreover, for transparency, but also to allow a comparison between studies, it is important that researchers clearly indicate the measure they used, the wording of the questions, and the answer options. Both the variety of measures used to assess perceived safety and the lack of precision in the way the questions and response options are formulated makes comparing findings across studies challenging and differences in results could be attributed to the use of different measures.

When looking at the few qualitative data (Krenichyn, 2006; Sonti et al., 2020; Willemse & Donaldson, 2012), it seems to make sense to expand the notion of safety perception beyond the fear of crime, given that participants also mentioned concerns not related to crime, like getting lost, the fear of accidents, or even the fear of animals like mosquitos. It would most likely be impossible to think of and include all the situations that can pose safety problems for individuals who visit public open spaces like UGSs. Moreover, these reasons may be very different from one individual to another or even from one country to another. For example, as already mentioned, UGS' safety concerns in Europe are probably not the same as those important or perceived in Asia (Huai & Van de Voorde, 2022). Creating a scale including items that encompass all possible safety problems seems therefore more than likely impossible.

In addition, pre-defined items or answer options automatically influence the answer that participants give (Yang & Hinkle, 2012). An omnibus measure, asking participants to rate how safe they feel in a target place seems to be more appropriate and allows assessing the overall feeling of safety. This would include all the safety aspects that participants may think about. The answer of the participants will be based on what is the most accessible in mind to them, rather than on what is suggested by pre-defined items. It would also be advisable to include, in addition to a question about the feeling of safety, a question about the feeling of unsafety. Indeed, feeling safe may not have the same impact on the attendance rate as feeling unsafe (e.g. Türkseven Doğrusoy & Zengel, 2017). Such general measures could take the form of two Likert-like scales, one assessing the feeling of safety, the other one the feeling of unsafety. Using Likert-like scales would allow the assessment of the intensity of these feelings of safety/unsafety. Obviously, this does not capture the reasons for these feelings. Depending on the objective of the study, or if the survey

has a practical purpose, it may be interesting, after this first question, to include questions allowing the individual to specify the reasons for this feeling. This or these open-ended question(s) could ask participants to spontaneously mention all reasons that might induce in them a feeling of (un)safety. Again, the answers given by the participants will probably be based on what is most accessible to them, and it is not unlikely that important reasons will not be mentioned because of their inaccessibility in mind. Therefore, it may be interesting to consider the addition of a third step, and listing different reasons potentially linked to safety perception in public places and asking participants to evaluate, on a Likert-like scale, the importance each of these reasons has on their safety perception. This list would be based on existing literature, mainly from qualitative studies (e.g. focus groups, semi-structured interviews). As already mentioned, this can include aspects such as the fear of getting lost or the fear of accidents.

3.4. How is the relationship between UGS' safety perception and UGS' attendance rate measured and characterized in the literature on this subject?

a.   Review findings

None of the 16 studies included allowed to make causal inferences about the perceived safety and attendance rate relationship, only correlational inferences could be made. If some studies were experimental or quasi-experimental, variables of interest for the present review were always secondary outcomes, with no manipulation being applied to them.

In one study, based on the theory of planned behavior (Ajzen, 1991), results are presented in the form of causal inferences (Yen et al., 2017). However, the methodology used (cross-sectional) only allows correlational inferences. In this study, perceived safety is measured by asking participants to rate their worry about accidents, theft, violence, or personal safety. This assessment is made on a 5-point scale ranging from 1 (strongly concerned) to 5 (no concern at all). Attendance intention is also measured on a 5-point scale ranging from 1 (strongly disagree [to attend the UGS]) to 5 (strongly agree [to attend the UGS]). The hypothesis predicts a negative effect of perceived safety on UGS attendance behavior ("Perceived safety (PS) would have a negative effect on the behavioral intention to the use of UGSs", p.100), which is supported by the results. The authors conclude that there is a significant impact of perceived safety on the intention to attend the UGS ("The study

also indicated that the safety of the existing UGSs had adamant effects on the (…) behavioral intention", p.106). Based on this paper and the direction of the Likert-scales, the results should, however, be formulated as follows: "The less individuals are concerned about the measured incidents, the less they intend to attend the UGS". This interpretation seems counterintuitive and difficult to interpret. The idea that having the intention to attend the UGS increases the worries about the events that can occur there seems a priori to make more sense. The relation being, in reality, correlational and not causal, it is not possible to determine the direction of this relationship. It is legitimate to wonder if there may was an encoding error somewhere.

One study was experimental in nature (Cohen et al., 2017). This study used a pre-/post intervention design, with control condition and randomization. The objective of this study was to test and compare whether additional free physical activity classes, a frequent user program where participants could win prizes based on the number of visits they made to the UGS or a combination of both, influenced a number of UGS users and physical activity in UGSs located in high poverty neighborhoods. These conditions were compared to a control condition (without additional programs or incentives), over a 6-month period. UGSs were randomly assigned to one condition, and park size, population density, percentage of households in poverty and race/ethnicity composition within a 1-mile radius was controlled for. Multiple regression analyses were used, but UGS attendance and perceived safety were both outcome variables, thus not allowing to test a causal relationship. Surprisingly, if considering the UGS as safe was positively and significantly related to the number of UGS visits in the last 7 days as well as to the duration of stay, considering the UGS as not very safe was also positively and significantly related to the number of UGS visits, even if it was not related to the duration of stay.

Two studies were quasi-experimental. Both used a pre/post-intervention design, with a control condition, but without randomization (Cohen et al., 2009, 2015). The objective of these studies was to assess the impact of UGS improvements on the use of the target UGS and the physical activity taking place in these spaces, on the overall population (Cohen et al., 2009), or among youth (Cohen et al., 2015). In the first study, five intervention UGSs, which underwent major improvements, and five comparison UGSs were compared at two-time points, at baseline and follow-up (Cohen et al., 2009). Four groups were thus compared, one "treated group" (sampled at intervention UGS at follow-up), and three non-treated groups (sampled at

intervention UGS at baseline, sampled at control UGS at baseline, and sampled at control UGS at follow-up). UGSs were matched based on size, features, and amenities and served populations with similar sociodemographic characteristics. UGS attendance and perceived safety were both outcome variables, thus not allowing to test a causal relationship. While specific statistics are not provided in the article, the authors state that if safety perception improved in intervention UGS and decreased in control UGS, this was not correlated with observed attendance measure, nor with self-reported attendance measure. In the second quasi-experimental study, 6 UGSs were compared at two-time points, 2 were un-renovated, 2 partially renovated and 2 renovated (Cohen et al., 2015). UGSs were matched based on size, the socio-economic and demographic composition of local neighborhoods, and one park in each pair was scheduled for renovation. UGS attendance and perceived safety were both outcome variables, thus not allowing to test a causal relationship. If observation and self-reported measures were used to assess UGS attendance, only the self-reported measure was tested in association with perceived safety. Perceiving the UGS as safe was significantly associated with frequency of use in the last 7 days among residents, as well as among UGS users. A small nuance, however, given that this measure was also recorded by the researchers: perceived safety was significantly associated with the number of exercise sessions in the target UGS among residents, but not among UGS users.

All other quantitative studies (8) used non-experimental approaches. Within these quantitative studies, some studies found a significant association between perceived safety and attendance (4; Aliyas & Masoudi Nezhad, 2019; Costigan et al., 2017; Derose et al., 2018; Lapham et al., 2016), whereas others found no significant association (2; Cohen et al., 2010, 2013) or more mixed results (2; Cohen et al., 2012; Türkseven Doğrusoy & Zengel, 2017). All studies that found a significant relationship used self-reported measures of UGS attendance. All studies that found no significant relationship used observational measures of UGS attendance. Even if these studies also included self-reported measures of UGS attendance, these were not examined in relation to perceived safety. The first study reporting mixed results used self-reported attendance measures among residents and UGS users (Cohen et al., 2012). The only significant relationship was observed among residents living in the vicinity of the UGS, where perceiving the UGS as safe was significantly related to the number of UGS visits. Perceiving the UGS as safe was not related to the number of UGS visits among the participants interviewed within the UGS (users). The researcher also recorded the number of exercise sessions within the UGS, but this was not related to safety perception, neither by residents nor by UGS users. The second study with

mixed results also used self-reported attendance measures but only included UGS users in their sample (Türkseven Doğrusoy & Zengel, 2017). This study found a significant relationship between perceiving the UGS as unsafe and the frequency of UGS visits but found no significant relationship between perceiving the UGS as safe and the frequency of UGS visits. The last 4 studies did not allow the statistical measurement of the perceived safety/attendance rate relationship. Three studies assessed this link qualitatively, and the last one used percentages. In the study using percentages, the most cited main reason for the non-use of UGS were safety concerns (mentioned by 28%), and the most cited desired improvements related to security facilities, like safer play equipment, security guards, or cameras (mentioned by 28%; Willemse & Donaldson, 2012). Personal safety and security were also what received one of the lowest satisfaction ratings and were highlighted as one of the main UGS issues. Lastly, three studies assessed the relationship qualitatively. In the first one, perceived safety figured prominently in the reasons children gave for never visiting an UGS or, when doing so, for choosing one UGS rather than another (no percentage provided; (Loukaitou-Sideris & Sideris, 2010). In addition, more than three-quarters of all interviewed parents reported not allowing their children to go to UGS without an adult, mostly for concerns about crime and traffic. The second study focused on one specific UGS, Prospect Park in Brooklyn, and interviewed only female UGS users to explore their physical activity within this UGS (Krenichyn, 2006). Women often centered on feelings of safety, which included both aspects of physical safety related to traffic, and safety related to interpersonal problems like harassment. While some women felt confident to use more hidden areas in Prospect Park, many experienced a conflict between their desire to use these areas and their concerns regarding personal safety. No percentages are provided in this article. In the last study, carried out in various UGSs in New York, the objective was to explore differences in UGS use and motivations for UGS attendance according to the site type and the gender of respondents (Sonti et al., 2020). More specifically, authors distinguished between urban natural areas (i.e. forests, meadows, and wetlands occurring in New York City parklands) and urban landscaped areas (i.e. more landscaped, manicured, or programmed parkland such as lawns, ballfields, playgrounds and plazas). Almost half of the interviewees (41 %) reported not visiting the UGS' natural areas, expressing a preference for landscape areas. The main cited barrier to the use of urban natural areas was fear or concern for safety, whether related to humans (e.g. rape, drug and alcohol problems) or animals (e.g. mosquitos, rats), or even related to the worry about getting lost.

b. Discussion

Relying on this analysis, the only consistent result, based however only on three studies from the same research team, is a non-significant relationship between safety perception and a number of people observed in the target UGS (Cohen et al., 2009, 2010, 2013). These results must be qualified, of course, since the first result of a research team can influence future results. In addition, it is important to note that the people observed in the UGS were not necessarily the same as the people in the sample selected for the survey measuring perceived safety, due to the applied methodology. However, it is still interesting to consider these results given their consistency, and because perceived safety measurements and attendance measurements are (almost) identical between these different studies.

Results from the studies using self-reported attendance measures were less consistent. Six studies found significant relationships (Aliyas & Masoudi Nezhad, 2019; Cohen et al., 2015, 2017; Costigan et al., 2017; Derose et al., 2018; Lapham et al., 2016) and three found inconsistent or unexpected results (Cohen et al., 2012; Türkseven Doğrusoy & Zengel, 2017; Yen et al., 2017). These results depended on the target population, or the way safety perception was measured. One study found a significant relationship between perceiving the UGS as safe and the number of visits among residents, but no significant relationship between perceiving the UGS as safe and the number of visits among UGS users (Cohen et al., 2012). Another study found a significant relationship between UGSs with positive environmental properties regarding the perceived safety and frequency of UGS visits, but no significant relationship between UGSs with negative environmental properties regarding the perceived safety and frequency of UGS visits (Türkseven Doğrusoy & Zengel, 2017). This safe/unsafe distinction is interesting, as it also leads to nuanced results in another study. In this study, both considering the park as safe and considering the park as not very safe was related to the number of visits to the UGS in the last 7 days (Cohen et al., 2017). However, only considering the park as safe was significantly related to the duration of stay (Cohen et al., 2017).

In summary, in the studies included in this review, the relationship between perceived safety and attendance is non-significant when the measure of attendance is objective (systematic observation method). However, more nuanced results are observed for the studies included in this review when the attendance measurement is subjective (self-reported by participants). These results vary, however, depending on the population studied, as well as on the methodology and measures used. All the

conclusions should also be taken with great caution, given the variety of spaces studied and the lack of information about them, the lack of precision regarding the methods used to measure perceived safety and UGS attendance, and the relatively small number of studies included in this review.

Besides these rather methodological aspects, as already highlighted, most of the studies were conducted in the US. Cultural differences exist between continents and make the results of this review difficult to generalize to countries outside the US. Understanding the relationship between perceived safety and UGS attendance on other continents would benefit from an increase in number of studies on the subject outside the US.

Finally, to continue to clarify this question, including experimental studies would allow a better understanding of this link.

Limitations

This review has several limitations. First, half of the included studies were conducted by the same research team. This implies that research methods are often very comparable between these studies, making it easier to compare results, but this can also lead to biased results, either because of repeated methodological errors or, for example, because of the so-called confirmation bias. Further replication by other research teams should benefit the topic and increase the scientific validity of the results. Secondly, only one author screened the articles and checked them against the exclusion/inclusion criteria. Some relevant studies and data could have been missed. In addition, other databases could be included in future reviews, for a more comprehensive search. Finally, to allow for more comparable measurements, only the notion of perceived safety was retained. However, it would probably be beneficial to include studies interested in fear of crime or even risk perception, and potentially compare the concepts and their related variables/outcomes.

Conclusion

In conclusion, this field of research still lacks precision and does not allow for generalization. Results appear relatively heterogeneous, as are the UGSs included in the studies and the definition and assessments of the concepts of perceived safety and attendance. There is also a lack of experimental or longitudinal studies, which does not allow to draw any conclusions about the impact of perceived safety on UGS'

attendance rate. In the future, researchers would benefit from defining the spaces studied as precisely as possible, using omnibus measures of perceived safety and attendance, and distinguishing between observational and self-reported attendance measures. In addition, beginning to develop study designs that test for causality would advance our knowledge of this topic.

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Data availability

Search strategy, flowchart and data extraction tool can be found open access on osf.

Declaration of competing interest

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APPENDIX

Figure A1. *Search strategy*.

Database: APA PsycInfo <1806 to November Week 2 2022>
Search Strategy:

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1 urban environments/ (28265)
2 recreation areas/ or playgrounds/ (1869)
3 ((urban or metropol* or city or cities or town* or municipalit* or recreation* or public) adj3 (environment* or space* or area* or place* or facilit* or infrastructure* or landscape*)).ti,ab,id. (32819)
4 playground*.ti,ab,id. (1845)
5 1 or 2 or 3 or 4 (55777)
6 "nature (environment)"/ (2537)
7 (natur* or green*).ti,ab,id. (355260)
8 vegetation*.ti,ab,id. (1137)
9 flora.ti,ab,id. (406)
10 6 or 7 or 8 or 9 (356645)
11 5 and 10 (4672)
12 ((urban or metropol* or city or cities or town* or municipalit* or recreation* or public) adj3 garden*).ti,ab,id. (138)
13 (park or parks).ti,ab,id. (6768)
14 greenspace*.ti,ab,id. (105)
15 11 or 12 or 13 or 14 (11194)
16 safety/ (16527)
17 (safe* or unsafe* or secur* or insecur*).ti,ab,id. (181942)
18 16 or 17 (182518)
19 (access* or use* or underuse* or disuse* or utiliz* or frequent* or visit* or attend* or presen* or activit*).ti,ab,id. (3011213)
20 (measure* or scale* or assess* or evaluat* or indicat*).ti,ab,id. (2292008)
21 19 and 20 (1470769)
22 15 and 18 and 21 (370)
****

Figure A2. *Flowchart. Only one exclusion criterion per study was recorded.*

```
┌─────────────────────────┐         ┌─────────────────────────┐
│ 625 studies imported for│ ──────> │  89 duplicated removed  │
│        screening        │         │                         │
└─────────────────────────┘         └─────────────────────────┘
              │
              ▼
┌─────────────────────────┐         ┌─────────────────────────┐
│ 536 studies screened    │ ──────> │ 473 studies irrelevant  │
│ based on title and      │         │                         │
│ abstract                │         └─────────────────────────┘
└─────────────────────────┘
              │
              ▼
┌─────────────────────────┐         ┌─────────────────────────┐
│ 63 full-text studies    │ ──────> │ 57 studies excluded     │
│ assessed for eligibility│         └─────────────────────────┘
└─────────────────────────┘
```

Reasons for exclusion:
- Safety perception measurement does not meet the criteria established for this review (18)
- Attendance and/or safety perception is/are not measured in relation to the UGS specifically (e.g. in relation to the overall neighbourhood environment) (13)
- Book, thesis, opinion text or review (8)
- The UGS and/or its attendance is evaluated among other spaces, making it impossible to distinguish UGS-specific results (5)
- Attendance measurement does not meet the criteria established for this review (4)
- No measurement of the relationship between perceived safety and attendance (3)
- No attendance measurement (2)
- No safety perception measurement (2)
- The space studied does not meet the UGS criteria established for this review (3)
- Text not available in English, French or German (1)

```
┌─────────────────────────┐
│ 10 studies included     │
│ based on bibliography   │
│ of included articles or │
│ on prior knowledge of   │
│ their relevance         │
└─────────────────────────┘
              │
              ▼
┌─────────────────────────┐
│ 16 studies included in  │
│       the review        │
└─────────────────────────┘
```

Table A3. *Articles included in the review.*

Article references

Krenichyn, K. (2006). 'The only place to go and be in the city' : Women talk about exercise, being outdoors, and the meanings of a large urban park. *Health & Place*, *12*(4), 631-643. https://doi.org/10.1016/j.healthplace.2005.08.015

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2.2 Reconnaissance phase

2.2.1 Selection of the indicators

In order to meet the criteria of measurability and transferability imposed by UIA funding, various indicators were identified and collected at the beginning of the project, and their evolution analyzed at the end of the project, during the evaluation phase.

These indicators were selected based on exchanges with field experts (e.g. local police) and, considering the main objective of the psychosocial intervention, based on the existing literature concerning the psychosocial incentives and obstacles to UGS attendance. These indicators can be grouped into two main categories: observable data (behavioral and environmental factors measured against external criteria) and so-called psychosocial data (factors measured through individuals' self-reported assessment). The selected indicators are listed and their relevance is explained below. A summary table can be found at the end of this chapter (Tab.4, pp. 110-112).

- Counted and self-reported UGS attendance.

Increasing UGS attendance is considered as being the main objective of the WP5. Two indicators are included, an objective one (based on the counting of entries and exits of the target UGS) and a subjective one (based on the self-reported attendance estimation of survey participants). It was decided to include both objective and subjective attendance rates, given the difference in results that can sometimes be observed depending on the type of measure used (e.g. Box 2, pp. 55-97).

- Collected waste in UGS.

One of the main issues highlighted by the municipal administration was a large amount of illegal dumping and out-of-box waste recorded in the project area. Approximately 20 % of the attention points concerning this issue and recorded on the Seresian territory can be identified within the area of the present project. This includes household waste, bulky waste, construction waste, green waste and even corrosive and dangerous products. Given the importance the city administration attaches to this issue, it has been decided to include an indicator concerning this waste issue, specifically focused on the UGS targeted by the WP5. In addition, it should be noted that the presence of non-civic behaviors within a specific location will probably have an impact on how that place is perceived, which, in turn, will influence individuals' place appraisal and shape their attendance intention and

attendance behavior. Positively evaluated stimuli, like places, are generally associated with approach intentions and behaviors, whereas negatively evaluated stimuli are generally associated with avoidance intentions or behaviors (Elliot, 2006). Therefore, given that incivility within a place will probably influence the way individuals perceive this place, it seemed important to include an indicator for non-civic behavior within the main target UGS, represented though the proxy of collected waste.

- Inhabitants' attachment to UGS.

Previous research has shown that attitudinal factors can be important drivers of individuals' place attendance intention and place attendance behavior. Individuals with positive attitudes towards a specific place seem more likely to attend this place regularly (e.g. Kil et al., 2012; Yuksel et al., 2010). PA is one of the most studied attitudinal factors in place attendance research and is described as the affective bond individuals may develop with a specific place (Low & Altman, 1992). Therefore, it refers to the individuals' mostly positive attitude towards the place. Although there is no consensus on the number of dimensions included in the concept of PA (Hernández et al., 2020; Lewicka, 2011), it is often considered to be constituted by affective (i.e. emotions, feelings and affects), cognitive (i.e. thoughts, knowledge and beliefs) and behavioral (i.e. actions and behavior) components (Florek, 2011; Jorgensen & Stedman, 2001; Low & Altman, 1992). The affective component of the concept, also called emotional attachment, tends to be the most studied one (Florek, 2011; Fornara et al., 2020). This affective component of the concept seems to be particularly prominent in the attachment to outdoor spaces (e.g. Jorgensen & Stedman, 2001).

- Inhabitants' appraisal of UGS.

As already mentioned, the way places are perceived will influence how these places are appraised, and this will shape individuals' place attendance intention and place attendance behavior. Positively evaluated stimuli (e.g. places), are inherently associated with approach intentions or behaviors, whereas negatively evaluated stimuli are associated with avoidance intentions or behaviors (Elliot, 2006). The positive-negative appraisal of an UGS is all the more important in social justice projects, given that UGSs in low-SES neighborhoods usually appear to be of lower quality and maintenance (Rigolon, 2016; Rigolon et al., 2018; Williams et al., 2020), and are thus evaluated as less positive. It is also worth noting that the way individuals perceive a place can influence beyond their approach and avoidance behaviors, and influence the way they act in these settings. For example, beauty perception in

natural environments can increase prosocial behaviors (Zhang, Howell, et al., 2014; Zhang, Piff, et al., 2014), i.e. behaviors that benefits others, like stewardship behaviors, and can thus be linked to the problems of incivility within the target UGS.

- Inhabitants' safety perception of UGS.

As highlighted in point 2.1.3. (pp. 53-55) and in Box 2 (pp. 55-97), safety perception can potentially have a significant impact on individuals' UGS attendance intention or actual attendance behavior. Although the safety perception-attendance rate relationship needs to be further investigated, given the inconsistent results through studies that have examined the issue, the importance that the city administration and the field actors attach to this issue means the it remains an important aspect of the project and deserves special attention.

- Inhabitants' familiarity with the UGS.

The most familiar places are the ones that are frequently attended, which makes the concept an interesting alternative indicator of individuals' actual interactions with the target place. Sense of familiarity is also important, as it is related to the emotional attachment one may feel towards a given place (Lewicka, 2011; Ujang & Zakariya, 2015), as well as the feeling of being safe (Traunmueller et al., 2016). Finally, when there is an intention to modify spaces (e.g. new facilities, changes in forms and actions within the space), it is extremely important to be aware that any modification, if not implemented sensitively, can potentially dissociate usual attenders from familiar objects within these places (Ujang, 2008). As changes were planned within the target UGS (new facilities, but also actions aiming to enhance UGS' biodiversity and maintenance in the WP4), it seemed interesting to take into account this indicator.

2.2.2 Data collection of the indicators

Indicators were not all measured at the same time, nor in the same way. It is therefore necessary to make a distinction between the data collection of the so-called "observable" indicators and the data collection of the so-called "psychosocial" indicators.

- Observable indicators

Counted UGS attendance. The inhabitants' attendance rate at the UGS was assessed during the third year of the project before the psychosocial intervention, which was implemented in mid-April 2022. These measures were only taken in the third year of the project in order to be out of the pandemic period and the impact it had on the

attendance of public places, but also to be out of the period of UGS development work planned by the city administration (i.e. see Appendix section at the end of this document, Table A1).

The data were collected by counting the number of entrances and exits of the target UGS, with the help of counting posts placed at the UGS' entrances (for more precise information about the counting posts: link). These posts use digital thermal detectors to count any person or vehicle (e.g. bikes) passing within 6 meters of the beam. The data were collected automatically and allowed us to determine the entries and exits of the target UGS, by quarter-hour.

Initially, the counting of UGS entrances and exits was planned to be continuous from September 1, 2021 to August 31, 2022, in Marêts Park and in Morchamps Park (the reasons for the withdrawal of Bernard Serin Park are explained in point 2.2.3, pp 97-99). However, the counting could not be carried out continuously, due to the theft of the counting posts in Morchamps Park and the damages caused to the equipment in Marêts Park. After an unsuccessful attempt to reinstall the counting posts in Morchamps Park, this indicator was abandoned for Morchamps Park, and only self-reported attendance was maintained. In order to optimize the chances of keeping the equipment intact until the psychosocial intervention, the counting posts in Marêts Park were removed end September 2022 and reinstalled in April 2022, approximately two weeks prior to the intervention. These periods were finally selected because of weather conditions similar to those of the post-intervention (Royal Meteorological Institute, 2022), but also taking into account the deadlines of the project.

In conclusion, the "Counted UGS attendance" data is only available for Marêts Park from September 1 to September 30, 2021 and from April 1 to April 15, 2022.

Collected waste in the UGS. The waste in the UGS was collected in collaboration with workers from the city's works department. First, waste was collected and weighed Monday to Saturday of the second week of January 2020. As the work required too much time and a rhythm of collecting and weighing each day could reasonably not be maintained on the long run, the collection was reduced to the first Monday of each month. This collection was only maintained for the months of February and March, and had then to be stopped due to the COVID-19 pandemic. The waste was collected in bags, which were weighed using a baggage scale.

- Psychosocial indicators

The data were collected per questionnaire and concerned the self-reported UGS attendance, the inhabitants' attachment to the UGS, the inhabitants' appraisal of the UGS, the inhabitants' safety perception of the UGS and the inhabitants' familiarity with the UGS.

A first draft of the survey was pretested on the field, in November 2019 (N = 58). This pretest allowed for a couple of adaptations (wording, removal of irrelevant questions/items, shortening of measurement scales). The data collected for the pretest and the final version of the survey questionnaire can be found in open access on osf.

For the final survey, in accordance with the application form of the project, a total sample of 250 participants was targeted. A first data collection (N = 131) was conducted between February and mid-March 2020. The data collection was initially conducted by surveying local residents through a door-to-door approach in the project area, presence at the local market and in various local associations, or by approaching residents in public places. All field data were collected by students during their projects, internships and/or master theses. These students were trained during several sessions on how to approach people and how to collect the data in the most neutral way possible. Students were also briefed on the importance of randomizing the order of presentation of the UGS, as well as the order of measurement scales and items. Students were familiarized with the field by visiting the entire project area before their first data collection. However, this data collection had to be stopped in mid-March due to the COVID-19 pandemic and the resulting social distancing measures. The questionnaire was then adapted online (online survey system of the FPLSE of the University of Liège) and disseminated through various communication channels (social media, the official website of the city of Seraing, the transfer by email to local associations). The online questionnaire was accessible from April 2020 to June 2020 (N = 110).

Before starting the survey, confidentiality assurance was provided to participants, who could only answer after confirming being over 18 years old and giving explicit consent to participate. The questionnaire began by asking for the participant's home address. This information was used to determine whether or not the participants lived in the project area, but also to determine the distance between their home and the target UGS. Participants who did not wish to give their exact address were asked to give only the name of their street of residence. After the usual socio-demographic questions asking participants to indicate their gender, age, the last obtained degree,

and profession, participants were asked to answer various questions about the target UGS (i.e. Marêts Park, Morchamps Park, and Bernard Serin Park). Satellite pictures were presented to the participants to ensure that they could correctly identify the target UGS (see pictures on osf). If at least one of the target UGS was known to the participants (only knowing the name and approximate location was necessary, having already attended the place was not required), several questions about the location were asked. These questions included their perceived familiarity with the place, attendance frequency, the main reasons for visiting the place, as well as their emotional attachment to the place, their appraisal of the place (beauty perception used as proxy for positive/negative evaluation), and the feeling of safety felt towards the place. A precise overview of the questions and scales used for these different variables can be found in Table 1. Other variables were included in the questionnaire, but these were part of the students' internship or master theses and are therefore not relevant to the present work. The complete questionnaire is available on osf.

Table 1. Description of the measurement tools used in the diagnostic questionnaire.

Variable	Description
Distance	By asking for the participants' home address, and by determining the coordinates of the center of the target UGS, it was possible to measure the distance, on foot, between these two points on the Google Map software (measurement unit = meters). Participants who did not wish to give their exact address were asked to give only the name of their street of residence. The distance measurements were then made based on the middle of the given street.
Self-reported attendance	Participants were asked to estimate the number of times they visit the target UGS during winter months (from September to February) and during summer months (from April to August). Participants could indicate an exact number of times, an approximatively number of times, or even an order of magnitude such as "every day", "once a week", etc. All answers were then converted into the number of visits per year, by combining winter and summer attendance rate.
Familiarity	Familiarity was assessed using one single item, asking participants to indicate, on a 7-point Likert scale, how well they feel they know the place, with 1 indicating they know the place not at all, 7 indicating they know the place perfectly, and 4 indicating a neutral opinion.

Variable	Description
Reasons for attendance	The reasons for attendance were determined by asking participants to choose from a list of given options, their main reason for using the target UGS (e.g. walking their pet, using the UGS as a shortcut, relaxing, moving and playing sports...). The option "other" allowed participants to specify reasons not included in the given list. Once the main reason was determined, participants were asked, if there were any other reasons they might use the place, and to rank them from the most important to the least important one. Only the top three reasons were retained for further consideration.
Attachment	Attachment to the target UGS score was assessed using the PA Scale developed by Lewicka (2008). This scale consists of 9 items describing positive feelings towards the target place (e.g. "I miss this place when I'm not here"), and 3 reversed items describing negative feelings towards the target place (e.g. "I leave this place with pleasure"). This scale has been tested and used previously on samples from different countries and shows satisfactory reliability for places at different scales (Lewicka, 2008; 2006). The scale was translated and back-translated to create a French version, and adapted from a 5-point Likert scale to a 7-point Likert scale (anchors = "Definitely do not agree/agree"). Based on the pretest, a factor analysis allowed to consider for the diagnostic questionnaire only the three un-reversed items with the highest loading (i.e. "I defend the place when somebody criticizes it"; "I'm proud of this place"; "It is part of myself"). The factor analysis can be found on osf. The scale's reliability was confirmed (Marêt: ω = .85; Morchamps: ω = .82; Bernard Serin: ω = .71).
Place appraisal	Beauty perception was used as proxy for positive/negative place appraisal. Participants were asked to rate the UGS' beauty on 3 bipolar scales. The scale ranged from -3 (unpleasant; ugly; inhospitable) to +3 (pleasant; beautiful; welcoming). The scale's reliability was confirmed (Marêt: ω = .83; Morchamps: ω = .81; Bernard Serin: ω = .90).
Safety perception	The safety perception measure was inspired by three items assessing subjective insecurity in public space, suggested by Carro, Valera and Vidal (2010). The participants reported their feeling of safety on three 7-point Likert scales, ranging from 1 = "unsafety" to 7 = "safety". These items refer explicitly to the perception of safety: "The last time you attended this park, you felt…"; "When you are in this park you normally feel…", "Compared to other places in the city where you go regularly, you would say that this park is...". The scale's reliability was confirmed (Marêt Park: ω = .92; Morchamps Park: ω = .94; Bernard Serin Park: ω = .90).

The data collected on the field and the data collected per internet were combined into a single data file for analysis. After removing participants with inconsistent responses (e.g. misunderstanding of the questions or overly consistent responses to the Likert scales), a total sample of 231 participants remained (aged between 17 and 84 years, M_{age} = 40.27, SD_{age} = 16.58, 126 females). The participants mostly lived in Seraing (N = 191). Participants not living in Seraing (N = 40) either have lived there in the past or attended the city for other reasons (e.g., professional reasons). These people lived in cities close to Seraing (e.g. Liège, Flémalle, Neupré, Nandrin,...). Of the people living in Seraing, 85 lived in the project area, 106 in the vicinity of this area. For an overview of participants' characteristics, see Table 2.

Table 2. Characteristics of the participants of the diagnostic phase.

Participants living in Seraing (N = 191)		Participants not living in Seraing (N = 40)	
Characteristics	M ± SD or n (%)	Characteristics	M ± SD or n (%)
Age (year)	43.00 ± 16.24	Age (year)	27.35 ± 11.38
Gender (female)	98 (51.31)	Gender (female)	28 (70.00)
Nationality		Nationality	
Belgian	164 (85.86)	Belgian	31 (77.50)
Not Belgian	23 (12.04)	Not Belgian	9 (22.50)
Double nationality	4 (2.09)	Double nationality	0 (00.00)
Job		Job	
Student	33 (17.28)	Student	26 (65.00)
(Self-)employed	76 (39.79)	(Self-)employed	8 (20.00)
Unemployed	24 (12.57)	Unemployed	2 (5.00)
Unable to work	19 (9.95)	Unable to work	0 (0.00)
Retired	26 (13.61)	Retired	1 (2.50)
Other	13 (6.81)	Other	3 (7.50)
Degree		Degree	
No CESS	43 (22.51)	No CESS	3 (7.50)
CESS profess.	39 (20.42)	CESS profess.	3 (7.50)
CESS for HE	33 (17.28)	CESS for HE	11 (27.50)
HE	66 (34.55)	HE	23 (57.50)
Other	10 (5.24)	Other	0 (0.00)
Years lived in Seraing	22.18 ± 18.94	.	.

No CESS = no certificate of higher secondary education; CESS for HE = certificate of higher secondary education preparing to college or university; CESS profess. = certificate of higher secondary education preparing for technical or manual professions; HE = graduate or undergraduate.

2.2.3 Data analyses and baseline of the indicators

The objective of the following analyses was to describe the target UGS and the relationships between the indicators and the attendance behavior, so that the most appropriate psychosocial intervention could be designed, but also to establish the baseline of the selected indicators. As a reminder, each participant had the opportunity to evaluate one or more of the target UGS. Analyses were conducted on Jamovi (version 2.2.5) and only descriptive and correlational analyses were performed.

Parc des Marêts was found to be the most familiar park to the participants of the study and was rated by 131 participants. Morchamps Park and Bernard Serin Park were rated respectively 99 and 82 times. The Marêts and Morchamps parks are mainly used as shortcuts. On the other hand, Bernard Serin Park is mainly used by parents who go there with their children, and by the children themselves, who go there to play.

Marêts and Morchamps parks are evaluated as not very beautiful/positive (Marêts: M = 3.85, SD = 1.63; Morchamps: M = 3.39, SD = 1.40). On the other hand, Bernard Serin Park is evaluated as being rather beautiful/positive (M = 4.97, SD = 1.59).

It should also be noted, that safety perception varies between these spaces. The participants reported, on average, feeling slightly unsafe when attending Marêts and Morchamps parks (Marêts: M = 3.39, SD = 1.76; Morchamps: M = 3.09, SD = 1.85), while Bernard Serin Park was rated as rather safe (M = 5.21, SD = 1.58).

These analyses highlighted that Marêts and Morchamps parks are not perceived similar to Bernard Serin Park by the participants. Moreover, Bernard Serin Park is located at the back of a building with offices and residential apartments, which requires walking through the building to access the space. Although the passage is through an open patio (there is no need to enter a building to access the space), it feels private for many residents. The design of this park is also very different from the other two UGSs (see pictures p.12 or pictures on osf). In addition, this area is closed at night and there are much fewer reported incivility behaviors. Therefore, the Bernard Serin Park was withdrawn for analyses in Table 3 (p.98) and for the WP5 intervention. For ease of reading, will also not be mentioned in the summary table at the end of this chapter (Tab.4, pp. 110-112).

The research methodology does not allow to test causal links between the indicators used and the target behavior (i.e. UGS attendance). However, in order to know the correlational relationship between each of the collected indicators and the target

behavior, a linear mixed model was performed (Tab. 3) allowing to take into account the nested structure of the data (multiple observations for the same participant), and therefore to control for intra-participant and intra-park correlation. Analyses were performed on the « long » format file from the diagnostic (see pictures on osf). Given that literature suggests that the distance between home and the UGSs (e.g. Schipperijn et al., 2010), age (e.g. Schipperijn et al., 2010) and gender (e.g. Basu & Nagendra, 2021) significantly relate to people's UGS attendance pattern, these variables were included as covariates.

Table 3. Linear mixed model assessing the relationship between the psychosocial indicators and self-reported UGS attendance, while controlling for age and gender.

| | b | SE | 95% IC | | df | t | p |
			Lower	Upper			
(Intercept)	44.473	7.2017	30.327	58.618	173	6.162	<.001
Familiarity	17.771	3.906	10.115	25.427	173	4.549	<.001
Attachment	9.918	5.013	0.093	19.744	173	1.979	.049
Safety	-15.382	5.077	-25.332	-5.431	173	-3.030	.003
Beauty	10.870	6.175	-1.232	22.972	173	1.760	.080
Distance	-0.001	0.003	-0.008	0.006	173	-0.282	.778
Age	-0.099	0.457	-0.995	0.796	173	-0.218	.828
Gender	17.755	14.632	-10.924	46.433	173	1.213	.227

* $p < .05$; ** $p < .001$.

Three of the indicators were significantly related to self-reported UGS attendance. Familiarity with and attachment towards the UGS were significantly and positively related to self-reported UGS attendance. Safety perception was significantly and negatively related to self-reported UGS attendance. This last result may seem counterintuitive, if interpreted as a decrease in the feeling of safety leads to an increase in attendance. However, the direction of the relationship cannot be determined, given its correlational nature. It is therefore more likely that the more an individual attend a place, the more he or she is concerned by what happens there. The target UGSs are places where many vandalism behaviors are reported, it is therefore possible that the more someone is attending the place, the more he or she associate it with a danger for personal safety.

The table at the end of this chapter intends to present a summary of all included indicators, as well as a brief description, their measurement method and measurement period. These data serve as baseline, to which data harvest at the end of the project will be compared to. Therefore, this table contains the data of the diagnostic-reconnaissance phase, but also the value targeted at the end of the project. These target values were one of the necessary conditions to be eligible for the UIA funding in order to allow the overall evaluation of the project, but were determined in an arbitrary way. The WP5 used these indicators to assess the impact of the psychosocial intervention, but it will also allow to discuss the overall impact of the APTB-project.

	Name of the indicator	Description of the indicator	Measurement	Measurement period 1	Baseline (Measurement period 1)	Target value
Observable indicators						
1.	Collected waste in UGS	Evolution of inhabitants' non-civic behaviors when attending the UGS was assessed at the beginning and at the end of the project (after psychosocial intervention) by weighing the waste collected in the target UGS.	Weight of waste collected in the target UGS, using a baggage scale. Units of measurement : kg	Average of the first Monday of the month (Jan., Feb. and March 2020) MARETS: N = 3 MORCH.: N = 3	Park MARETS : M = 249.00, SD = 64.86 Park MORCH. : M = 936.67, SD = 592.48	15% decrease
				Average of all 2020 weighing MARETS: N = 8 MORCH.: N = 8	Park MARETS : M = 143.12, SD = 100.91 Park MORCH. : M = 431.13, SD = 526.36	15% decrease
2.	UGS attendance	Evolution of inhabitants' attendance rate of the UGS was assessed during the second year of the project and at the end of the project (after psychosocial intervention) by counting the number of entrances and exits of the target UGS by means of counting posts placed at the UGS' entrances.	Number of park entries and exits per day using digital thermal camera counters installed at park entrances.	Entries/exits from Sept. 1 to Sept. 30 2021 and from April 1 to April 15, 2022, recorded per quarter-hour and aggregated into a measure per day MARET: N = 45 MORCH: N.A.	Park MARETS: M = 378.78, SD = 204.71 Park MORCH. : N.A.	20% increase

Psychosocial indicators					
3.	UGS attendance perception	Evolution of inhabitants' attendance rate perception of the UGS was assessed at the beginning and at the end of the project (after psychosocial intervention) through the psychosocial diagnostic survey.	Self-reported measurement asking people to estimate their average park use.	Data collection from February 2020 to mid-March 2020. MARET: N = 128 MORCH: N = 98	Park MARETS : M = 43.20, SD = 105.74 Park MORCH. : M = 29.20, SD = 81.53	20% increase
4.	Inhabitants' attachment to UGS	Evolution of inhabitants' emotional attachment to the UGS was assessed at the beginning and at the end of the project (after psychosocial intervention) through the psychosocial diagnostic survey.	Average of three 7-point Likert scales asking participants to rate their attachment towards the target UGS from 1 (not at all) to 7 (high)	Data collection from February 2020 to mid-March 2020. MARET: N = 102 MORCH: N = 82	Park MARETS : M = 3.03, SD = 1.83 Park MORCH. : M = 2.71, SD = 1.76	4 = a little better
5.	Inhabitants' appraisal of UGS	Evolution of inhabitants' appraisal of the UGS was assessed at the beginning and at the end of the project (after psychosocial intervention) through the psychosocial diagnostic survey.	Average of three bipolar scales asking participants to rate the perceived beauty of the target UGS from -3 (unpleasant; ugly; inhospitable) to +3 (pleasant; beautiful; welcoming)	Data collection from February 2020 to mid-March 2020. MARET: N = 131 MORCH: N = 99	Park MARETS : M = 3.85, SD = 1.63 Park MORCH. : M = 3.39, SD = 1.40	5 = much better
6.	Inhabitants' safety perception in UGS	Evolution of inhabitants' safety perception regarding the UGS was assessed at the beginning and at the end of the project (after psychosocial intervention) through the psychosocial diagnostic survey.	Average of three 7-point Likert scales asking participants to rate the perceived safety of the target UGS from 1 (unsafe) to 7 (safe)	Data collection from February 2020 to mid-March 2020. MARET: N = 105 MORCH: N = 85	Park MARETS : M = 3.39, SD = 1.76 Park MORCH. : M = 3.09 SD = 4.10	4 = a little better

7.	Inhabitants' familiarity towards the UGS	Evolution of inhabitants' familiarity perception towards the UGS was assessed at the beginning and at the end of the project (after psychosocial intervention) through the psychosocial diagnostic survey.	7-point Likert scale asking participants to indicate how well they feel they know the target park, from 1 (not at all) to 7 (perfectly)	Data collection from February 2020 to mid-March 2020. MARET: N = 125 MORCH: N = 94	Park MARETS : M = 4.00, SD = 2.63 Park MORCH. : M = 4.07, SD = 2.49	4 = a little better

Table 4. Summary table of the measurement method and the baseline of all included indicators used to assess the overall impact of the APTB-project and the psychosocial intervention.

2.3 Summary

The main objective of the WP5 was to improve residents' relationship to their local environment. As mentioned in point 2.1.2, UGSs provide physical, psychological and social benefits, making these spaces particularly interesting for public health and social justice interventions.

The cross-sectional study presented in Box 1 shows a significant relationship between UGS attendance and prosocial behavior if the most visited UGS during COVID-19 pandemic was perceived as sparsely crowded, therefore also contributing to support and understand the resilience role UGSs can play and their importance in projects addressing public health concerns. Literature also suggests that the nature-health relationship is even more important for low SES groups, making these spaces particularly interesting in terms of social justice interventions.

Although still under-researched, it seems that the nature-health relationship is influenced by certain space-specific characteristics. Accessibility (e.g., proximity), perceived quality (e.g., maintenance), size of available UGSs, but also biodiversity and naturalness rates are part of the structural aspects that have an influence on this relationship. These characteristics depend mainly on political decisions.

However, it also seems that the way we are exposed to these UGSs will influence the nature-health relationship. Some studies suggest that it is the actual interaction with or the time spent in the UGS, which will allow a significant relationship between UGS exposure and health (e.g. Triguero-Mas et al., 2017; van den Berg et al., 2016). The mere presence of UGSs does not always seem sufficient. This is consistent with some of the hypotheses regarding the mechanisms by which UGS may improve health, suggesting that health outcomes of UGS exposure are the result of increased physical activity, increased positive social interactions and more or less prolonged contact with nature, which suppose an active use of the UGS. The relationship between inhabitants and the UGSs of the project area was therefore conceptualized in terms of attendance rate.

The importance to have an actual interaction with the natural setting also explains why the WP5 focus on public UGSs, and not on green spaces in general. Public UGSs are accessible to all urban residents, regardless of socioeconomic circumstances. As seen previously, public UGSs are often the only natural settings to which low SES groups have access. This is also true for Belgium, and more specifically for Wallonia, and therefore also for the target population of this project.

With this in mind, the research question that guided the diagnostic phase and the entire intervention of the WP5 was formulated as follows: "*How to increase public UGS attendance by inhabitants of the project area?*".

The effective use of UGS by residents will depend on different factors, including many psychosocial factors.

Safety concerns are often cited as being an important barrier to UGS attendance, especially in high-poverty neighborhoods. However, as highlighted in Box 2, up to date it seems difficult to draw any conclusions concerning the perceived safety and the UGS attendance rate relationship, due to the diversity of measures and conceptualizations of the variables of perceived safety and attendance rate, but also due to the lack of experimental studies allowing causal conclusions. Despite the lack of clear evidence regarding the impact of safety perception on UGS attendance, exchanges with field actors show that the safety issue remains an important aspect of the project and deserves special attention. Safety perception was therefore included in the indicators allowing to meet the criteria of measurability and transferability imposed by UIA funding, along with several other indicators selected based on the existing literature concerning the psychosocial incentives and obstacles to UGS attendance.

These indicators can be grouped into two main categories: observable data (counted UGS attendance and collected waste in the target UGS) and so-called psychosocial data (self-reported UGS attendance, emotional attachment to the UGS, appraisal of the UGS, and familiarity with the UGS). The data collection and their analysis made it possible to establish the pre-intervention baseline, but also to better characterize the target UGS in order to be able to propose, for the planning and acting phases, the most appropriate psychosocial intervention.

CHAPTER 3: PLANNING, ACTING AND EVALUATION PHASES

3.1 Planning phase

3.1.1 Interpretation of the diagnostic results to design the psychosocial intervention

Following the diagnostic and recognition phases, the next step consisted of determining and designing the most appropriate psychosocial intervention. The choice of intervention was based on the research question that guided the WP5 (i.e. "*How to increase public UGS attendance by inhabitants of the project area*?"), as well as on scientific literature, field observations and field constraints, exchanges with the field actors and the results of the diagnostic survey.

As highlighted by the analyses of the diagnostic survey, three indicators were significantly related to self-reported UGS attendance among participants: familiarity and attachment towards the target UGS, as well as safety concerns. Individuals' beauty perception of the UGS, used as proxy for positive/negative appraisal of the place, was not significantly related to self-reported UGS attendance.

The non-significant relationship between beauty perception and attendance rate is not in line with literature. Research shows that individuals automatically evaluate encountered stimuli (i.e. objects/events/possibilities), and that in a general way positively evaluated stimuli (e.g. places), are inherently associated with approach intentions or behaviors (e.g. attendance), whereas negatively evaluated stimuli are associated with avoidance intentions or behaviors (e.g. Elliot, 2006). Approach-avoidance motivation has been extensively studied, and non-significant relationships between place appraisal and place attendance intention or behaviors are not in line with previous studies.

However, measuring only the positive/negative appraisal of the target UGS in order to explain attendance behaviors does not reflect the complexity of place appraisal/place attendance relationship. The Theory of Affective Judgment in Spatial Context (AJ-space) posits that the affective meaning attached to places and the way people will orient themselves in the environment goes beyond the intrinsic properties, and thus the affective meaning of the given place alone (Blaison, 2022; Blaison & Hess, 2016).

To understand approach and avoidance behaviors in a physical space, one also needs to consider the broader spatial context in which the place is embedded. According to AJ-space, the way we evaluate a place will also depend on the affective meaning we attach to the places in the surrounding, the affective value of each place depending on the interplay of the affective value of all the other places within the larger spatial context. The affective value individuals attach to each location will therefore be part of the overall "affective field" (Blaison, 2022; Blaison & Hess, 2016). This "affective field" is the result of several principles (Blaison, 2022; Blaison & Hess, 2016).

First, some places pop out as affectively prominent. A place with a high emotional value is called a "hotspot" (HS). These HS influence the construction of the affective field "disproportionally" and significantly color the evaluation of whole areas through assimilation and contrast effects. For example, places close to an unsafe housing block (i.e. negative HS) will also be perceived as more negative than usual through an assimilation effect, whereas more distant places will be perceived as more attractive than usual through a contrast effect (Blaison et al., 2017, 2018; Blaison & Hess, 2016). In essence, any emotionally salient HS produces an affective polarization of the places distributed in the surroundings.

Second, the reach of the influence of an HS depends on its "gradient of influence", that is, people's "naïve" estimation of how much and how far an HS affectively influences the surrounding. For example, most people attach a wider gradient of influence to a nuclear power plant than to an unsafe housing block, which leads to the observation that attractiveness grows faster with increasing distance to the unsafe housing block than to the nuclear power plant (Blaison & Hess, 2016).

Third, the frame of reference (i.e. all the elements considered relevant to the judgment) influences the perceived scope of the gradient of influence. The frame of reference in a spatial context are all the places to which the target is compared. The reach of influence from an HS will appear shorter in smaller spatial frames of reference than in larger spatial frames of reference, which also will lead the contrast effect to emerge closer to the HS (Blaison & Hess, 2016). However, it should be noted, that if the frame of reference is too small, the influence will fill the frame of reference completely and only assimilation will be observed, the contrast effect will simply not emerge (Blaison & Hess, 2016). On the basis of this knowledge, the importance of taking the context into account becomes salient, given that it will have a significant influence on the affective meaning of the places, and thus on people's decision to attend them or not.

In addition, individuals' behavior is function of the overall affective meaning they attach to their environment (e.g. Blaison & Schröder, 2019; Heise, 2007) and this affective meaning people attach to a stimulus goes beyond the positive/negative appraisal of it. At least three fundamental affective dimensions seem to best capture how individuals make sense of their environment: evaluation, potency and activity (Osgood et al., 1975; Scholl, 2013). The evaluation dimension can be described as positive versus negative evaluation (e.g. pleasant/unpleasant), the second one as strong versus weak characterization (e.g. big/little), and the last one as active versus passive impression (e.g. noisy/quiet).

In the present case, it would have been interesting to evaluate the affective meaning of the UGS on the three dimensions of EPA, as well as to investigate the affective meaning of the surroundings, the presence or absence of HS and their respective valence, and their gradient of influence. Thus, there is a significant lack of data to draw any real conclusion regarding the non-significant relationship between the positive-negative appraisal of the UGS and self-reported place attendance.

Finally, while taking into account the general context in which the place is located seems just as important as taking into account the intrinsic properties of the location, the affective meaning individuals attach to themselves in terms of EPA profiles should also be part of the equation. The Affect Control Theory (ACT; Heise, 2007) describes how human behavior unfolds in the socio-emotional space constituted by the EPA dimensions and posits that individuals act so as to maintain culturally constructed meanings of identities, behaviors and settings. According to the ACT, any mismatch between the affective meaning people attach to themselves and the affective meaning they attach to the places they attend should generate uncomfortable feelings of dissonance, the so-called affective deflection (Blaison & Schröder, 2019; Heise, 2007). Therefore, people should avoid places whose EPA profile elicits maximal affective deflection, and prefer places whose EPA profile elicits minimal affective deflection (Blaison & Schröder, 2019). For example, older people, low on the activity dimension, should avoid places deemed as high in activity (e.g. a playground), whereas young people, high on the activity dimension, should feel comfortable attending these same places. Of course, the attendance pattern based on (dis)similarity between people's EPA profile and places' EPA profile will take place within the limits of people's objective needs. Nevertheless, it probably would have been of interest to also take into account the affective meaning people attach to themselves, in addition to the affective meaning of the target UGS, to better understand Seresians' attendance behavior of the target UGS.

Regarding the significant results, three indicators were significantly related to self-reported UGS attendance among participants: familiarity and attachment towards the target UGS, as well as safety perception. All three variables are psychological variables, which should be investigated more closely so that the most appropriated intervention could be built on these variables.

Safety perception was significantly and negatively related to self-reported UGS attendance, which seems counterintuitive. However, as already mentioned, the direction of the relationship cannot be determined in a correlational analysis. It is therefore likely that the relationship should be interpreted in the sense that an increase in attendance leads to an increase in the feeling of unsafety, and not in the sense that an increase in the feeling of unsafety leads to an increase in attendance. Tthe more an individual attend a place, the more he or she is concerned by what happens there. Familiarity and PA were both significantly and positively related to self-reported UGS attendance.

Familiarity and PA are two closely linked variables (Ujang, 2008). The most familiar places are the ones that are frequently attended. On the other hand, PA can be described as the affective bond individuals develop with specific places (Low & Altman, 1992). Knowing that one mechanism by which an individual will develop an emotional bond towards a given place is by spending powerful, long periods of time in that place (Hashemnezhad et al., 2013), it becomes obvious why familiarity and attachment often go hand in hand.

PA is one of the most studied attitudinal factors in place attendance research. It has been studied across many disciplines and in relation to many places and scales, ranging from home and neighborhood levels, to city, region, state and continent levels (Lewicka, 2011), while passing through "micro"-levels like UGSs (e.g. Fornara et al., 2020; Plunkett et al., 2019; Zhang et al., 2015). Previous research has shown that attitudinal factors, for example, PA, can be important drivers of place attendance intention and place attendance behavior (Kil et al., 2012; Lee & Shen, 2013; Yuksel et al., 2010; Zhang et al., 2022). However, given that the development of emotional attachment generally requires spending a significant amount of time in the target location and experiencing powerful, long periods in that place (Hashemnezhad et al., 2013), intervention based on PA will be very expensive in time and/or resources. Therefore, this variable seems inappropriate in field interventions where funding constraints generally require measurable outcomes in a relatively short period of time. Moreover, there is an abundance of scientific literature concerning the concept of emotional attachment, and more specifically emotional

attachment to places, and the concept was defined and measured in many ways, still lacking a solid empirical progress and theoretical foundation (Hernández et al., 2020; Lewicka, 2011; Moulay et al., 2018). As a consequence, even if throughout different disciplines the results seem to support the importance emotional attachment can play on place attendance, the multidisciplinary, added to the multidimensional and multi-paradigmatic nature of PA, makes the concept unclear (Hernández et al., 2020; Lewicka, 2011; Moulay et al., 2018), and thus even more difficult to implement and measure in field interventions. Therefore, it was necessary to look into the literature for another attitudinal factor, easier to manipulate, without forgetting the safety issues. These different reasons lead to consider the feeling of psychological ownership to design the psychosocial intervention.

3.1.2 How people connect to places – the role of psychological ownership

Psychological ownership (PO), also known as perceived ownership, is the subjective feeling of owning a tangible or intangible object, place, or idea (Merrill, 1998; Snare, 1972). PO differs from formal ownership, which, unlike the subjective feeling of ownership, is a legal claim of property protected by law (Merrill, 1998; Snare, 1972). This explains why individuals can develop a sense of ownership for public goods like for example public UGSs (Peck et al., 2021). This psychology of possession seems to be well rooted in people and can have important psychological, emotional and behavioral consequences, regardless of the actual possession of the target (Dawkins et al., 2017; Pierce et al., 2001). If PO has been extensively studied and used in marketing and consumer psychology (Peck & Luangrath, 2023), it is now increasingly applied to other fields and the possessiveness towards places, and specifically public places, can easily be found in prior literature.

PA and PO link people to places in a different way (Storz et al., 2020). PA addresses feelings of belonging to a place ("I belong here"), while PO refers to the perception that a place belongs to an individual ("the place belongs to me") (Pierce et al., 2001; Storz et al., 2020). PA and place PO can, however, emerge through similar routes, i.e. having an intimate relationship with the place or investing one's time, effort, or energy in it. Contrary to PA, PO can also arise by having a sense of control over the place (Peck & Luangrath, 2023; Pierce et al., 2001; Shu & Peck, 2018).

This sense of control is a fundamental difference between these two types of bonds and a defining characteristic of place PO (Merrill, 1998; Snare, 1972). On the other hand, PA is mainly an emotional bond to the place, developed without the need for control over the target (Storz et al., 2020). Therefore, even if PO and PA are probably

regularly linked, they remain very distinct concepts differentiated in particular by this need for (perceived) control.

This need for control is of particular interest in the present project and is probably what explains why an increased sense of PO is linked to an increase in civic behavior in public places. Research about the well-known "public-good dilemma" (i.e. the tendency people have to neglect public resources as compared to privately owned ones) seems to suggest that enhanced PO encourages people to care more for those resources, which enhances stewardship behaviors (Kirk & Rifkin, 2022; Peck et al., 2021; Preston & Gelman, 2020; Shu & Peck, 2018; Zhang & Xu, 2019). These stewardship behaviors, i.e. the actions taken to ensure the well-being or maintenance of the target (Peck et al., 2021), can be considered as a form of control over the environment. One of the mechanisms underlying the relationship between high levels of PO and stewardship behaviors is the increasing in perceived responsibility that this sense of "mineness" generates (Peck et al., 2021).

To the best of our knowledge, the relationship between PO and safety perception in public places has not yet been directly tested as such. However, given the perceived control associated with high feelings of PO, it can be hypothesized that this feeling of control may increase individuals' believe that they have some influence over the space, which could lead to increased feelings of safety.

3.1.3 Hypotheses

According to the main objective of the WP5, the psychosocial intervention was designed to improve citizens' relationship towards the target UGS (i.e. Marêts and Morchamps parks), conceptualized through the UGS attendance rate.

The diagnostic results showed a significant relationship between PA and self-reported UGS attendance. This is in line with scientific literature, showing that attitudinal factors like PA can have a significant impact on place attendance. However, given the confusion surrounding the concept of PA and the difficulty of having a quick and inexpensive impact on it, the psychosocial intervention was mainly designed around another type of ties people can develop with places, the sense of psychological ownership.

Considering the positive impact of PA on place attendance, and given that PO also represents a positive attitude towards UGS and can emerge through similar routes as PA, we assumed a positive significant relationship between the level of PO and residents' UGS attendance. We also assumed that an increased sense of PO would

lead to more stewardship behaviors and an increase in safety perception within these spaces, as well as a more positive appraisal of these spaces.

The general hypothesis, therefore, posits that increasing the sense of PO Seresians' experience towards the UGS will improve the following indicators: UGS attendance and attendance perception, amount of waste in UGSs, inhabitants' appraisal of UGSs and inhabitants' safety perception in UGSs.

3.1.4 Experimental study

As noted in Chapter 1, despite the many advantages the problem-focused action research methodology can have in this type of project, testing causal relationships and being able to generalize the obtained results is complicated, if not impossible, through this type of methodology. To "nourish" the results from the field intervention and enhance the quality of their interpretation, while meeting the criteria of transferability imposed by the funding requirements, an experimental study was added to the process.

> **Box 3 (pp. 112-138) presents an experimental research focusing on the impact of PO on UGS attendance and aims to back up the hypotheses made in point 3.1.3 and afterwards to allow a better analysis of the results of the field intervention.**

PAPER 3
Psychological Ownership to Enhance Public Green Space Loyalty

Tania Noël [1, *] and Benoit Dardenne [1]

1 Psychology and Neuroscience of Cognition Research Unit, University of Liège, Belgium; tania.noel@uliege.be; b.dardenne@uliege.be
* Correspondence: tania.noel@uliege.be

ABSTRACT

Urban nature is increasingly acknowledged as being one of the suppliers of citizen health and well-being. However, currently, many publicly accessible green spaces (GS) remain underused. The present study (N = 232) examines the impact psychological ownership (PO) can have on GS attendance intention and attendance behavior (GS loyalty) while controlling for place attachment (PA). Contrary to previous research, PA showed no significant impact on GS loyalty, but an increase in PO was significantly and positively related to both intentional and behavioral loyalty. If PA is one of the most studied attitudinal factors in place loyalty research, results suggest that people's sense of PO has a potentially more interesting role to play when trying to enhance GS attendance, although PA should probably not be overlooked to move an individual from intention to action.

Keywords: urban nature, psychological ownership, PA; public place loyalty; public health

Theoretical background and hypotheses

Urban nature is increasingly acknowledged as being one of the suppliers of citizen health and well-being (e.g. Braubach et al., 2017; Jimenez et al., 2021). However, currently, many urban GS remain underused (Moulay et al., 2018). Previous research has shown that attitudinal factors can be important drivers of place loyalty (i.e. attendance intention and actual attendance) and that individuals with positive attitudes towards a specific place seem more likely to regularly attend this place (e.g. Kil et al., 2012; Lee et al., 2012; Yuksel et al., 2010). PA is one of the most studied attitudinal factors in place loyalty research, but, as further developed below, still lacks a solid theoretical foundation (Hernández et al., 2020; Lewicka, 2011; Moulay et al., 2018) and can be difficult to use in field interventions. In this study, we will focus on another, possibly more easily manipulated attitudinal factor to predict GS loyalty, the feeling of PO. Although often studied in relation to emotional attachment, to the best of our knowledge, PO has not yet been introduced in research focusing on intentional and behavioral loyalty of a GS, nor even to other public places.

1.1 Psychological ownership and public places

PO refers to the subjective feeling of individuals that they own a tangible or intangible target, like an object, place, or idea (Merrill, 1998; Snare, 1972). PO differs from formal ownership, given that it reflects a subjective feeling, whereas formal ownership represents a legal claim on a property that is protected by law (Merrill, 1998; Snare, 1972). This psychology of possession seems to be well rooted in people and feelings of ownership have important psychological, emotional and behavioral consequences, whether or not the individual has factual possession of the target (Dawkins et al., 2017; Pierce et al., 2001). PO can emerge via different routes (Dawkins et al., 2017; Peck & Luangrath, 2023; Shu & Peck, 2018). Investing time, effort and energy in the target, or having an intimate relationship with or a form of control over the target, are different paths that can lead individuals to consider a target as their own (Peck & Luangrath, 2023; Pierce et al., 2001; Shu & Peck, 2018). If PO has been extensively studied and used in consumer psychology and marketing (Peck & Luangrath, 2023), it is now increasingly applied to other fields and the possessiveness towards public places can easily be found in prior literature. This perception of ownership of public places is for example increasingly studied in relation to the well-known "public good dilemma" referring to the tendency people have to neglect public resources as compared to privately owned ones (Shu & Peck,

2018). Studies seem to highlight that enhancing PO towards public goods, like public places, will encourage people to care more for those public resources and enhance stewardship behaviors (Kirk & Rifkin, 2022; Peck et al., 2021; Preston & Gelman, 2020; Shu & Peck, 2018; Zhang & Xu, 2019). These results make sense given that stewardship behaviors can be seen as a form of control and that a defining characteristic of place ownership is the need to have a certain control over this specific environment (gatekeeper right; Merrill, 1998; Snare, 1972).

1.2 Distinction between psychological place ownership and place attachment

Individuals can develop various types of ties with places, not only based on ownership perceptions (Storz et al., 2020). PA is one of the most studied bonds between individuals and places. It has been studied in relation to many places (Lewicka, 2011), including urban GS (e.g. Fornara et al., 2020; Plunkett et al., 2019; Zhang et al., 2015). The concept of PA can be described as the affective bond individuals may develop with a specific place (Low & Altman, 1992), and therefore refers to the individuals' mostly positive attitude towards the place. PA has been defined in many ways, sometimes considered unidimensional, sometimes multidimensional (Hernández et al., 2020; Lewicka, 2011). In environmental psychology the concept is most of the time considered to include three "key factors" and to be constituted by affective (i.e. emotions, feelings, and affects), cognitive (i.e. thoughts, knowledge and beliefs), and behavioral (i.e. actions and behavior) components (Florek, 2011; Jorgensen & Stedman, 2001; Low & Altman, 1992). The affective component tends to be the most emphasized and the most measured one (Florek, 2011; Fornara et al., 2020), also in relation to outdoor spaces (Jorgensen & Stedman, 2001).

As already mentioned, previous research has shown that attitudinal factors, like PA, can be important drivers of place loyalty (Kil et al., 2012; Lee et al., 2012; Yuksel et al., 2010). However, while some studies predict place loyalty by PA, there is also some evidence and theoretical reasons that hints at the influence of place loyalty on PA (e.g. Peters et al., 2010; Vorkinn & Riese, 2001; Williams & Vaske, 2003). In a study examining how attachment to GS and GS loyalty relate, the authors tested two models through structural equation modeling: the first one where PA predicted GS loyalty, and the second one where GS loyalty predicted PA (Plunkett et al., 2019). Only the second model showed significant structural paths, which might suggest that as participants increase their attendance of the target GS, they start to form stronger PA to those GS (Plunkett et al., 2019). The direction of this relationship is to date still

open to debate. The multidisciplinary, added to the multidimensional and multi-paradigmatic nature of PA, also makes the concept unclear, lacking empirical progress and a solid theoretical foundation (Hernández et al., 2020; Lewicka, 2011; Moulay et al., 2018). Finally, PA cannot be easily manipulated during field interventions. Indeed, the positive emotional bond that an individual can develop towards a place requires that the individual experiences a powerful, long period in that place (Hashemnezhad et al., 2013), or interact with the community in a way that increases the number of relationships within this community (Florek, 2011). This makes the manipulation of PA for field interventions expensive in time and/or resources.

Given the confusion surrounding the concept of PA and the difficulty of having a quick and inexpensive impact on it, in this study, we will focus on the possibly more easily manipulated attitudinal factor of PO. If both PO and PA can link people to places, it seems they do this in a different way (Storz et al., 2020). PA addresses feelings of belonging to a place ("I belong here"), while PO refers to the perception that a place belongs to an individual ("the place belongs to me") (Pierce et al., 2001; Storz et al., 2020). One defining characteristic of PO is the need to have certain control over the target (Merrill, 1998; Snare, 1972), whereas PA is mainly an emotional bond formed without the need for control (Storz et al., 2020). This is especially true for public places like parks (Scannell & Gifford, 2010). It is therefore clear that although PO and PA are probably linked and can emerge from similar routes, they remain very distinct concepts, distinguished in particular by this need for (perceived) control. Moreover, if there seems to be a consensus that the two concepts can be linked, it is not yet clear how they are related and how they influence each other. While some studies and theoretical models predict PO by emotional attachment to the target (e.g. Kumar & Nayak, 2019; Kuo et al., 2021), others predict emotional attachment by the sense of PO (e.g. Rioux et al., 2017; H. Zhang & Xu, 2019). If it seems that these two variables can interact, it is still difficult to define the exact mechanisms.

1.3. Hypotheses

The current study was designed to test if PO can enhance public GS attendance while controlling statistically for PA. Given that PA and PO can emerge from similar routes, and that the link between PA and place loyalty seems to be positive and significant (e.g. Kil et al., 2012; Yuksel et al., 2010), including for GS (Zhang et al., 2022), we assume a similar effect of PO on GS loyalty. In addition, since PO is linked to increased

civic behavior in public places (Kirk & Rifkin, 2022; Peck et al., 2021; Preston & Gelman, 2020; Shu & Peck, 2018; Zhang & Xu, 2019), probably due to the increasing need for control, it makes sense to hypothesize that PO will also increase intentional and behavioral loyalty towards a public place through the so-called gatekeeper right. Given that PO and PA seem to interact, even if the exact mechanism is not yet clear, we suppose that the impact of PO on place loyalty will be even more important when PA towards the place is high.

H1: High levels of PO will increase participants' intentional loyalty towards the target GS (H1a), and even more so (H1b) or only in high PA condition (H1c).

H2: High levels of PO will increase participants' behavioral loyalty towards the target GS (H2a), and even more so (H2b) or only in high PA condition (H2c).

We also included several covariates. Socio-economic level, age and length of residence are among the most frequently analyzed socio-demographic predictors of PA magnitude (Hernández et al., 2020), which also seems to vary with participants' gender (Hidalgo & Hernández, 2001). Noise and overcrowding are among the most frequently analyzed socio-environmental predictors of PA magnitude (Hernández et al., 2020), and also seem related to the beauty of the place (Lewicka, 2011; Neuvonen et al., 2010). Therefore, it seems important to consider these variables when exploring the impact of different kinds of bonds between people and places. Distance between home and the target GS was also controlled for, given that it can have a direct impact on people's GS attendance rate (e.g. Ugolini et al., 2020). Finally, the usual GS attendance pattern from participants was also controlled for, given that past behaviors are often the best predictor of future behaviors (Ajzen, 2002).

Materials and Methods

This study employed a 2 (high PO vs. low PO) x 2 (high PA vs. low PA) between-subjects design.

2.1. Participants and Procedure

The study was conducted online and participants were recruited using convenience and snowball sampling. An invitation message with an online link to the survey was posted on social media, explaining the objectives of the study and asking people to complete the survey and spread the message on their social platforms. Participation

was voluntary and unpaid. Using Gpower, we calculated the number of participants needed for a power of .95 and a small to medium effect size *(f² = .10, α = .05)*. Based on this, a minimum of 176 subjects was required. A total of 424 individuals participated in the study, of which 183 answered only the first part of the study, and 241 also completed the second part of the study. After removing outliers (+/- 2.5SD), a final sample of 415 participants (303 female, M_{age} = 32.32, SD_{age} = 16.52) remained, 183 participants (137 female, M_{age} = 31.13, SD_{age} = 16.32) completing only the first part of the study and 232 participants (166 female, M_{age} = 33.25, SD_{age} = 16.64) also completing the second part of the study. Analyses were performed only on participants who completed both parts of the study. There was no significant difference between these two groups (completing or not the second phase) regarding independent variables included in the following analyses (Tab.1).

Table 1. Non-parametric one-way anova.

	χ^2	df	p	ε^2
PA	1.502	1	0.220	0.004
PO	3.119	1	0.077	0.008
Age	0.396	1	0.529	0.001
LOR	0.096	1	0.757	0.000
PB	1.493	1	0.222	0.004
PC	0.071	1	0.789	0.000
Distance	0.003	1	0.960	0.000
UAP	0.067	1	0.796	0.000

PA = score of the place attachment scale; PO = score of the psychological ownership scale; LOR = length of residence; PB = perceived beauty; PC = perceived crowdedness; UAP = usual attendance pattern. *p<0.05; **p<0.001.

The actual purpose of the study was not disclosed to the participants. As a cover story, participants were told that the general purpose of the research was to assess the link between mental visualization and judgment, but participants were not initially made aware of the PO aspects of the study. After the socio-demographic questions, participants moved on to a place visualization task. Participants in high PA condition visualized a place to which they felt a strong emotional connection. Participants in low PA condition visualized an emotionally neutral GS. After indicating their attachment to the target GS, participants evaluated its beauty and crowdedness, and the walking time from home/workplace, before indicating the length of residence/frequentation of the area and their usual attendance patterns of the GS. Afterwards, participants were asked to rename the GS. The instruction either activated the idea that the GS belonged to them (high PO condition) or emphasized

the shared aspect of it (low PO condition). Participants then reported their strength of PO and their wish and intention of future attendance of the target GS. One week later, participants were automatically contacted by email to answer some last questions about their actual attendance of the GS over the past week. All the participants who did not answer this second part of the study were automatically contacted again, 3 days later, insisting on the importance of this second part. No other reminder was sent again after these three days. The study ended with a debrief explaining the real objectives of the study.

2.2. Materials

Place attachment condition – visualization task. PA was manipulated using a visualization task inspired by Scannell and Gifford's (2017) methodology. Participants in high PA condition were asked to think of a familiar GS, within walking distance, for which they had strong positive feelings and to which they felt particularly attached. Participants in low PA condition were asked to think of a familiar GS, within walking distance, for which they did not have any strong (negative or positive) emotion. Participants were then asked to take a few moments to imagine walking through the selected GS. Participants were guided through this visualization by questions asking them to imagine, with as many details as possible, what they might see, smell, hear, feel, and notice when being in this GS. After this, participants were invited to share their thoughts and write down a short description of the selected GS. The task ended with a question asking them to explain in a few words why the GS was (or was not) important to them. The manipulation was pre-tested on a sample of 150 participants, not included in the main study, and found to be effective (see osf link at the end of the article).

Place attachment scale. The PA score for the manipulation check was assessed using the *Place Attachment Scale* developed by Lewicka (2008). This scale consists of 9 items describing positive feelings towards the target place (e.g. "*I miss this place when I'm not here*"), and 3 reversed items describing negative feelings towards the target place (e.g. "*I leave this place with pleasure*"). This scale has been tested and used in previous research and shows satisfactory reliability for places at different scales like cities, districts, houses, or apartments (Lewicka, 2008). The scale was translated and back-translated to create a French version and adapted from a 5-point Likert scale to a 7-point Likert scale (anchors = "Definitely do not agree/agree"). Based on a pretest of 45 participants not included in the main study (see osf link at the end of the article), a factor analysis allowed to consider only the three un-

reversed items with the highest loading for the present study (i.e. "*I defend the place when somebody criticizes it*"; "*I'm proud of this place*"; "*It is part of myself*"). The scale's reliability was confirmed (ω = .86).

Psychological ownership manipulation. PO was triggered by asking participants to rename the GS they were thinking about, given that previous research showed that naming a target can enhance PO (Stoner et al., 2018). Given instructions either activated the idea that the GS belonged to them (high PO condition – "*If you were to rename your space, what name would you choose? To imagine this name, think about the moments you have experienced in this place, elements that make you feel that this place is yours*"), either emphasized the shared aspect of the GS and the fact that it belongs to the community (low PO condition – "*If the city/village where this place is located were to rename this public space, what name would people in the administration be likely to give it? Think about the elements of this place that would be of interest and attraction to outsiders and that emphasize the public and shared aspect of the place*"). The present manipulation was freely inspired by an experimental design used in a study aiming to enhance stewardship behaviors by triggering the sense of PO, and who showed a significant increase in the feeling of PO when naming the place (Peck et al., 2021). The manipulation was pre-tested on a sample of 150 participants, not included in the main study, and found to be effective (see osf link at the end of the article).

Psychological ownership scale. The score of PO for the manipulation check was assessed based on a 5-item scale used by other authors (Fuchs et al., 2010; Kirk et al., 2018; Peck & Shu, 2009). The construct was measured using a 7-point Likert scale (anchors = "strongly disagree/agree"). Only the three first items, as done by Kirk and colleagues (2018) to reduce the length of the scale, were considered (i.e. "*Although I do not legally own this (target of ownership), I feel like this is 'my' (target)*"; "*I feel a very high degree of personal ownership of this (target)*"; "*I feel like this (target) belongs to me*"). The scale was translated and back-translated to create a French version. Internal consistency was excellent (ω = .92).

Green space intentional loyalty. GS's intentional loyalty was assessed by asking two questions. The first question asked participants to indicate, on a 7-point Likert scale (anchors = "strongly disagree/agree"), the degree to which they would like to attend this GS more regularly. This score was later referred to as "GS attendance desire". The second question asked participants to indicate, on a 7-point Likert scale (anchors

= "strongly disagree/agree"), if they think they would actually increase their attendance of this specific GS during the upcoming weeks (= participants' confidence to increase their GS attendance behavior). This score was later referred to as "GS attendance confidence".

Green space behavioral loyalty. Green space's actual attendance behavior was assessed by automatically contacting participants via email one week after they completed the main part of the survey. Participants were then asked to indicate the number of times they visited the GS since the first part of the study. Participants were informed that even just walking through the GS also had to be counted as a visit. This number was divided by the number of days between the two parts of the study, to obtain comparable data between participants, as they did not all respond within the same timeframe. This score was later referred to as "GS attendance rate". Last but not least, participants indicated, on a 7-point Likert scale, if they attended the target GS more often than usual (anchors = "totally disagree/agree"). This score was later referred to as "GS attendance evolution".

Covariates. To measure participants' socioeconomic level, education level was used as a proxy (Baker, 2014) and divided into four categories based on the last obtained degree: participants without CESS (= "Certificat d'enseignement secondaire supérieur" – certificate of higher secondary education), participants owning a CESS giving access to manual professions (= CESS prof.), participants owning a CESS preparing for higher education (= CESS HE) and graduate/undergraduate participants (= HE). The length of residence was assessed by asking participants to indicate, in months, how long they have lived in the area where the target GS is located, or how long they have been attending it regularly (e.g., for work). Perceived beauty was assessed by 3 items, using bipolar scales ranging from -3 (unpleasant; ugly; inhospitable) to +3 (pleasant; beautiful; welcoming). The median value represents a neutral opinion. Internal consistency was good (ω = .89). GS' crowdedness was assessed by asking participants how crowded they perceived the place to be. Perceived crowdedness was assessed by 3 items, using bipolar scales ranging from -3 (calm; quiet; lightly frequented) to +3 (lively; noisy; heavily frequented). The median value represents a neutral opinion. Internal consistency was good (ω = .88). The walking distance was assessed by asking participants to indicate the required time, by foot and in minutes, to get to the target GS. Finally, the usual GS attendance pattern was assessed by asking participants to indicate how many times a week they usually attend the target GS.

2.3. Statistical Analysis

Analyses were conducted on Jamovi (version 2.2.5). Manipulation checks were performed through non-parametric Kruskal-Wallis tests, given that PA scores, nor PO scores were normally distributed. Hypotheses were then tested using multiple linear regression models, which controlled for potential confounders. Analyses were performed four times, with a different dependent variable each time: GS attendance desire, GS attendance confidence, GS attendance rate, and GS attendance evolution. Independent variables were mean-centered.

Results

Manipulation check. Non-parametric one-way ANOVA comparing the high PA condition and the low PA condition showed a significant difference between the two experimental conditions (X^2 = 90.114, df = 1, p = <.001, ε^2 = .390), with participants in high PA condition reporting higher levels of PA than participants in low PA condition (M_{low-PA} = 2.89; $M_{high-PA}$ = 4.99). A second non-parametric one-way ANOVA comparing the high PO condition and the low PO condition showed no significant difference between the two experimental conditions (X^2 = 0.006, df = 1, p = .941, ε^2 = 0.0). Given that the PO manipulation did not produce the expected results, the PO condition as a dichotomous variable was not included in the following analyses. However, the PO degree felt by participants towards their target UGS varies across participants. Therefore, the "natural" sense of PO was included as a continuous independent variable in the upcoming regression analyses based on participants' scores on the PO scale, rather than as a dichotomous manipulated variable.

High levels of PO will increase participants' intentional loyalty towards the target GS (H1a), and even more so (H1b) or only in high PA condition (H1c). Linear regression (Tab.4) shows no evidence that the PA condition affects the participant's desire to visit the target GS. However, as expected, an increase in PO leads to a higher desire to visit the target GS (H1a). The socioeconomic level, as well as the perceived beauty of the target GS and the participant's usual attendance pattern also significantly impact the participants' GS attendance desire. Specifically, participants without CESS report higher levels of GS attendance desire than participants with CESS for higher education ($M_{No\ CESS}$ = 5.27, SD = 1.68; $M_{CESS\ HE}$ = 4.13, SD = 1.73), and higher levels of GS attendance desire than graduated/under graduated participants (M_{HE} = 3.69, SD = 1.96). The increase in beauty perception

leads to an increase in the participant's GS attendance desire. Also, the more regularly participants already attend the GS, the lower their desire to increase their attendance rate. To test our specific H1b and H1c, the pattern of the interaction between PA and PO was decomposed to have a look at simple effects.

Table 4. Multiple linear regression with GS attendance desire as dependent variable.

	b	SE	95% IC		df	t	p
			Lower	Upper			
(Intercept)	4.415	0.178	4.065	4.765	192	24.857	< .001
PA	0.071	0.271	-0.463	0.605	192	0.262	0.793
PO	0.189	0.082	0.028	0.351	192	2.308	0.022
PA*PO	-0.277	0.153	-0.580	0.026	192	-1.804	0.073
SEL1	-1.116	0.550	-2.201	-0.03	192	-2.028	0.044
SEL2	-1.005	0.616	-2.221	0.21	192	-1.631	0.105
SEL3	-1.336	0.544	-2.408	-0.264	192	-2.458	0.015
Age	-0.006	0.008	-0.022	0.009	192	-0.773	0.440
Gender	-0.244	0.246	-0.729	0.242	192	-0.989	0.324
Length of Res.	-0.000	0.001	-0.002	0.001	192	-0.461	0.645
PB	0.668	0.115	0.441	0.895	192	5.808	<.001
PC	-0.007	0.075	-0.155	0.141	192	-0.088	0.93
Distance	0.006	0.010	-0.015	0.026	192	0.551	0.582
UAP	-0.192	0.064	-0.318	-0.066	192	-3.015	0.003

PA = place attachment condition (dichotomous variable); PO = psychological ownership (continuous variable); PA*PO = interaction between PA condition and PO measurement; SEL1 = socioeconomic level (No CESS – CESS HE); SEL2 = socioeconomic level (No CESS – CESS prof.); SEL3 = socioeconomic level (No CESS – HE); LOR = length of residence; PB = perceived beauty; PC = perceived crowdedness; UAP = usual attendance pattern. *p<0.05; **p<0.001.

Table 5 shows that the impact of PO on GS attendance desire is only statistically significant in low PA condition. In low PA condition, an increase in PO leads to an

increase in participants' desire to attend the target GS more regularly, which is not in line with the formulated hypothesis (H1b or H1c).

Table 5. Simple effects of PO on GS attendance desire at low and high PA level.

| Moderator levels | | | 95% IC | | | | |
PA	b	SE	Lower	Upper	df	t	p
-1	0.328	0.128	0.076	0.580	192	2.568	0.011
1	0.051	0.095	-0.136	0.238	192	0.539	0.591

* p < .05 ; ** p < .001. High PA condition coded 1, low PA condition coded -1.

Linear regression (Tab.6) shows no evidence that the PA condition affects the participant's confidence to attend the target GS. As expected, an increase in PO leads to higher confidence to actually increase GS attendance (H1a). The perceived beauty of the GS also impacts participants' confidence to increase their GS attendance behavior. Specifically, the increase in beauty perception leads to an increase in participants' confidence to attend the GS more regularly. To test our specific H1b and H1c, the pattern of the interaction between PA and PO was decomposed to have a look at simple effects.

Table 6. Multiple linear regression with GS attendance confidence as dependent variable.

	b	SE	95% IC Lower	95% IC Upper	df	t	p
(Intercept)	3.142	0.167	2.813	3.470	192	18.846	< .001
PA	0.077	0.254	-0.425	0.578	192	0.301	0.764
PO	0.236	0.077	0.084	0.388	192	3.064	0.002
PA*PO	-0.170	0.144	-0.454	0.114	192	-1.179	0.240
SEL1	-0.591	0.516	-1.610	0.428	192	-1.145	0.254
SEL2	-0.677	0.579	-1.818	0.464	192	-1.170	0.243
SEL3	-0.926	0.510	-1.932	0.080	192	-1.815	0.071
Age	0.013	0.007	-0.002	0.027	192	1.710	0.089
Gender	-0.411	0.231	-0.867	0.044	192	-1.781	0.077
Length of Res.	-0.001	0.001	-0.002	0.001	192	-0.713	0.477
PB	0.280	0.108	0.068	0.493	192	2.598	0.010
PC	-0.043	0.070	-0.182	0.096	192	-0.616	0.539
Distance	-0.005	0.010	-0.025	0.014	192	-0.549	0.583
UAP	-0.062	0.060	-0.180	0.056	192	-1.035	0.302

See legend in Table 4.

Table 7 shows that the impact of PO on GS attendance confidence is only statistically significant in low PA condition. In low PA condition, an increase in PO leads to an increase in participants' desire to attend the target GS more regularly, which is not in line with the formulated hypothesis (H1b or H1c).

Table 7. Simple effects of PO on GS attendance confidence at low and high PA level.

Moderator levels PA	b	SE	95% IC Lower	Upper	df	t	p
-1	0.321	0.120	0.085	0.557	192	2.679	0.008
1	0.151	0.089	-0.024	0.326	192	1.701	0.090

$* p < .05$; $** p < .001$. High PA condition coded 1, low PA condition coded -1.

High levels of PO will increase participant's behavioral loyalty towards the target GS (H2a), and even more so (H2b) or only in high PA condition (H2c). Linear regression (Tab.8), shows that only the socioeconomic level, the length of residence and the usual attendance pattern have a significant impact on participants' GS attendance rate. Participants without CESS report a higher GS attendance rate ($M_{No\ CESS}$ = 0.31, SD = 0.34) than graduated/under graduated participants (M_{HE} = 0.20, SD = 0.28). The increase in length of residence is linked to an increase in participants' GS attendance rate. In a counter-intuitive way, the more regularly participants already attend the GS, the lower their attendance rate after the first part of the study. To test our specific H2b and H2c, the pattern of the interaction between PA and PO was decomposed to have a look at simple effects.

Table 8. Multiple linear regression with GS attendance rate as dependent variable.

	b	SE	95% IC		df	t	p
			Lower	Upper			
(Intercept)	0.213	0.024	0.165	0.261	190	8.723	< .001
PA	0.016	0.038	-0.058	0.09	190	0.433	0.666
PO	0.011	0.011	-0.011	0.034	190	0.978	0.329
PA*PO	0.037	0.022	-0.006	0.079	190	1.698	0.091
SEL1	-0.122	0.075	-0.271	0.026	190	-1.627	0.105
SEL2	-0.142	0.084	-0.308	0.024	190	-1.683	0.094
SEL3	-0.152	0.074	-0.299	-0.006	190	-2.05	0.042
Age	-0.001	0.001	-0.003	0.002	190	-0.537	0.592
Gender	-0.008	0.034	-0.074	0.059	190	-0.233	0.816
Length of Res.	0.000	0.000	0.000	0.001	190	2.638	0.009
PB	-0.013	0.016	-0.044	0.018	190	-0.842	0.401
PC	0.006	0.010	-0.014	0.026	190	0.568	0.571
Distance	-0.002	0.001	-0.005	0.001	190	-1.584	0.115
UAP	0.088	0.009	0.071	0.105	190	10.063	< .001

See legend in Table 4.

Table 9 shows that the impact of PO on the GS attendance rate is only significant in high-place PA condition (H2b). In high PA condition, an increase in PO leads to an increase in participants' GS attendance rate. H2c is thus preferred over H2b.

Table 9. Simple effects of PO on GS attendance rate at low and high PA level.

Moderator levels			95% IC				
PA	b	SE	Lower	Upper	dl	t	p
-1	-0.007	0.018	-0.043	0.029	190	-0.392	0.696
1	0.030	0.013	0.004	0.055	190	2.285	0.023

* p < .05 ; ** p < .001. High PA condition coded 1, low PA condition coded -1.

Linear regression (Table 10) shows no evidence that PA condition affects participants' attendance evolution. As expected, an increase in PO leads to an increase in self-reported GS attendance (H2a). No other variable significantly impacts this outcome. To test our specific H2b and H2c, the pattern of the interaction between PA and PO was decomposed to have a look at simple effects.

Table 10. Multiple linear regression, with GS attendance evolution as dependent variable.

| | b | SE | 95% IC | | df | t | p |
			Lower	Upper			
(Intercept)	2.122	0.153	1.820	2.424	192	13.856	< .001
PA	-0.297	0.234	-0.758	0.164	192	-1.271	0.205
PO	0.246	0.071	0.106	0.385	192	3.47	< .001
PA*PO	-0.025	0.132	-0.286	0.236	192	-0.189	0.850
SEL1	-0.623	0.474	-1.559	0.313	192	-1.313	0.191
SEL2	-0.393	0.532	-1.441	0.655	192	-0.739	0.461
SEL3	-0.700	0.469	-1.624	0.225	192	-1.492	0.137
Age	0.003	0.007	-0.010	0.017	192	0.468	0.641
Gender	-0.014	0.212	-0.432	0.405	192	-0.064	0.949
Length of Res.	0.001	0.001	-0.000	0.003	192	1.679	0.095
PB	-0.040	0.099	-0.235	0.156	192	-0.398	0.691
PC	0.011	0.065	-0.117	0.138	192	0.166	0.868
Distance	-0.017	0.009	-0.035	0.001	192	-1.861	0.064
UAP	0.079	0.055	-0.029	0.188	192	1.444	0.150

See legend in Table 4.

Table 11 shows that the impact of PO on GS attendance evolution is significant in high and low PA condition, which is not in line with the formulated hypothesis (H2c and H2b).

Table 11. Simple effects of PO on GS attendance evolution at low and high PA level.

| Moderator levels | | | 95% IC | | | | |
PA	b	SE	Lower	Upper	df	t	p
-1	0.258	0.110	0.041	0.475	192	2.345	0.020
1	0.233	0.082	0.072	0.394	192	2.857	0.005

* p < .05 ; ** p < .001. High PA condition coded 1, low PA condition coded -1.

Discussion

The current study was designed to test whether PO can enhance GS attendance. High PO was expected to increase intentional and behavioral loyalty towards the GS, especially in high PA condition. Given that the PO manipulation did not produce the expected results, analyses included the level of PO based on the "natural" sense of PO reported by participants on the PO-scale initially included for the manipulation check.

While previous research has shown that high feelings of PA should increase place attendance (e.g. Kil et al., 2012; Lee et al., 2012; Lee & Shen, 2013; Prayag & Ryan, 2012; Yuksel et al., 2010; Zhang et al., 2022), results did not show a significant impact of PA on GS intentional or behavioral loyalty. However, it can often be difficult to determine the extent to which place loyalty predicts or is predicted by PA. Most studies investigating the link between PA and a number of psychological outcomes are descriptive, correlational, or qualitative, which makes causal inferences impossible (Scannell & Gifford, 2017). As mentioned in the introduction, the question of the direction of this relationship remains open, but it is possible that attendance influences attachment, rather than the other way around (Plunkett et al., 2019). In addition, given the confusion surrounding the concept of PA, a huge variety of different measurements of the concept can be found, some treating PA as unidimensional, others as multidimensional. Studies sometimes show different results for each included PA dimension, with some being significantly related to loyalty and others not (e.g. Lee et al., 2012; López-Mosquera & Sánchez, 2013).

Importantly, PO had a statistically significant impact on GS attendance desire (H1a), GS attendance confidence (H1a) and GS attendance evolution (H2a). These results can be explained by the need for control, which requires attending the target place. When decomposing the interaction between PA and PO to look at simple effects to test the specific hypotheses (Hb and Hc), mixed results were observed. The impact of the sense of PO on intentional loyalty (i.e. GS attendance desire and GS attendance confidence) was only significant in low PA condition, which is not in line with the formulated hypothesis (H1b or H1c). It is possible that the intention to attend the GS is the result of the cognitive dissonance that may arise when individuals do not feel emotionally attached to the GS but still feel that the place belongs to them, leading to the moral obligation to care for it (i.e. the gatekeeper right). In response to this dissonance, the individual formulates the intention to visit the place more regularly. However, this intention may never turn into actual

attendance of the place, given that, on average, behavioral intention accounts for only a little more than 25 % of the variance of future behavior (Sheeran, 2002). If the impact of PO on GS attendance evolution was not statistically dependent on the PA condition, the impact of PO on GS attendance rate was only significant in high PA condition, this last result being in line with the formulated hypothesis (H2c). The difference in results between these two behavioral measures could lie in the fact that the former remains very subjective and potentially more subject to biases such as optimism bias (going out for a walk is good for your health, so you can convince yourself that you are already doing it regularly), whereas the latter is more factual. Thus, when looking at the more factual data, PO appears to significantly impact attendance only in high PA condition, suggesting that this emotional connection has not to be neglected in order to actually take action.

Several covariates significantly impacted GS loyalty. Beauty perception directly affected people's desire and confidence to attend GS. It seems relatively intuitive that people would like to spend more time in quality spaces. The increased length of residence was significantly linked to the GS attendance rate, possibly due to the close ties people have developed in the neighborhood, referring to the social aspect linked to a place. Surprisingly, participants without CESS report higher levels of GS attendance desire than participants with CESS for higher education or graduated/under-graduated participants, as well as a higher GS attendance rate than graduated/under-graduated participants. Low-income groups are often living in neighborhoods with public GS of lower quality and maintenance, and being often perceived as less safe (Rigolon, 2016; Rigolon et al., 2018; Williams et al., 2020). However, public GS are often the only natural spaces low-income groups can rely on, which may explain these results. However, our data do not allow for an in-depth analysis of this question. Last but not least, results showed that the more regularly participants already attend the GS, the lower their desire to increase their attendance rate and the lower their attendance rate after the first part of the study. It is possible that this simply shows a phenomenon of regression to the mean. People who already attend regularly these spaces can hardly increase their attendance rate.

3.1. Theoretical and practical contributions

The present study intends to contribute to both theory and practice. From a theoretical perspective, if PA has already been studied in relation to place loyalty, it seems that only a few studies have examined the PA constructs from the urban GS perspective (Dasgupta et al., 2022). Moreover, most studies investigating the link

between PA and several psychological outcomes are descriptive, correlational, or qualitative, sometimes quasi-experimental, which limits the internal validity of the claims (Scannell & Gifford, 2017). By using PA as an independent variable in an experimental design, the present study contributes to a better understanding of the concept. Our results show no significant impact of PA on GS loyalty, and suggest that the sense of PO people experience towards places has a potentially more interesting role to play when trying to enhance GS attendance. However, the emotional relationship probably remains important to actually take action, with PO having no statistically significant impact on GS attendance rate in low PA condition. Besides, to the best of our knowledge, this study is the first one to introduce PO in research concerning places' intentional and behavioral loyalty and hence lay a theoretical foundation for further studies.

From a practical point of view, city administrations and other interested stakeholders can also benefit from this study, as it provides first results of the role PO can play in increasing GS attendance and thus public health. Much remains to be discovered about the best way to increase the sense of PO people experience towards places, but first tracks are beginning to emerge, and giving citizens some control over these places is probably one of them. Moreover, the sense of PO will probably influence people's behaviors in the target places and increase civic behaviors, through the so-called gatekeeper effect, which makes it a double win and particularly interesting for field interventions. In a study comparing the impact of legal ownership to the impact of PO, the second one emerged as a more effective way to preserve natural areas (Preston & Gelman, 2020). This suggests that before going through the privatization of some natural or semi-natural places, considering alternative solutions like increasing citizens' sense of PO can be (more) effective.

3.2. Study limitations and future research

This study has several limitations, which opens up possibilities for future research. First, the manipulation of PO did not produce the expected results, despite the pre-test which had been conducted. Therefore, causal inferences about this specific variable are not possible. Ideally, the study should be replicated with a design allowing the manipulation of this variable and enabling causal inferences.
Secondly, even if not inherent to the present study, PA is a complex construct, and it remains unclear how many and which dimensions it encompasses. Our manipulation check was measured by three items, considering PA as unidimensional. If it is not necessary to always include all levels of the PA concept (which, to date, is

simply not possible), it is important to know that if PA is multidimensional, different PA dimensions can have different impacts.

Conclusions

Previous research has shown that attitudinal factors can be important drivers of place loyalty. Unlike former studies, our results show no impact of PA on GS loyalty. The sense of PO people experience towards GS has a potentially more interesting role to play in the enhancement of GS attendance. While controlling for the level of PA, results showed a significant impact of PO on both the intention and the actual attendance behavior, although the emotional attachment individuals experienced towards GS should probably not be overlooked to move from intention to action. To the best of our knowledge, this study is the first one to introduce PO in research concerning places' intentional and behavioral loyalty and hence lay a theoretical foundation for further studies.

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Data availability

Raw data and supporting information can be found open access on osf: https://osf.io/2vg6m/?view_only=e2e4b8db51cb4b2aba36e3616da83c6c

Credit author statement

Tania Noël: Conceptualization, Methodology, Formal Analysis, Data collection, Writing – Original draft, Writing – Review and Editing. Benoit Dardenne: Methodology, Formal analysis, Writing – Review and Editing, Supervision.

Declaration of competing interest

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3.2 Acting phase

3.2.1 Field intervention

As a reminder, the main objective of the WP5 consisted of "an improvement of residents' relationship to their local environment". Based on a literature review showing the important role UGSs can have in public health and social justice interventions, but also based on regular interactions with the project area, the project population and field experts, the research question that guided the intervention was formulated as follows: "*How to increase public UGS attendance by inhabitants of the project area?*"

The diagnostic phase provided a better understanding of the intervention area, while identifying in the existing scientific literature potential psychosocial incentives to UGS attendance (the different indicators first proposed in point 2.2.1), adapted to the specificities and requirements of the present project.

Two aspects were particularly important for the WP5: how people connect to places and safety concerns. Place connection was assessed through the emotional attachment to the UGS, as PA is the most studied attitudinal factor in relation to place attendance research. The safety aspect focused on perceived safety rather than actual crime rates, for the reasons discussed earlier (see pp. 53-55).

Although the methodology (cross-sectional) does not allow making causal inferences, correlational relationships were tested. PA was significantly and positively related to self-reported UGS attendance. A strong emotional attachment to the UGS was linked to a higher attendance rate. PA could therefore have been an interesting attitudinal factor to consider in the psychosocial intervention of the WP5. However, as highlighted in chapter 3, as well as in the experimental study presented in Box 3 (pp. 123-150), a thorough search of the scientific literature shows that using this variable in field interventions probably makes little sense. Therefore, it was decided to create the intervention around the feeling of PO, another attitudinal factor that also represents a type of relationship people can develop towards public places, and which seems to suit more to field interventions. In view of the scientific literature, but also based on the results of the experimental study, it can be assumed that increasing the sense of PO residents experience towards the public UGS will lead to an increase in UGS attendance rate, but also in stewardship behaviors and perceived safety within these places.

The main objective of the psychosocial intervention was therefore to enhance residents' sense of PO towards UGSs, in order to increase the attendance rate of the public UGSs and so ensure that these spaces contribute as much as possible to the quality of life in the project area. However, it should not be forgotten that the main objective of this project and of the psychosocial intervention carried out in WP5, and of action-research methodology in a more general way, is to have an impact-oriented approach (Simon & Wilder, 2018), and to aim at practical solutions to specific field issues (Reason & Bradbury, 2001). Like any behavior, attendance behavior is the result of the interaction of different factors, each explaining a different share of variance. A behavioral intervention where the main objective is to have an impact on the field and not to increase theoretical knowledge should thus be more effective if including several psychosocial incentives. The intervention was therefore also based on two other psychosocial incentives: social norm and commitment, through binding communication.

3.2.2 Psychological ownership and other incentives to enhance attendance rate

In order to identify the important aspects to consider for the design of the psychosocial intervention, it was important to have a minimum of theoretical background about the psychosocial incentives.

- Psychological ownership

As summarized by Peck and Luangrath (2023) in their review, the antecedents to PO, also known as the routes to PO (Pierce et al., 2001, 2003) can be used as levers to manipulate the sense of PO that individuals will experience towards a target. PO can emerge by having an intimate relationship with the target or investing the self into it, as already mentioned in point 3.1.2 (pp. 119-120), but also by having a sense of control over it (Pierce et al., 2001). Indeed, perceived control is not only what will characterize and differentiate this type of connection from other types of connections between an individual and a target, like PA, but also one way to develop this sense of "mineness".

Different methods to manipulate the feeling of PO, playing on these different antecedents, have already been tested and seem to show conclusive results (for a review see Peck & Luangrath, 2023).

Naming the place is one example of manipulation that increases the sense of PO (Peck et al., 2021; Peck & Luangrath, 2023), probably because it requires some self-investment (Peck et al., 2021) and offers a sense of control over the place. Although

used by other researchers (see Peck et al., 2021), this manipulation did not yield the desired results in the experimental study (Box 3, pp. 123-150). This may be due to the fact that in the study we referred to (i.e. Peck et al., 2021), the researchers also asked participants to say the nickname they imagined for the place both to themselves and speaking it out loud while attending the place. Although not all participants in the study did so (49 % of the participants in the PO condition reported that they called the name out loud at least once and 79 % reported that they said it to themselves), it was not required in the experimental study of the present project. Another possible explanation is that participants in our experimental study were asked to think about an UGS near their homes. Even for spaces to which participants did not feel a strong emotional connection, it is likely that they were familiar with the UGS they were thinking about and had a lot of past experiences within this space, leading to an intimate knowledge of it. More information and knowledge about a target can lead to an increased sense of PO (Peck & Luangrath, 2023), which potentially led some participants from the low PO condition to think of an UGS for which they already felt a high sense of PO. Finally, our two experimental groups were asked to imagine a name for the UGS they were thinking about, although the instruction emphasized either the feeling of possession or the shared aspect of the place. It is possible that just the act of taking the time to imagine a name for the place increased the sense of PO, regardless of the experimental condition and the associated instructions.

However, there are other possible manipulations to increase the sense of PO towards the public spaces (Peck et al., 2021). Another very simple manipulation to implement and which is very adapted to public spaces consists in installing signs indicating that the place belongs to the people who attend the place. For example, participants in a study confronted with a "Welcome to the park" sign (control condition) reported significantly lower levels of PO than participants confronted with a "Welcome to YOUR park" sign (Peck et al., 2021), which allows a feeling of investment towards the place (Peck & Luangrath, 2023).

- Social norms

In addition to the sense of PO, the intervention also builds on social norms as an incentive for UGS attendance.

Over the past few decades, there has been a significant surge in research interest in social norms across various fields such as health, environment, and philanthropy (Rhodes et al., 2020). A wide variety of terminologies, definitions, theoretical approaches and ways to operationalize social norms exist across disciplines (Chung

& Rimal, 2016; Legros & Cislaghi, 2020). One major distinction that can be established between different theoretical approaches is to see social norms as an individual construct (i.e. psychological states of individuals, such as beliefs or emotions) or as a social construct (i.e. conditions or features of social groups or structures; Legros & Cislaghi, 2020).

In the present work, social norms are considered as individual constructs, more appropriate to the study of psychological mechanisms underlying normative phenomena (Legros & Cislaghi, 2020). Various types of norms can be identified in scientific literature. The concept of "subjective norms", for example, is widely used in psychology and is a key element in both the theory of planned behavior and the theory of reasoned action (Ajzen & Fischbein, 1980), referring to perceptions of whether important others (e.g. family and friends) think a specific behavior should be performed. In the present project, we focus on another social norm conceptualization often used in psychology, stemming from the Focus Theory of Normative Conduct (Cialdini et al., 1990). According to this theory, social norms significantly and systematically affect human behavior. When faced with multiple social norms simultaneously, the behavior will be determined by the "focal norm" which is the norm that is made salient and given attention. This theory makes a distinction between two types of social norms: descriptive and injunctive social norms. Descriptive norms pertain to the perception of how common a particular behavior is observed among group members, while injunctive norms pertain to the perception of group members' approval or disapproval of the behavior (Cialdini et al., 1990; Kallgren et al., 2000). The concepts of injunctive norms and subjective norms, from the theory of planned behavior and the theory of reasoned action (Ajzen and Fishbein, 1980), are often seen as comparable and are sometimes even used interchangeably (e.g. Niemiec et al, 2020). In this work, we will refer only to the concept of injunctive norms.

Research on social norms has primarily been driven by the understanding that people often have an incorrect perception of how prevalent certain behaviors are among their social group (Lewis & Neighbors, 2006; Perkins & Berkowitz, 1986). This misperception often leads individuals to modify their own behavior to conform to the perceived social norm (Schroeder & Prentice, 1998). With this in mind, the idea emerged that correcting these normative misperceptions through communication could decrease the social motivation to engage in negative behaviors (Rhodes et al., 2020). A multitude of communication and awareness campaigns are thus based on social norms. As mentioned by Rhodes and colleagues (2020), numerous forms of social norm manipulations in communication campaigns have been developed and

used, ranging from single-message campaigns aimed at correcting norm misperceptions to comprehensive media campaigns incorporating a variety of different strategies.

Whatever the way to conceptualize or manipulate social norms, or how different type of norms influence each other, it seems presently fairly well established that social norms have a considerable impact on our beliefs, attitudes and behaviors. Some research findings suggest that injunctive and descriptive norms each exert their own independent influence on behavior (e.g.Jacobson et al., 2011; Melnyk et al., 2011). Going into the details of the processes which may underline the impact of these different types of norms would go beyond the scope of this work. However, with this in mind, it becomes pertinent to question which type of norm, injunctive or descriptive, would be more effective to manipulate in order to achieve the targeted behavioral change.

In a meta-analysis examining how correlations vary by the type of different norms and type of conservation behavior, measured through behavioral intention, results suggest that, compared to injunctive norms, descriptive norms were more often significantly associated with intentions (Niemic et al., 2020). The statistical analysis suggested a stronger influence of descriptive norms on behavioral intention, as evidenced by the significant difference between the pooled standardized coefficient estimate of .23 for descriptive norms and .09 for subjective norms (Niemic et al., 2020). However, in a review using meta-analytic techniques to investigate the influence of social norm manipulations, findings suggested that even if both types of norm manipulations had a small but significant impact on behavior, injunctive norm manipulations had a significantly stronger effect (Rhodes et al., 2020). One could argue that this difference could be the result of assessing behavioral intentions in the first meta-analysis, and behaviors in the second one. However, Rhodes and colleagues (2020) found no significant difference between descriptive and injunctive norm manipulations regarding behavioral intentions. In addition, a third meta-analysis looking at the influence of social norms on consumer decision-making showed the opposite pattern, and highlighted a stronger impact of descriptive norms on behavior, and a stronger impact of injunctive norms on intentions (Melnyk et al., 2019).

Many factors are to be taken into account in studies looking at the impact of descriptive and injunctive norms on intentions and behaviors, and could help understanding this difference in results. Methodological (e.g. duration of message exposure or message delivery method), sample (e.g. culture, age, or gender), and

message framing variables (e.g. proscriptive vs. prescriptive messages, behavioral domains or chosen referent group) are some of the factors that probably affect the norm and behavior/intention link (e.g. Rhodes et al., 2020), to name only a few of them. Given the difficulty of determining which type of norm intervention is the most effective, it is worth considering to include both norm messages in one single intervention. Indeed, if injunctive and descriptive norms each exert their own independent influence on behavior (e.g. Jacobson et al., 2011; Melnyk et al., 2011), the effectiveness of a normative message could be maximized by including both types of norms.

In their review, Rhodes and colleagues (2020) found a significant effect of mixed manipulations (activating elements of both the injunctive and descriptive norms) only on behavioral intentions, and not on the behavior. However, it is necessary to put this result in perspective. First, little information is given in their review about studies using mixed manipulations, since their main objective was to distinguish the impact of the descriptive and injunctive norm. Besides, these manipulations could just as well include the presentation of congruent descriptive and injunctive norms as incongruent descriptive and injunctive norms. Some studies have looked specifically at whether presenting both types of norms works better than presenting only one type of norm. These studies highlight that persuasive messages which incorporate congruent descriptive and injunctive norms (i.e., demonstrating that a behavior is not only commonly performed but also socially approved) are more effective than messages that rely on only one type of norm (Bhanot, 2018; Habib et al., 2021; Schultz et al., 2008). Moreover, these studies measure the impact of the normative message on observable behaviors, whereas in their review, Rhodes and colleagues (2020) merge observable and self-reported behaviors, which potentially also affect the significance and strength of the relationship. On basis of this, but also on basis of the explanation given above and explaining the importance of activating several psychosocial levers simultaneously for a field impact research, it still seems interesting to use both types of norms, as long as they send out a consistent message.

Besides of this, normative messages can be created by using proximal normative references such as family, friends, or "important others", or by using more distant normative references such as the overall population. Distal referents were the most prevalent representation of norm referent groups in the studies included in Rhodes and colleagues' (2020) review, however, no meaningful comparisons could be drawn given that the available data for the proximal conditions were too limited. The authors point out, however, that based on previous research (i.e. Neighbors et al.,

2008) one should expect better results when using proximal referents. Therefore, it is something that should be kept in mind even if no systematic review conclusions can be drawn regarding this specific question.

- Binding communication

There is a widely held belief that modifying one's ideas can lead to the desired behavior. As a result, communication campaigns are frequently based on the assumption that providing people with the right information and strong enough persuasive arguments will guarantee the target behavior (Joule et al., 2007).

However, research in social psychology has long since shown the limitations of this assumption, and while these campaigns may increase people's knowledge about a given topic or change their attitude towards a target behavior, they are not very effective in changing actual behaviors (Girandola & Joule, 2008, 2012, 2022; Joule et al., 2007). The study of Kurt Lewin (1947) is among the most telling studies on this topic and shows the value of obtaining an a priori trivial action from individuals whose behavior we wish to change. In Kurt Lewin's action research carried out during the Second World War, American housewives were informed about the importance to use cheaper cuts of meat and offal, to prevent malnutrition. The goal was to convince housewives to change their dietary patterns.

Although they appeared fully convinced during the presentation, they still cooked the exact same amount of the cheaper cuts of meat as before (3 % cooked offal). However, when asked for a show of hands to express their decision to serve offal, they were 10 times more likely to actually follow through with their decision (32 % cooked offal). Based on this, Lewin argued that there is no direct link between our ideas about a given behavior and the actual behavior, so an intermediate link, the decision action, is necessary. The results obtained by Lewin demonstrate the benefit of "securing" a decision, as people are more likely to stick to a decision once made (freezing effect).

According to Joule and Beauvois (1998), research carried out in the field of persuasion can be brought back to a single paradigm: free will compliance. This paradigm can be seen as the study of techniques or procedures that can induce others to change their behavior, regardless of their values, attitudes, or personality, but based on the circumstances (Joule et al., 2007). The psychological process leading up to the behavioral change lies in the so-called preparatory or binding action, a decision easy and simple to obtain going in the right direction, and the resulting freezing effect (Joule et al., 2007).

There are various procedures that create circumstances that help prepare individuals to make decisions that lead them to comply freely with what is expected of them, such as the low-ball or the foot-in-the-door principle, to name only two of them (for a summary of the techniques see for example Girandola, 2003). For the low-ball principle (Cialdini et al., 1978), people are led to make a decision, without knowing all the details, and then presented with more information (disadvantages or changes to the original positive deal), that might change their decision. Despite this, people tend to stick with their original decision due to the priming effect, even when conditions change. Cialdini and colleagues (1978) demonstrated this in an experiment where students were invited to participate in research without knowing it would start at 7 am. Those who were only told about the early start time after agreeing to participate were more likely to still show up compared to those who were told upfront. This shows that people feel committed to their original decision, even if the situation changes and it becomes more costly. The foot-in-the-door technique is a compliance strategy where a small request is made before a bigger one (Freedman & Fraser, 1966). It's commonly used and there are several variations of this technique. This technique was first studied by Freedman and Fraser in 1966, in an experiment where they found that housewives were more likely to agree to a 2-hour interview if they had previously answered some simple questions on the phone. In both examples, individuals still had the option of withdrawing, and not pursuing this costly second request. The circumstances under which the requests were made, and where people took a, at priori, inexpensive decision, meant however that more people accepted compared to the control condition.

The theory of commitment provides a good theoretical interpretation of the free will compliance phenomena (Girandola, 2005; Joule & Beauvois, 1998; Kiesler, 1971). Kiesler (1971) suggests that people who take action tend to become committed to their actions, which can impact both attitudes and behaviors. Committing to a counter-attitudinal action can result in a change of attitude or rationalization (i.e. a better adjustment of attitude to action), while committing to an action in line with one's attitudes can lead to a consolidation of the attitude and, probably, better resistance to subsequent influence attempts. When it comes to behavior, committing to a decisional action can lead the person to stick to it (e.g. freezing or low-ball effect), while committing to an innocuous action can increase the likelihood of complying with subsequent, more demanding requests (e.g. foot-in-the-door effect). However, this impact on attitude and behavior depends on the specific commitment conditions, and the same action can be more or less binding (Joule et al., 2007; Joule & Beauvois, 1998).

Given all this, the issue at hand is figuring out how to develop communication campaigns that are more effective by going beyond basic information and persuasion. This leads to the research paradigm of binding communication, which combines research from the field of persuasive communication and research from the field of voluntary submission, and rests on the idea individuals can be motivated to move from ideas to actions if the necessary, thoughtfully planned, preparatory or binding actions are not verlooked (Girandola & Joule, 2008, 2012, 2022; Joule et al., 2007). However, this is a difficult task as it requires empowering the target audience to be active participants rather than passive receivers. In addition to determine what information to convey and the best arguments, channels, tools and media to use, it is essential to identify which preparatory or binding actions are necessary to engage the target audience effectively.

From a practical point of view, it is necessary to take into account research results from the literature on persuasive communication, as well as research results from the literature on free will compliance.

As briefly discussed for example by Girandola and Joule (2008), the literature on persuasion informs, for instance, about the importance of taking into account different variables that will affect the effectiveness of the message. For example, the effectiveness of the message will be affected by the credibility of the source or the "likability" of the person conveying the message. The characteristics of the source are therefore an important aspect to consider. The way the message is constructed will also affect its effectiveness. The choice of arguments, the type of argumentation, or whether the conclusions are presented explicitly or implicitly. The context in which the message is delivered will also be important, for example, if it is communicated during a situation that is perceived as pleasant or unpleasant.

On the other hand, the literature on free will compliance highlights the importance of an engaging action. It should be kept in mind that the stronger the commitment, the bigger the effects (Joule et al., 2007). Not all actions will have the same commitment effect. Strong commitment can be achieved by playing on various factors, some specific to the characteristics of the act itself, and others specific to the characteristics of the context in which the act was performed. One can thus play on the context of freedom in which the action is carried out, the public and explicit nature of the action, the irrevocability and the repetition of the action, and the consequences, costs and reasons for the action (Joule et al., 2007). Moreover, an action carried out in a context of freedom is more binding than when carried out in a context of constraint. Similarly, actions done in public are more significant than

those done in private or anonymously. Clear and explicit action is also more significant than an ambiguous one, and an irreversible action holds more weight than a reversible one. In addition, an action that is repeated is more binding than an action carried out once. An action is also considered more binding if it is accompanied by significant consequences, and if it comes at a cost (e.g. money, time, or effort). Finally, an action is more binding when it is the result of internal motivations, such as personal values, rather than external influences like the promise of rewards. In summary, in order to build a good persuasive message it is necessary to address not only the questions of "who says what?", "to whom?" and "how?", but also "by making him do what?" (Girandola & Joule, 2008).

3.2.3 Procedure and material

Based on the development in section 3.2.2 (pp.152-160), the psychosocial intervention (also called manipulation later on) consisted of a binding communication campaign, with the main objective of increasing self-reported and actual UGS attendance in the project area. This campaign was built on the incentives of PO (i.e. increase the sense of ownership that citizens experience towards the UGS) and social norms (i.e. convey the message that UGSs are visited and that this is a good thing).

The intervention was conducted in a constantly changing field setting and influenced by a significant number of other interventions and changes (including interventions made in the other WPs as part of the project). Therefore, it is necessary to distinguish an "ideal" experimental condition, allowing it to control for a maximum of confounding factors, from what is actually feasible in this specific field.

- **Conditions required for a good field intervention**

An optimal situation would require: (1) the comparison of a control condition to an experimental condition; (2) the inclusion of a pre-test and/or manipulation check and (3) the control of confounding variables.

- *The comparison of a control condition to an experimental condition*.

Some possibilities exist for applied research or action-research to allow comparison between an experimental and a control condition.

A first possibility would be to have at least two similar spaces with regard to as many characteristics as possible. These characteristics have to include the physical and objectively measurable aspects of the UGS (e.g., socioeconomic level of the neighborhood, size, public or private aspect, maintenance, infrastructures, presence

or absence of organized and supervised activities, vegetation ratio ....), but also the psychosocial aspects of the UGS (e.g., how the UGSs are perceived and which relationship people in the neighborhood have with these spaces). Having at least two similar settings allows to have a manipulation in one (or more) of these settings (experimental condition), and to compare it to a setting without manipulation (control condition). For the intervention planned for the WP5, it could mean running the communication campaign for UGS-1, and not running a communication campaign for UGS-2.

Another possibility would be to run a classic communication campaign for UGS-1, and a binding communication campaign based on the sense of PO and social norms for UGS-2. However, this assumes that the locations are far enough apart from each other to avoid the influence of the intervention from the experimental condition on the control condition, which is probably not the case for the Morchamps Park and the Marêts Park (< 1km as the crow flies). This also raises the ethical question of which UGS, and therefore which population, will benefit from the binding communication campaign, for which better results are expected than for a traditional communication campaign or for no communication campaign at all. This concern was also discussed with the stakeholders at the city level, which expressed the desire to avoid favoring one park, and therefore one neighborhood, over the other.

Another possibility would be to take measurements at different points in time. Attendance measurements would in this case be taken during the diagnostic year (baseline), in the second year of the project where a traditional communication campaign would be conducted, and then in the third year of the project where the binding communication campaign would be conducted. In this case neither, it cannot be excluded that the communication campaign in the second year would not have any impact on the attendance rate in the third year. This would, however, imply a very long-term impact of this traditional communication campaign, which, although not impossible, would remain surprising. For a normative message, for example, its impact on behavior seems to slightly wane over time (Rhodes et al., 2020). A perfect experimental situation is anyway never achievable in action research. This last option, taking measurements at different points in time, was not possible for the present project due to the constraints related to the COVID-19 pandemic from 2020 onwards, but also due to the floods in the summer of 2021. Alternatively, it would be possible to limit to two measurement times, one before and one after manipulation. This last possibility was selected in the present case.

The advantage to take measurements at different points in time rather than comparing the intervention from a control UGS to an experimental UGS is that it is not necessary to have several similar settings. Although Morchamps Park and Marêts Park are relatively similar regarding the measurements taken during the diagnostic phase, discussions with field actors showed that these sites remain very different in terms of use by residents, but also regarding the extent and frequency of vandalism and other criminal behaviors. Taking measurements at different points in time, whether two or three times, requires, however, that the conditions before and after the manipulation are similar (e.g., no new infrastructures in the UGS during this period or similar weather conditions).

- *The inclusion of a pre-test and/or manipulation check.*

It is difficult to pre-test a field manipulation, especially because of the time and money investments it requires. Pre-testing the manipulation through a laboratory experiment may be an option if time allows it. It is however important to be aware that the laboratory setting will never be totally comparable to the field setting, and is unlikely to include all the important confounding variables found in the field setting. Including a manipulation check may make sense, to try to assess the effectiveness of a manipulation. This is all the more important for the present project because of the various constraints that made data collection impossible in the second year of the project and therefore did not allow for the establishment of a baseline for the sense of PO, which would have been the ideal situation.

This manipulation check can of course not be done through the methods typically available for laboratory experiments, and therefore do not allow detailed checks on the impact of the manipulation. One option would be to ask participants to indicate whether or not they are aware of the manipulation (e.g., are they aware of the communication campaign?). Obviously, the effectiveness of this type of manipulation check can be discussed, given the limitations that are inherent to conscious and unconscious processes. For example, exposure to a stimulus, like a communication campaign, does not guarantee the individual's attention. It seems, however, that regardless of the level of attention, and even if an advertising message is not consciously remembered, the stimulus can still be unconsciously processed and subsequently change the individual's attitude (Yoo, 2008).

To the best of our knowledge, the self-reported recall is the only manipulation check option that can easily be applied on the field, even if some participants will not consciously remember the campaign at the very moment this question is put to them. For the present project, an experimental study (Box 3, pp. 123-150), as well as

a measurement of participants' awareness of the communication campaign, were included.

- *The consideration of covariates.*

As in any experimental study, it is important to be able to control a maximum of confounding variables. This is especially true for field interventions, where external influences are multiple. If it will never be possible to get close to conditions as well controlled as in laboratory settings, knowing the field well (i.e. having gone through a diagnostic phase) however maximizes the chances of including the most important covariates. While it is not always possible to include external factors that potentially influence the results in the statistical analyses, a well-conducted diagnostic phase allows for a better interpretation of the results and allows to bring the necessary nuance to this type of methodology.

Given that weather influences people's outside activities, it was taken into account to select the most appropriate times for data collection and intervention but was also included as a covariate in the analyses of the UGS' objective attendance rate (i.e. temperature of the day and precipitation rate). In addition, activities and interventions that took place in or were related to the UGSs of the project area were recorded. This information cannot be added to the analyses but was taken into account in the discussion of the results. An overview of the activities and interventions hold in/about the UGSs during the years of the project can be found in Appendix 1. This table is meant to be as complete as possible and has been written in collaboration with the other WPs of the project, but does not have the claim to be exhaustive.

The timeline (Fig.5; p. 165) gives a general overview of the different phases of the project, the constraints that impacted the schedule and the moment of the field intervention.

- **The communication campaign**

The communication campaign was built in collaboration with the WP3 "communication". A first version of the campaign-visual was pre-tested on the field (for the pre-test poster, see osf), at the end of February 2022. For the pre-test, 12 people were approached in the project area and asked to answer several open-ended questions regarding the visual of the communication campaign (see Table 5).

Table 5. Questions asked for the pre-test of the binding communication campaign.

Question	Purpose of the question
What are your thoughts about this poster? Feel free to say anything that comes to mind.	To know the general opinion about the poster, without the risk of inducing answers/opinions by asking more specific questions.
What do you think is the purpose of this poster?	To know if the main objective is correctly understood.
Do you find this poster visually pleasing/pretty/attractive?	To know how the poster is perceived (positive/neutral/negative perception).
Do you know what a QR code is? Do you know how to use QR codes? Would you scan this QR code?	To know whether the binding action is likely to be understood and used.
Which formulation do you find the most effective? Which one makes you want to visit the seresian parks the most? 1) "The majority of Seraing residents use parks" 2) "More than 60% of Seraing residents use the parks"*	To determine which formulation of social norm activation is most appreciated, and perceived as most effective.
Is the park you see in the picture crowded in your opinion?	To know if the picture is in line with the social norm that the campaign seeks to activate.
Do you have any comments or questions about the poster? Any suggestions for improvement?	To let people address aspects that were not covered by the questions.

* Percentage based on the results of the diagnostic phase
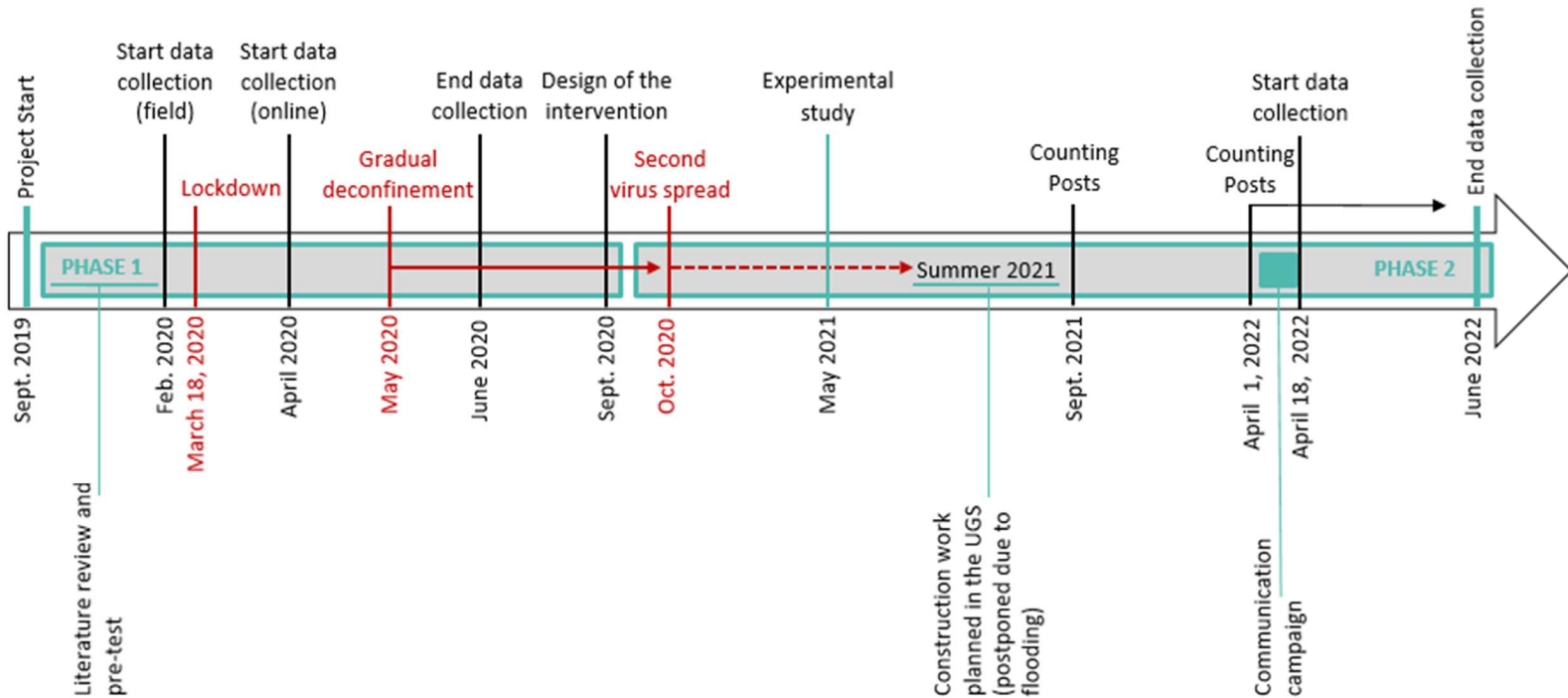
Figure 6. Timeline giving a general overview of the different phases of the project, the constraints, and the temporality of data collection and field intervention.

1) Psychological ownership. Based on the theory developed earlier, the sense of PO was activated through the message "Rediscover YOUR parks".
2) Social norm. Based on the theory developed earlier, both descriptive and injunctive norms, sending out a consistent message, were incorporated. For the present project, it seemed difficult to use proximal reference groups to construct the normative message. Proximal groups typically represent family, friends or "important others". However, the use of the term "Seresians" was intended to make the reference group appear more proximal than the overall notion of "people".
3) Binding communication. A binding communication campaign includes, in addition to the traditional persuasive message, at least one preparatory or binding action. The present campaign used a QR code (= preparatory action), linking people to an awareness-raising video highlighting the benefits of UGSs (= persuasive message), and a questionnaire allowing individuals to indicate if they were willing to engage in different behaviors regarding these spaces (= engaging actions).

For the video script and the associated questionnaire, see Fig.6. Refer to osf to see the complete video (in French).

The poster was adapted in flyer format. The posters were displayed in public spaces (in stores, cafés and restaurants, on street billboards, and in public buildings such as administrations, premises of local associations, libraries...) mainly within the project area, but also in the surroundings. The flyers were distributed in the mailboxes of all inhabitants of the project area (N = 6000). The posters were put up and the flyers distributed between April 13 and April 15, 2022.

	1a – BC (preparatory action)	1b – Other incentives
Posters - Flyers	[QR code]	**Psychological ownerhip** («Your park») **Social norm** (descriptive and injunctive norms)

	2 – BC (persuasive message)
Online	The video started automatically when people scanned the QR code. 1 min – "punchy" and motivating. Joyful background music at the end. **Synopsis:** Popularized video to help people understand the benefits of visiting UGS. Seresians share with other Seresians, in short sentences, all the benefits related to UGS attendance. The protagonists represent the diversity of the area in terms of gender, age and nationality. Final shot: wide shot showing all the protagonists, in the Marêts and the Morchamps parks. Takes an equitable alternate between the two parks.

3 - BC (binding actions)

Questionnaire at the end of the video.

The majority of Seresians use the parks! ☺
Would you like to participate in bringing life to the Morchamps and Marêts parks?

You are free to check the following answers:
- ❑ *Yes, every time I pass by the park, I'll check it out and walk through it!*
- ❑ *I share my walks through the park with a selfie on social media, along with the hashtag #parcseraing and/or the tag "A Place to Be-Come" on Facebook or Instagram.*
- ❑ *I agree to be contacted in the coming weeks for a short survey to share my opinion about the Marêts and/or Morchamps parks.*

If you agree to be contacted for the survey, please provide your phone number or email address.

Figure 7. Structure of the communication campaign. BC = binding communication.

Figure 8. English version poster from the binding communication campaign.

1) Message aiming to activate a sense of PO. 2a) Picture aiming to activate the social norm (descriptive norm). 2b) Message aiming to activate the social norm (descriptive norm). 2c) Message aiming to activate the social norm (injunctive norm). 3) QR code aiming to engage people (part of the binding communication).

▪ **Data collection for the indicators from the evaluation phase**

All indicators, both attendance and other evaluation indicators, were collected from mid-April 2022 onwards. A summary table of all collected indicators and their evolution can be found at the end of this chapter (Tab.11, pp. 183-186).

Counted UGS attendance. The data were collected from April 16 to May 31, 2022, by counting the number of entrances and exits of the target UGS using the counting posts placed at the UGS' entrances.

Collected waste in the UGS. For the evaluation phase, waste collection and weighing were taken over by the workers hired for the project and responsible for the UGSs in the project area, which allowed more frequent measurements than for the diagnostic phase. These measures were taken each Monday, from Monday 17 January 2022 to Monday 23 May 2022. Such as during the first year of the project, the waste was collected in bags, which were weighed using a baggage scale.

Psychosocial indicators. The data for the psychosocial indicators were collected per questionnaire. Again, in accordance with the application form of the project, a total sample of 250 participants was targeted. Data collection (N = 257) was conducted three days after the start of the communication campaign, i.e. between April 18 and May 31, 2022. As for the diagnostic phase, data collection was conducted by surveying residents through a door-to-door approach in the project area, the presence at the local market and in various local associations, or by approaching residents in public places. All field data (N = 237) were collected by students during their projects, internships and/or master theses, trained in the same way as for the diagnostic phase. Even if not forced this time by the sanitary situation, an online questionnaire (N = 20) was again created and disseminated through various communication channels (social media, the official website of the city of Seraing, and the transfer by email to local associations). The online questionnaire was accessible from April 18 to May 31, 2022.

The procedure and the measurements were identical to those of the questionnaire of the diagnostic phase (Tab.6, p. 170). Only a measurement of the level of PO participants' experience towards the UGS was added. As for the diagnostic questionnaire, measurements of other variables were included, but these were part of the student's internship or master theses and are therefore not relevant to the present work. The complete questionnaire is available on osf.

Table 6. Overview of the measurement tools used in the evaluation questionnaire.

Variable	Description
Distance	See description Chap. 2, pp. 104-105
Reasons for attendance	See description Chap. 2, pp. 104-105
Attachment	See description Chap. 2, pp. 104-105 The scale's reliability - Marêts: $\omega = .83$; Morchamps: $\omega = .80$
Place appraisal	See description Chap. 2, pp. 104-105 The scale's reliability - Marêts: $\omega = .79$; Morch.: $\omega = .79$
Safety perception	See description Chap. 2, pp. 104-105 The scale's reliability - Marêts: $\omega = .87$; Morchamps: $\omega = .88$
Familiarity	See description Chap. 2, pp. 104-105
Psychological Ownership	See description from the PO scale in Box 3, pp. 123-150 The scale's reliability - Marêts: $\omega = .92$; Morchamps: $\omega = .93$

The data collected on the field and the data collected online were combined into a single data file for analysis, resulting in a total sample of 257 participants (aged between 16 and 87 years, $M_{age} = 38.52$, $SD_{age} = 17.89$, 122 females). The participants mostly lived in Seraing (N = 210). Participants not living in Seraing (N = 30) either lived there in the past or attended the city for other reasons (e.g., professional reasons, family reasons...). These people lived in cities close to Seraing (e.g. Liège, Flémalle, Neupré, Nandrin...). Of the people living in Seraing, 126 lived in the project area, and 84 in the vicinity of this area. It is to be noted, that 17 participants did not want to share their residence address, nor the name of the street they were living but stated orally living in Seraing. It was however not possible to determine if they lived or not within the project area. These participants are not included in the analyses. For an overview of participants' characteristics, see Table 7.

Table 7. Characteristics of participants from the evaluation phase.

Participants living in Seraing (N = 210)		Participants not living in Seraing (N = 30)	
Characteristics	**M ± SD or n (%)**	**Characteristics**	**M ± SD or n (%)**
Age (year)	38.98 ± 18.08	Age (year)	33.60 ± 16.22
Gender (female)	102 (48.57)	Gender (female)	12 (40.00)
Nationality		Nationality	
Belgian	157 (74.76)	Belgian	25 (83.33)
Not Belgian	49 (23.33)	Not Belgian	5 (16.67)
Double nationality	2 (0.95)	Double nationality	0 (0.00)
Job		Job	
Student	53 (25.24)	Student	11 (36.67)
(Self-)employed	81 (38.57)	(Self-)employed	12 (40.00)
Unemployed	27 (12.86)	Unemployed	2 (6.67)
Unable to work	7 (3.33)	Unable to work	0 (0.00)
Retired	29 (13.81)	Retired	1 (3.33)
Other	9 (4.29)	Other	4 (13.33)
Degree		Degree	
No CESS	79 (37.62)	No CESS	10 (33.33)
CESS profess.	51 (24.29)	CESS profess.	5 (16.67)
CESS for HE	35 (16.67)	CESS for HE	6 (20)
HE	32 (15.24)	HE	9 (30)
Other	9 (4.29)	Other	0 (0.00)
Years lived in Seraing	25.63 ± 19.10	.	.

No CESS = no certificate of higher secondary education; CESS for HE = certificate of higher secondary education preparing to college or university; CESS profess. = certificate of higher secondary education preparing for technical or manual professions; HE = graduate or undergraduate. Note: 17 participants did not share their residence address and were not included in this table.

3.2.4 Data analyses and evolution of the indicators

Although initially designed to draw causal conclusions concerning the impact of psychosocial intervention on people's UGS attendance behavior, various limits only allow for the analysis of correlational relationships.

First of all, as already mentioned, in order to be able to assess the evolution of the attendance rate, as well as of the other psychosocial indicators, the context of data collection during the diagnostic phase and the context of data collection during the evolution phase have to be similar. The outbreak of the COVID-19 pandemic led to

many restrictive measures and disrupted people's daily activity patterns. In a context where quarantine and social distancing measures became the new norm, with limited or no access to indoor public places and leisure facilities, UGSs were one of the few recreational places that remained mostly accessible. Indeed, even if restriction measures for UGSs were implemented in some countries during contamination peaks, they remained mostly accessible in Belgium, during the majority of the pandemic. This can lead to the fair assumption that these spaces became all the more important and popular during the pandemic. However, some papers report an increase in UGS attendance rates during COVID-19 peaks (e.g. Venter et al., 2020), while others report a decrease in UGS attendance rates (e.g. Khalilnezhad et al., 2021). Other papers qualify this, indicating that while some users increased their green space attendance (about 36% of the 1,002 surveyed people) or were even attending the place for the first time (about 45%), others reduced their attendance rate (about 26%; Berdejo-Espinola et al., 2021). One possible explanation relies on the fact that outdoor trips during the COVID-19 peaks were limited to the immediate residential neighborhood. Since not all neighborhood UGSs are equally attractive, it is likely that site characteristics have influenced attendance rates. In a study conducted in Australia, the authors reported, indeed, that the increase or decrease in attendance behaviors was not only related to individual characteristics (e.g., gender, age), but also to site-specific characteristics (e.g., accessibility, presence of blue spaces, vegetation characteristics; Berdejo-Espinola et al., 2022). This observation can also be linked to the results obtained by Khalilnezhad and colleagues (2021), where a decrease in the use of public UGSs was observed, but an increase in the use of private green spaces, suggesting that nature exposure needs during the pandemic were influenced by different factors.

Based on the results of the diagnostic phase, we know that these spaces were not perceived as very attractive by residents. Besides, Seraing is bordered by a relatively large peri-urban forest, which does not make the UGSs of the project area the only accessible natural space for this population. This suggests rather a decrease in UGS attendance rate during lockdowns. However, on the other hand, it takes an easy 30 minutes to walk from the center of the project area to this peri-urban forest, with a relatively large difference in elevation. This makes the forest less accessible than the UGSs, especially for people with reduced mobility. Moreover, it is not impossible that the COVID-19 restrictive measures lead to a decrease in un-civic behaviors within the UGSs, making them suddenly more appealing and popular to the other citizens during this short period. However, data about the attendance rate of the UGSs of the project area were not collected during the COVID-19 peaks, not allowing us to

determine if the pandemic lead to an increase, decrease, or no change at all, in the attendance rate of the UGSs. Another important point, if there have been changes in peoples' attendance pattern, is to determine if it has been maintained over time, after the COVID-19 pandemic and the associated restrictions. Indeed, it is quite possible that once the usual pace of life gets back, this attendance pattern will return to its pre-pandemic level, caught up by the rhythm and the daily obligations that were put on stand-by during these periods of (semi-)lockdowns. However, since the lockdown periods lasted for some time, it is not impossible that new habits have been established, increasing the chances that these behaviors will be maintained over time, whether or not these are attendance or non-attendance behaviors. In any case, there is a lack of data to draw conclusions, but it would probably be unwise to assume that de pre-COVID situation is comparable to the post-COVID situation.

Another reason that prevents drawing causal conclusions is the number of interventions carried out in the project area, whether by other project partners or not. Many of these interventions targeted the UGSs. For an overview of these interventions, see Appendix 1. Many interventions aimed at improving the UGSs, which more than likely contributed to a change of the appraisal of these spaces. In addition, some of these interventions involved citizens and allowed them to interact with these spaces. For example, nature workshops and discovery walks were offered by the main partner of WP4 (Natagora), including a workshop involving citizens in the restoration of vandalized facilities in the target UGS. It is not impossible that this also increased the sense of PO experienced towards these spaces, given that PO is linked to a sense of control. The construction of sports facilities initiated by the city administration in the two targeted UGSs probably also impact how the UGSs are perceived. It is therefore not possible to know whether the observed changes are due to the psychosocial intervention or to other actions in or about the UGSs. Finally, as already highlighted, it is always interesting to activate several psychosocial levers in action research, since the main objective is to have an impact on the field. Obviously, this makes it impossible to isolate the impact of each of these levers.

The manipulation used in the experimental study did not show the expected effect (refer to Box 3, pp. 123-150). For this reason, another manipulation of the sense of PO was selected for the field intervention (i.e. written message using the "YOUR park" formulation), and a manipulation check was included. The Mann-Whitney U test shows no significant difference in the sense of PO between the group reporting awareness of the communication campaign (N = 77) and the group reporting no awareness of the communication campaign (N = 171; Marêts Park: $U_{mann-whitney}$ = 3386.5, p = .55; Morchamps Park: $U_{mann-whitney}$ = 1051, p = .06). This does not mean

that the communication campaign had no impact, but it is not possible to determine, if effect there is, if this is partially due to an increase in the sense of PO or not.

- **Data analyses**

Comparative analyses between 2020 and 2022, were carried out to provide a basis for discussion regarding the evolution (or lack thereof) of the indicators, even if it is not possible to determine the factors affecting the evolution if evolution there is, and therefore to test causal relationships. These results allow, however, discussing the possible overall impact of the project APTB. For the analysis of objective attendance at Marêts Park (as a reminder, Morchamps Park did not benefit from objective counts do to vandalism issues), the situation is more nuanced, given that the pre- and post-manipulation situations are very similar. However, it is not possible to identify the people who visited the UGS and therefore to determine whether or not they were aware of the communication campaign. Only correlational relationships will be tested therefore as well. Analyses were conducted on Jamovi (version 2.2.5). As a reminder, each participant had the opportunity to evaluate one or both target UGSs. Marêts Park and Morchamps Park were rated respectively 188 and 115 times.

A summary table of all indicators and their evolution can be found at the end of this chapter (Tab.11, pp. 183-186). As already mentioned, not all the indicators serve the main objective of the psychosocial intervention, which is to increase UGS attendance, while taking into account un-civic behaviors and the feeling of safety. These indicators do, however, provide an overview of the evolution on the territory within these three years and enrich the discussion..

- *Observable indicators*

In contrast to the other indicators, the objective attendance of UGS was measured only in the last year of the project, over two time periods (for the reasons see section 3.2.2, pp. 102-103). Pre-manipulation measurements (i.e. before the communication campaign) were therefore obtained from September 1 to September 30, 2021, and from April 1 to April 15, 2022 (N = 45 days). Post-manipulation measurements (i.e. after the implementation of the communication campaign) were obtained from April 16 to May 31, 2022 (N = 46 days). As a reminder, these periods were selected because they were similar from a meteorological point of view when based on data from previous years. The period from April 4 to April 15 is a period of school vacations in Belgium (spring break) and is potentially conducive to an increase in the

use of UGSs. To respect the similarity of the weather conditions and the deadlines imposed by the project, it was not possible to avoid this period. However, since these vacations are in the pre-manipulation period, they are more likely to increase the risk of false negatives and not false positives. In order to control for the impact of weather conditions on objective attendance, the data were analyzed using a regression model (Tab.8), even if only correlational interpretations can be made.

Table 8. Multiple linear regression assessing the relationship between the communication condition (1 = after communication campaign / -1 = before communication campaign) and the attendance rate of Marêts Park, while controlling for weather conditions.

	b	SE	95 % IC		df	t	p
			Lower	Upper			
(Intercept)	520.535	18.413	483.938	557.133	87	28.270	<.001
BC condition	274.547	36.962	201.082	348.012	87	7.428	<.001
Temperature	5.926	3.933	-1.890	13.743	87	1.507	.135
Precipitation rate	-25.026	10.494	-45.168	-0.193	87	-2.385	.019

BC condition = binding communication condition (coded: before communication campaign = -1 and after communication campaign = 1); temperature = mean temperature of the day; precipitation rate = precipitation of the day in mm.

There is a significant difference between the pre-communication and post-communication conditions while controlling for weather conditions (Fig.8). Post-communication UGS attendance rate is significantly higher (M_{2022} = 662.20, SD_{2022} = 157.37) than pre-communication UGS attendance rate (M_{2020} = 378.78, SD_{2020} = 204.71).
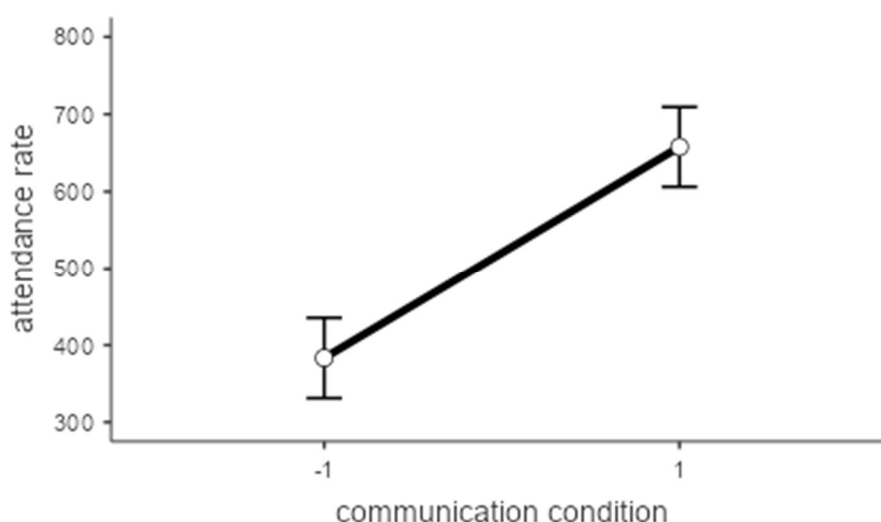
Figure 9. Graphic of the attendance rate of Marêts Park as function of awareness (coded 1) or lack of awareness (coded -1) of the communication campaign, while controlling for weather conditions.

The evolution of the amount of waste collected in the UGS between the first year of the project (2020) and the last year of the project (2022) was analyzed through non-parametric one-way ANOVA. Results for the Marêts Park show no significant difference between the first year of the project and the last year of the project for the total amount of collected waste (χ^2 = 3.162, df = 1, p = .075, ε^2 = .126). Results for Morchamps Park show a significant difference between the first year of the project and the last year of the project for the total amount of collected waste self-reported attendance rate (χ^2 = 14.609, df = 1, p = <.001, ε^2 = .696). The amount of waste collected in the first year of the project is significantly higher than in the last year of the project (M_{2020} = 431.13, SD_{2020} = 100.91; M_{2022} = 16.05, SD_{2022} = 35.01).

- ▪ *Psychosocial indicators*

The evolution of the psychosocial indicators between the first year of the project (2020) and the last year of the project (2022) was analyzed through non-parametric one-way ANOVA, given that none of the variables were normally distributed. Statistics are reported in Table 9. Results for Marêts Park show a significant difference between the first year of the project and the last year of the project for the self-reported attendance rate (M_{2020} = 43.20; M_{2022} = 82.39), the beauty perception used as proxy for positive/negative place appraisal (M_{2020} = 3.85; M_{2022} = 4.57), and the safety perception (M_{2020} = 3.39; M_{2022} = 4.26) of the place. Results for

176

Morchamps Park show a significant difference between the first year of the project and the last year of the project for the self-reported attendance rate (M_{2020} = 29.81; M_{2022} = 44.68), the familiarity experienced towards the place (M_{2020} = 2.04; M_{2022} = 2.82), the beauty perception (M_{2020} = 3.39; M_{2022} = 4.28), and safety perception (M_{2020} = 3.09; M_{2022} = 4.10) of the place.

Table 9. Non-parametric one-way ANOVA comparing the level of the psychosocial indicators between 2020 and 2022.

Marêts Park				
Variables	**χ²**	**df**	**p**	**ε²**
Self-reported attendance	16.259	1	<.001	.052
Familiarity	0.461	1	0.497	.002
Attachment	0.090	1	0.764	.000
Beauty	11.424	1	<.001	.034
Safety perception	12.985	1	<.001	.034
Morchamps Park				
Variables	**χ²**	**df**	**p**	**ε²**
Self-reported attendance	8.008	1	.005	.038
Familiarity	12.395	1	<.001	.059
Attachment	0.479	1	.489	.002
Beauty	15.205	1	<.001	.068
Safety perception	11.932	1	<.001	.060

Although the use of the UGS as a shortcut remains the main reason for attendance, we can nevertheless observe a slight decrease in this percentage, in favor of other activities (e.g. walking one's dog, using the place with children, meet people; Tab.10).

Table 10. First reason for UGS attendance, split by data collection year and target UGS.

Attendance reasons	Marêts Park (N = 188)		Morchamps Park (N = 115)	
	N (%) 2020	**N (%) 2022**	**N (%) 2020**	**N (%) 2022**
I use the park as a shortcut	27 (20.61)	32 (17.06)	31 (31.31)	21 (18.26)
I use the park to walk my pet	13 (9.92)	28 (14.89)	7 (7.10)	13 (11.30)
The park is a place to meet people	8 (6.11)	18 (9.57)	5 (5.05)	22 (19.13)
I go to the park to the play sports	8 (6.11)	19 (10.11)	3 (3.03)	9 (7.83)
I use the park to have picnic	1 (0.76)	12 (6.38)	3 (3.03)	0 (0.00)
I go to the park with (my) children	14 (10.69)	27 (14.36)	14 (14.14)	20 (17.39)
I go to the park to relax	10 (7.63)	18 (9.57)	3 (3.03)	9 (7.83)
I use the park for work	10 (7.63)	16 (8.51)	8 (8.08)	11 (9.57)
Other reasons	7 (5.34)	11 (5.85)	5 (5.05)	7 (6.09)
Missing data	33 (25.19)	7 (3.72)	16 (16.16)	3 (2.61)

3.3 Evaluation phase

3.3.1 Discussion of the results of the field intervention

The methodology used and the various field constraints limit the interpretation of the results and their generalization. However, it is important to distinguish the subjective measure of the dependent variable (self-reported attendance) from the objective measure of the dependent variable (observed attendance).

The data collection year for the diagnostic (2020) and the data collection year for the evaluation (2022) cannot be considered similar and therefore do not allow conclusions to be drawn regarding the impact of the psychosocial intervention on the self-reported attendance measure, nor on the other psychosocial indicators. The observed changes are probably the result of the interaction of broader changes (e.g., the pandemic) and the many interventions conducted in the project area between 2020 and 2022.

The evolution of the indicators has mostly followed the predictions that were made at the beginning of the project. There has been an improvement in all harvested indicators, although not always statistically significant. A statistically significant improvement can be found in how pleasant and how safe the two UGSs are perceived to be. For Morchamps Park, a significant difference can also be found in the weight of trash collected in the park (used as a proxy for civic behavior) and in the sense of familiarity experienced towards it. Even more interesting for the purpose of the WP5, there was a significant difference for both UGSs in self-reported attendance, with an almost 90 % increase in self-reported attendance for Marêts Park and an increase of over 50 % for Morchamps Park. Although it is not possible to determine what allowed the positive evolution of these different indicators, various assumptions can be made.

Significant and regular maintenance of the UGSs has been done during the whole project. This was done either by regular cleaning by the city staff or, later, by almost daily cleaning by the workers hired for the project. In addition to this, many improvements were made in the UGS (plantings, vegetal constructions, maintenance of the vegetation...). It is reasonable to believe that these interventions contributed to the improvement of the perception of the UGS.

This may also explain the improvement in the feeling of safety. The regular UGS attendance by the park workers provides a reassuring presence (visible clothing in the city's colors, but also a feeling of familiarity with these daily present workers). In addition, the park workers may be seen as so-called "place managers", to whom the

city has delegated part of the UGS management function and who therefore participate in "guarding" these places. This relates to Jacobs' concept of "eyes on the street", and the idea that urban areas are safer when allowing street watching (Jacobs, 1961). In a book briefly discussing place management theory to handle crime, Eck and colleagues state that, although many later research using this concept of "eyes on the street" assumed that these eyes belong to residents, it would be more accurate to assume that Jacobs was actually referring to what the authors call "place managers" (Eck et al., 2023). According to these authors, place managers are people who own a place or to whom the owner has delegated authority to "manage" the place, and who have an incentive to "guard" this place. In this project, the park workers have been hired solely to manage the UGS. This way, the city administration sort of delegated part of the management power to them. Furthermore, for these workers, the quality of these spaces and inhabitants' perception of their maintenance was probably the best evidence of their investment and their professional integration, and therefore also a potential "calling card" for future jobs. The incentive to not only restrict themselves to the tasks they were paid for (i.e. maintenance of the UGS), but also to keep an overall watch over these spaces and report on the various incidents that took place there (i.e. guardianship) seems therefore obvious. Of course, these park workers cannot make the UGSs safe places on their own. In fact, although the evolution of the indicators is encouraging, incivilities and safety issues within these places cannot be considered as solved. We will come back to this aspect in the monitoring phase (pp. 192-199).

For Morchamps Park, there was also a significant improvement in the weight of litter pick-ups and in the sense of familiarity. At the time of the data collection of the diagnostic phase, results showed that Morchamps Park was much less known than Marêts Park, probably partly due to the fact that this space is smaller and less visible from the street. The numerous interventions and communication campaigns have probably contributed to people (re)discovering this space and led people to attend it through the nature workshops and guided walks organized by Natagora, thus increasing the sense of familiarity. Regarding the waste problem, although it is a generalized concern in the project area, the UGSs, and especially Morchamps Park, are areas strongly affected. Morchamps Park was therefore based on an already higher baseline concerning this issue.

While no conclusion can be drawn with regard to the impact of the psychosocial intervention on self-reported attendance, the situation is not the same and has to be qualified for the objective attendance rate, measured by counting posts at the

entrances to Marêts Park. As a reminder, this measure was not taken in Morchamps Park due to problems of vandalism.

These vandalism behaviors are not uninteresting. It is likely that this space has already been adopted by certain groups, who may feel a high level of PO for the UGS. Although studies suggest an increase in civic behavior in public spaces where individuals feel a strong sense of PO (Kirk & Rifkin, 2022; Peck et al., 2021; Preston & Gelman, 2020; Shu & Peck, 2018; Zhang & Xu, 2019), it is important to remember that one of the mechanisms underlying this relationship is the increase in perceived responsibility that this sense of "mineness" generates (Peck et al., 2021). This perceived responsibility then leads to control behaviors within the place. Maintaining some form of control over the environment can be done through civic behaviors, but probably also through un-civic behaviors like vandalism, if it is considered that the new developments in the place are not desired or jeopardize this perceived control. The various interventions and the setting up of the counting posts were probably perceived as a taking of control by people outside the group(s) who already felt like possessing the site. In addition, when the counting posts were set up, the mistake was made of not communicating clearly about the purpose of these pickets. The numerous exchanges that citizens had on social networks about these counting posts showed that they have sometimes been mistaken for surveillance cameras, which is obviously very intrusive towards people if they consider this place to be theirs. Following this observation, small signs were hung on the remaining counting posts in Marêts Park, to explain the objective of these pickets and to assure that anonymity was well and truly preserved.

To return to the discussion about the possible impact of the psychosocial intervention, if the situation in year 1 cannot be compared to the situation in year 2, things are much more nuanced for the comparison between the month of September 2021 and spring 2022, i.e. pre-manipulation and post-manipulation attendance rate counting times. Indeed, no major event like the pandemic is to be noted between the two periods, but also very few interventions in or about the UGS by other partners of the project or at the city level.

Although it is not impossible that some interventions have been forgotten, the only interventions listed, in or about Marêts Park, between September 1, 2021 and mid-May 2022 are:

1) Two instructional videos on differentiated park management;
2) The workshops proposed by Natagora (one filmed in September 2021 and another one filmed in April/May 2022, both released on social media);
3) Two guided walks in April 2022 (April 19 and 26, 2022);
4) The resumption of sports field construction in both parks.

The improvements made in WP4 were mainly done in 2021-2022 but were ongoing throughout the whole project time and should therefore not impact the results.

The impact of the instructional videos can probably be considered null since one was shot and released during the pre-manipulation collection period (September) and another during the post-manipulation collection period (April/May).

For the guided walks organized by Natagora, the number of participants was relatively low (from 1 to 7 participants for walks where the number of participants are provided). Given the low number of participants, the impact should be limited.

Finally, regarding the construction work done in the UGS, it can also fairly be assumed that the impact is probably limited. It started in 2020 and was continuously halfway running or on standby, until a break in July 2022 and a final restart in August 2022. Although not continuous, it can be assumed that this work had an impact on both the pre-manipulation and post-manipulation attendance rate counting.

In summary, similar pre- and post-manipulation can be considered for the counting of the attendance rate. As mentioned, it is not possible to isolate the impact of the different psychosocial levers activated (PO, social norm and commitment), nor to consider that the manipulation of the feeling of PO has worked given the non-significant result for the manipulation check. In general, as it is the case for most studies with a baseline-to-intervention design (e.g. Loschelder et al., 2019), real-life conditions can hardly allow causal inferences, and should therefore be interpreted with caution. However, given the similar pre- and post-manipulation conditions, it is possible to consider that the communication campaign as a whole may be related to the attendance rate in Marêts Park.

3.4 Summary

The intervention was designed based on the results of the diagnostic survey, as well as on scientific literature and exchanges with field actors.

PA is one of the most studied attitudinal factors in place attendance research, and was significantly related to self-reported UGS attendance among participants in the diagnostic survey. However, this variable lacks solid theoretical and methodological foundations and seems inappropriate in field interventions, given the cost in time and/or resources it represents to increase individuals' emotional attachment towards a place.

Therefore, the intervention was mainly built on another attitudinal factor, the feeling of PO, i.e. the subjective feeling of owning a tangible or intangible object, place, or idea (Merrill, 1998; Snare, 1972). An increase in PO was expected to lead to an increase in UGS attendance, mainly due to the increased need for control, as well as an increase in stewardship behaviors and, in the end, an increase in safety and beauty perception within the places.

To "nourish" the results from the field intervention and enhance the quality of their interpretation, an experimental study was added to the process. This study examined the impact of PO on UGS attendance intention and attendance behavior while controlling for PA. The manipulation used in this study did not produce the expected results. Therefore, the "natural sense" of PO was used for the analyses. An increase in PO was significantly and positively related to both intentional and behavioral loyalty.

For the field intervention, it was necessary to search for a more efficient way to improve residents' sense of PO. However, interventions where the main objective is to have an impact on the field should be more effective if including several psychosocial incentives, given that behaviors are always multifactorial. The intervention was therefore also based on two other psychosocial incentives: social norm and commitment through binding communication.

The communication campaign was conducted during the third year of the project, and intended to increase residents' UGS attendance. Due to various field constraints, no conclusions regarding the impact of the psychosocial intervention on self-reported attendance can be drawn. However, the situation is not the same, and to be qualified for the objective attendance rate for Marêts Park, similar pre- and post-manipulations should be considered. If it is not possible to isolate the impact of the different psychosocial levers activated, nor to consider that the manipulation of the feeling of PO has worked, it is probably fair to consider that the communication campaign as a whole may be related to the attendance rate in Marêts Park.

Name of the indicator	Measurement	Measurement period 1	Measurement period 2	Baseline (Measurement period 1)	Evolution (Measurement period 2)	Target value	Result
Collected waste in UGS	Weight of waste collected in the target UGS, using a baggage scale (kg).	Average of the first Monday of the month (Jan., Feb. and March 2020) MARETS: N = 3 MORCH.: N = 3	Average of the first Mondays of the month (Jan., Feb. and March 2022) MARETS: N = 3 MORCH.: N = 3	Park MARETS: M = 249.00, SD = 64.86 Park MORCH.: M = 936.67, SD = 592.48	Park MARETS: M = 77.73, SD = 43.49 Park MORCH.: M = 23.63, SD = 16.81	15% decrease	Park MARETS: 68% decrease Park MORCH.: 97% decrease
		Average of all 2020 weighing MARETS: N = 8 MORCH.: N = 8	Average of all 2022 weighing MARETS: N = 18 MORCH.: N = 14	Park MARETS: M = 143.12, SD = 100.91 Park MORCH.: M = 431.13, SD = 526.36	Park MARETS: M = 71.99, SD = 35.01 Park MORCH.: M = 16.05, SD = 11.48	15% decrease	Park MARETS: 49% decrease Park MORCH.: 96% decrease

UGS attendance	Number of park entries and exits per day using digital thermal camera counters installed at park entrances.	Entries/exits from Sept. 1 to Sept. 30 2021 and from April 1 to April 15, 2022, recorded per quarter-hour and aggregated into a measure per day MARET: N = 45 MORCH.: N.A.	Entries/exits from April 15 to May 31, 2022, recorded per quarter-hour and aggregated into a measure per day MARET: N = 46 MORCH.: N.A.	Park MARETS: $M = 378.78, SD = 204.71$ Park MORCH.: N.A.	Park MARETS: $M = 662.20, SD = 157.37$ Park MORCH.: N.A.	20% increase	Park MARETS: > 100% increase Park MORCH.: N.A.
UGS attendance perception	Self-reported measurement asking people to estimate their average park use	Data collection from February 2020 to mid-March 2020 MARET: N = 128 MORCH.: N = 98	Data collection from mid-April 2022 until end of May 2022 MARET: N = 188 MORCH.: N = 119	Park MARETS: $M = 43.20, SD = 105.74$ Park MORCH.: $M = 29.20, SD = 81.53$	Park MARETS: $M = 81.95, SD = 166.06$ Park MORCH.: $M = 45.50, SD = 81.95$	20% increase	Park MARETS: 89% increase Park MORCH.: 55% increase

Inhabitants' attachment to UGS	Average of three 7-point Likert scales asking participants to rate their attachment towards the target UGS from 1 (not at all) to 7 (high)	Data collection from February 2020 to mid-March 2020 MARET: N = 102 MORCH.: N = 82	Data collection from mid-April 2022 until end of May 2022 MARET: N = 184 MORCH.: N = 115	Park MARETS: *M* = 3.03, *SD* = 1.83 Park MORCH.: *M* = 2.71, *SD* = 1.76	Park MARETS: *M* = 3.20, *SD* = 2.03 Park MORCH.: *M* = 3.02, *SD* = 1.96	4 = a little better	Park MARETS: 0.17 increase Park MORCH.: 0.31 increase
Inhabitants' appraisal of UGS	Average of three bipolar scales asking participants to rate the perceived beauty of the target UGS from -3 (unpleasant; ugly; inhospitable) to +3 (pleasant; beautiful; welcoming)	Data collection from February 2020 to mid-March 2020 MARET: N = 131 MORCH.: N = 99	Data collection from mid-April 2022 until end of May 2022 MARET: N = 205 MORCH.: N = 127	Park MARETS: *M* = 3.85, *SD* = 1.63 Park MORCH.: *M* = 3.39, *SD* = 1.40	Park MARETS: *M* = 4.57, *SD* = 1.80 Park MORCH.: *M* = 4.28, *SD* = 1.65	5 = much better	Park MARETS: 0.72 increase Park MORCH.: 0.89 decrease

Inhabitants' safety perception in UGS	Average of three 7-point Likert scales asking participants to rate the perceived safety of the target UGS from 1 (unsafe) to 7 (safe)	Data collection from February 2020 to mid-March 2020 MARET: N = 105 MORCH.: N = 85	Data collection from mid-April 2022 until end of May 2022 MARET: N = 184 MORCH.: N = 115	Park MARETS: M = 3.39, SD = 1.76 Park MORCH.: M = 3.09 SD = 4.10	Park MARETS: M = 4.26, SD = 1.86 Park MORCH.: M = 4.10, SD = 1.96	4 = a little better	Park MARETS: 0.87 increase Park MORCH.: 1.09 increase
Inhabitants' familiarity towards the UGS	7-point Likert scale asking participants to indicate how well they feel they know the target park, from 1 (not at all) to 7 (perfectly)	Data collection from February 2020 to mid-March 2020 MARET: N = 125 MORCH.: N = 94	Data collection from mid-April 2022 until end of May 2022 MARET: N = 188 MORCH.: N = 114	Park MARETS: M = 4.00, SD = 2.63 Park MORCH.: M = 4.07, SD = 2.49	Park MARETS: M = 5.39, SD = 1.69 Park MORCH.: M = 5.25, SD = 1.90	N.A. Added after editing the application form.	Park MARETS: 1.39 increase Park MORCH.: 1.18 increase

Table 11. Summary table of the measurement method and time of all included indicators, and comparison of the first data collection phase to their level of the second data collection phase. Note : green square = statistically significant difference between first data collection phase and second data collection phase; red square = no statistically significant difference between first data collection phase and second data collection phase; blue square = statistically significance between first data collection phase and second data collection phase can not be tested.

CHAPTER 4: MONITORING PHASE

In this last phase, decisions about the next steps are taken, based on inferences generated from the evaluation of the implemented psychosocial intervention, as well as on the scientific literature. As a reminder, action research methodology has to be seen as cyclical, and is characterized by regular to-ing and fro-ing and constant interactions between these different phases (Ivankova & Wingo, 2018; Lewin, 1948). The present document rather than presenting the end and conclusion of *Work Package 5 – Citizenship and soft skills development* (WP5), should therefore be seen as the end of a first "action research loop", enabling future loops to be initiated based on new knowledge of this constantly evolving field.

The next steps can involve continuing in the same direction as the intervention we carried out (i.e. the intervention built on the main incentive of psychological ownership; PO). This means including further evaluation and refinement of the intervention and enhancing scientific validity through more experimental studies testing the link between PO and UGS attendance. Alternatively, the decisions may involve delving deeper into the problem by returning to the reconnaissance phase and rethinking the intervention plan accordingly.

Before discussing the next steps, it seemed essential to review briefly the most important findings of the two studies and the narrative review conducted in the context of this work (refer to Boxes 1 to 3), as well as the field intervention. Doing so allows us to combine the results of these three papers with the outcomes of the field intervention to provide an as comprehensive as possible reading of the work carried out within this project, and to make the most appropriate recommendations to the city of Seraing.

4.1 Main research questions and results summary

This work is characterized by many different research questions, due to the action research methodology. As a reminder, the main objective of the WP5 was to improve residents' relationship to their local environment. Based on scientific literature showing the potential impact UGSs can have on health and social justice issues, it was determined that increasing residents' UGS attendance is a coherent translation of this general main objective within a project aiming to fight urban poverty. However, beyond the actual attendance of UGSs, it is important to keep in mind the implicit underlying idea that these spaces need to contribute as much as possible to

the quality of life in the project area. These objectives underpin not only the field intervention but also the narrative review and the two studies included at some key stages of the process.

4.1.1 Paper 1: Relationships between green space attendance, perceived crowdedness, perceived beauty and prosocial behavior in time of health crisis

The idea to consider UGSs as a quality of life and resilience infrastructure was the underlying objective of study number 1. The paper in Box 1 (pp. 19-50) presents a study conducted during the COVID-19 pandemic, aiming to help to understand which characteristics possibly contribute to make UGSs efficient resilience infrastructures, by looking at the relationship between how the most attended UGSs are perceived and individuals prosocial behaviors. Prosocial behaviors contribute to the creation and maintenance of an individual's social capital, a good predictor of health, and act like a buffer on socioeconomic health inequalities (see p.17).

Research question:

- How do UGS attendance, perceived beauty and perceived crowdedness of the UGS relate to social orientation during times of health crisis?

Hypothesis:

- The positive relationship between UGS attendance and prosocial behavior will only appear when the most regularly used UGS is perceived as beautiful and uncrowded.

The results showed a significant relationship between UGS attendance and prosocial behavior, but only when the attendance rate of the most visited UGS was perceived as low. Contrary to the hypothesis, no significant relationship was found between beauty perception, attendance rate, and prosocial behavior.

During the health crisis, UGSs may have served as a place for disconnection and relaxation, contributing to positive moods and enhancing prosociality. This observation aligns with the Self-Categorization Theory (Turner et al., 1987, 1994), which explains that our response to crowds varies based on our psychological proximity to others. Social distancing and the perceived risk of infection may have increased psychological distance, rendering crowded places stressful. Interestingly, the study did not find a significant relationship between the perceived beauty of the most attended UGS and prosocial behavior, contrary to previous research suggesting that beauty perception enhances social connections. Possible reasons for this

discrepancy include the study's cross-sectional design without direct exposure to nature and the potential influence of lower positive feelings during the health crisis (floor effect) mediating the relationship between beauty and prosocial behavior.

Based on these results, which do however not allow for causal conclusions, UGSs may positively relate to public health by fostering caring behaviors and a sense of community during crises. Increasing UGS availability, especially in disadvantaged areas, may significantly contribute to health equity during pandemic recovery.

4.1.2 Paper 2: Perceived safety and urban green space attendance – A narrative review

It is interesting to analyse what might encourage or hinder UGS attendance. The objective of this work being to increase the attendance of the chosen UGS.

Both the scientific literature and our interactions with field actors and residents constantly referred us to the notion of perceived safety. Safety concerns are often cited as being an important barrier to UGS attendance (Jones et al., 2009; Williams et al., 2020), especially in high-poverty neighborhoods (e.g. Cohen et al., 2010, 2016; Han et al., 2018). However, the relationship between UGS' safety and UGS' attendance is far from being unanimously accepted and seems to vary according to the way attendance and safety are conceptualized and measured.

Research questions:

- How do studies investigating the relationship between safety perception and attendance define and characterize UGS?
- What indicators are used to evaluate UGS attendance?
- What indicators are used to assess perceived safety?
- How is the relationship between UGS' safety perception and UGS' attendance rate measured and characterized in the literature on this subject?

This narrative review, based on 16 studies between 2006 and 2020, highlights many conceptual and methodological challenges in this research area. First, the definition and characteristics of the studied UGSs vary greatly, making result generalization difficult. Second, indicators used to assess UGS attendance and safety perception are often poorly defined and reported. Third, results about the perceived safety and attendance rate relationship are very heterogeneous. Studies using subjective measures of attendance show inconsistent results, with sometimes reporting a significant relationship between safety perception and attendance, and sometimes

reporting insignificant results. These results vary depending on the population studied, as well as on the methodology and measurement tools used. Objective measures consistently reported a non-significant relationship between both indicators, although it is important to note that only three studies, all conducted by the same research team, looked at the relationship between objective attendance rate and perceived safety. It is important to note that none of the included studies allows us to test the causality of the relationship.

Results show that the relationship between perceived safety and UGS attendance is far more complex than expected and that it is not yet possible to draw any conclusions regarding this relationship. This review also highlights the complexity associated with topics covered by various disciplines and the non-standardization of conceptualizations of certain notions and the associated measurement indicators.

4.1.3 Paper 3: Psychological ownership to enhance green space loyalty

The relationship between safety perception and UGS attendance being inconclusive, other attitudinal factors, which could potentially play a role in our approach and avoidance behaviors of UGSs were looked at.

PA is one of the most studied attitudinal factors in place attendance research, and was significantly related to self-reported UGS attendance among participants in the diagnostic survey. However, as discussed in Chapter 3, this variable lacks solid theoretical and methodological foundations and seems also inappropriate in field interventions, given the cost in time and/or resources it represents to increase individuals' emotional attachment to a place. Therefore, it was decided to build the intervention on another attitudinal factor, the feeling of PO, i.e. the subjective feeling of owning a tangible or intangible object, place, or idea (Merrill, 1998; Snare, 1972).

Research question:

- Can PO enhance UGS attendance while controlling statistically for PA?

Hypotheses:

- High levels of PO will increase participants' intentional loyalty towards the target GS, and even more so or only in high place-attachment condition.
- High levels of PO will increase participants' behavioral loyalty towards the target GS, and even more so or only in high place-attachment condition.

In the study conducted to examine the impact of PO on UGS attendance intention and attendance behavior, the manipulation used did not produce the expected

results. Therefore, the "natural sense" of PO was used for the analyses (refer to p. 131). Contrary to expectations, the study did not find a significant impact of participants' PA on UGS intentional or behavioral loyalty. However, the sense of PO is significantly related to UGS attendance desire, confidence and evolution. These results can be explained by the need for control, which requires attending the target place. The interaction between PA and PO yielded mixed results, with the impact of PO on intentional loyalty being significant only in low place-attachment condition and the impact on attendance rate being significant only in high place-attachment condition. It is possible that the intention to attend the UGS is the result of the cognitive dissonance that may arise when individuals do not feel emotionally attached to the UGS but still feel that the place belongs to them, leading to the moral obligation to care for it. In response to this dissonance, the individual formulates the intention to visit the place more regularly. However, results suggest that PA individuals experience towards an UGS should probably not be overlooked to move from intention to action.

The study introduces PO as a new variable in place of loyalty research and opens avenues for further investigations. Increasing citizens' sense of PO can be a promising strategy to enhance UGS attendance (and promote civic behavior within the place) if causality could be confirmed.

4.1.4 Field intervention

The intervention was designed taking into account data from the diagnostic survey, insights from scientific literature and input from various field experts, and aimed to increase residents' UGS attendance by increasing residents' feeling of PO towards an UGS. Given that the main objective of the field intervention was a practical impact rather than theoretical knowledge, it was essential to be as impact-oriented as possible. Like any behavior, attendance behavior is the result of the interaction of different factors, each explaining a different share of variance. Consequently, a behavioral intervention should be more effective if it includes several psychosocial incentives. The intervention was thus further bolstered by two other psychosocial incentives: social norms and commitment through binding communication.

Research question:

- Can PO, coupled with other psychosocial incentives, increase individuals' UGS attendance in field interventions?

Hypothesis:

- A psychosocial intervention built on the incentives of PO, social norms and commitment will increase Seresians' UGS attendance.

While it remains impossible to isolate the specific impact of each psychosocial incentive and determine the effectiveness of the PO manipulation, given similar pre- and post-manipulation conditions, it is possible to consider that the communication campaign as a whole may be related to the objective attendance rate recorded by the counting posts in Marêts Park. The results of the counted attendance rate showed a significant difference between pre- and post-intervention conditions while controlling for weather conditions. The results from the field intervention, therefore, concur with the results from the third paper, even if these results are to be taken with caution, given the correlational nature of these analyses.

4.2 Recommendations for future steps

As already mentioned, the present document rather than presenting the end and conclusion of *Work Package 5 – Citizenship and soft skills development* (WP5), should rather be seen as the end of a first "action research loop", enabling future loops to be initiated based on new knowledge of this constantly evolving field.

4.2.1 Theoretical background of the recommendations

The research question posed at the project start was the following one: "*How to increase public UGS attendance by inhabitants of the project area?*" To address this question, a focus was primarily set on attitudinal factors, such as perceived safety, PA, and the feeling of psychological ownership (PO). Particular attention has been paid to this last factor, based on the reasons developed earlier (refer to pp. 119-120).

As a reminder, PO is the subjective feeling of owning a tangible or intangible object, place, or idea (Merrill, 1998; Snare, 1972). PO differs from formal ownership, which is a legal claim of property protected by law (Merrill, 1998; Snare, 1972). This explains why individuals can develop a sense of ownership for public goods like public UGSs (Peck et al., 2021). PO can emerge through different routes, i.e. having an intimate relationship with the place, investing one's time, effort, or energy in it, or having a sense of control over the place (Peck & Luangrath, 2023; Pierce et al., 2001; Shu & Peck, 2018).

Results from our experimental study (refer to Box 3, pp. 123-150), as well as from our field intervention (pp. 151-154), even if not allowing to draw causal conclusions, suggest however that the sense of PO could be linked to the attendance of the target place. Of course, this needs to be further investigated, by including experimental studies testing the causality of this relationship as well. However, it makes sense to hypothesize that PO increases intentional and behavioral loyalty towards a public place, given the so-called gatekeeper right, i.e. the increased need for control.

Building interventions based on the idea of favoring residents' feeling of PO towards UGSs seems, at first glance, interesting for other reasons as well. As highlighted in Chapter 1, the project area is characterized by a high number of recorded antisocial behaviors and crimes (Ville de Seraing, 2019). Based on discussions with field actors, police data and observations made during these last four years, Morchamps Park and Marêts Park can be considered as so-called hotspots (HS) of antisocial behaviors. Although crime management was not presented as a main objective in the APTB-project, it was difficult to ignore given its importance in the field. This gatekeeper right is therefore of particular interest for the present project.

First, as discussed previously (see point 3.1.2, pp. 119-120), literature seems to support the idea that an increased sense of PO is linked to an increase in civic behavior in public places. Research about the well-known "public-good dilemma" seems to suggest that enhanced PO encourages people to care more for those resources, which enhances stewardship behaviors (Kirk & Rifkin, 2022; Peck et al., 2021; Preston & Gelman, 2020; Shu & Peck, 2018; Zhang & Xu, 2019), probably due to this gatekeeper right (Nijs et al., 2022). Stewardship behaviors and encouraging people to care more for these spaces could be an interesting first step in urban crime management interventions, which would help to avoid two other often used approaches: coercive measures and privatization policies.

It is important to remember that the city administration in Seraing is fully aware of the crime issue in the UGSs and has already implemented some interventions, though they have proven ineffective. If the problem persists, city administrations may be inclined to turn to coercive measures. These often involve restricting access to the crime-affected spaces, which seems to be a cost-effective solution. This approach has been raised in numerous discussions between stakeholders, over the past four years. However, such coercive actions can lead to public health and social justice concerns when they limit access to the spaces in any way, especially in low socioeconomic status (SES) neighborhoods, where most people lack access to private green spaces and are thus entirely dependent on public accessible UGSs (see 2.1.2, pp. 13-17).

Another approach, frequently suggested in common goods issues (though not mentioned, to the best of my knowledge, for the UGSs in the APTB project), is the privatization of the crime-affected spaces. Economic motives and urban neoliberal policies are liable explanations behind the loss of public space in many cities (Leclercq et al., 2020). This trend, which also affects UGSs in a multitude of ways with long-term repercussions (Colding et al., 2020), seems to be occurring in Belgium

as well. As detailed in one of the biennial reports by the "Service to Fight against Poverty, Precariousness and Social Exclusion" (2019), some trends are tending to reduce the number of (available) UGSs in Belgium, thus exacerbating inequalities in access to nature. The privatization of public spaces, including green spaces, is one of these trends (SLPPES, 2019). Transferring management power to a limited few carries the risk of restricted or even prohibited access to remaining UGSs. Similar to risks associated with coercive measures, this raises questions related to public health and social justice. However, besides the economic motives and urban neoliberal policies, private ownership is also often proposed as a solution to the common good issue because of the widely-shared assumption that legal owners of a resource will be more invested in protecting this resource than non-owners. This does not always seem to be true. In one laboratory experiment, participants who were assigned private ownership of limited resource units chose to exploit more of those units for personal benefit at the expense of the collective benefit and indicated feeling less responsible to further the collective's interest, compared to participants without private ownership (van Dijk & Wilke, 1997). More recently, Preston and Gelman (2020) showed in an experimental study that, in most cases, participants with either psychological ownership alone or in combination with legal ownership showed greater support for protecting and not exploiting natural areas such as woods, lakes and gardens, compared to when people were only legal owners or non-owners. These research outcomes suggest that individuals could seek to protect public places they have a psychological connection with, regardless of legal ownership, and might neglect to care for places they legally own, but do not feel connected to.

The second reason why interventions based on PO could sometimes be effective is that the sense of PO manifests itself not only at the personal level but also at the group level in the form of what we call collective PO, i.e. the collective-held feeling that the target of ownership is collectively "ours" (Pierce & Jussila, 2010). Studies seem to confirm that a collective feeling of ownership can emerge regarding public places, such as UGSs (e.g. Nijs et al., 2022). At the individual level, personal feelings of PO arise from interactions between a person and a target, e.g. a specific place (Pierce & Jussila, 2010). Conversely, collective PO depends on person-object, other-object, and person-to-person interactions (Pierce & Jussila, 2010). Specifically, this collective PO requires two or more individuals to engage with the same target, be aware of each other's interactions with that target, and develop a jointly held understanding (i.e. a collectively held single cognitive/emotional framework) that they are the psychological owners of the target (Pierce & Jussila, 2010). Therefore, what differentiates these two concepts is a collective realization of unity and shared possession (Pierce & Jussila, 2010). Other factors can differentiate individual PO and

collective PO. One of them, unsurprisingly, is a social-identity motive that underpins the development of collective PO, which is not necessarily the case for personal feelings of ownership (Pierce & Jussila, 2010). According to the *Self-Categorization Theory,* people have multiple social identities and can understand themselves as a unique individual (personal self) and as a member of a group (group self), which vary in salience depending on context (Turner et al., 1987). Switching from the personal self to a group self implies a shift from personal terms and concerns to collective ones, such as from personal efficacy to collective efficacy, personal responsibility to collective responsibility, personal interests to collective interest, and from personal ownership to collective ownership (Martinović & Verkuyten, 2023; Nijs et al., 2022). While individual psychological ownership enables the individual to enhance and express his or her personal identity, in the case of collective psychological ownership, it is the individual's social identity that is being enhanced and expressed (Pierce & Jussila, 2010). The question that arises is why this collective PO and the associated enhancement and expression of the social identity are so important, and how can it maybe be fostered.

The research question that guided the intervention was to increase the UGS attendance rate. However, when looking back on paper 1 (refer to Box 19-50), results showed a significant relationship between UGS attendance and prosocial behavior, but only when the attendance rate of the most visited UGS was perceived as low. Increasing UGS attendance rates, therefore, seems incompatible with UGS as a place to withdraw from daily urban life and to look for some "me-time", and therefore potentially limits the role these spaces can have as public health infrastructures. However, as posited by the *Self-Categorization Theory* (Turner et al., 1987; Turner et al., 1994), individuals' responses and desire for crowds can vary greatly, sometimes even experienced as very pleasant and even actively sought (Novelli et al., 2013). *Self-Categorization Theory* explains that individuals' response to a crowd will be contingent on their psychological closeness to its members, i.e. whether or not those people are part of the individuals' in-group (Novelli et al., 2013). Conversely, the more individuals within a crowd are perceived as "other", the greater the tendency for people to seek physical distance from them or, if creating such a distance is impossible, the situation may be experienced as stressful or unpleasant (Novelli et al.,2013). The social-identity motive that underpins the development of collective PO, and the associated enhancement and expression of the social identity, may contribute to a less negative perception of "crowds" in the UGS.

However, collective PO will not naturally emerge by bringing people back to the UGSs, given that it needs person-object, other-object, and person-to-person interactions (Pierce & Jussila, 2010). We often assume that UGSs are mainly seen as meeting places, given that they provide opportunities for people to interact with

others in ways that may not occur in other settings (Jennings & Bamkole, 2019). Although these spaces are indeed important meeting places in the urban environment, it is important to highlight that, even if people tend to engage in small talk with other visitors, they generally do not visit UGSs with the intention to meet strangers (Elands et al., 2018). Increasing residents' collective PO for UGSs, therefore, seems difficult to obtain in places that people generally do not visit with the intention to interact with strangers (Elands et al., 2018). If it does not emerge naturally, how can this collective PO for the public UGS be achieved? As a reminder, the feeling of PO at an individual level can emerge through different routes, such as exerting control over the target or investing time, energy, or labor in it (Peck & Luangrath, 2023; Pierce et al., 2001; Shu & Peck, 2018). At the collective level, the emergence of PO needs person-object, other-object, and person-to-person interactions (Pierce & Jussila, 2010), which also reflects this idea of investment and control, but in a collective way. To align with the project's objectives, and in particular, with the objectives from the WP6 - *Planning for and with residents*, I suggest to consider giving residents some real place management power, i.e. involving citizens on a regular basis in decision-making and management processes for these UGSs, through collectives. This could take the form of neighborhood committees, citizens' assemblies, or even groups of local associations - Seraing being extremely well served in this respect. Whatever the form, the aim is to get residents involved, together and on a regular basis, in the control processes of the area. Not only should this allow the emergence of a collective feeling of PO towards these places, but it should also be favorable for more long-lasting effects by fostering a shared social identity.

This reasoning suggests that interventions favoring residents' collective PO towards UGSs could potentially be a double win. Such interventions may increase UGS attendance and civic behaviors within these spaces. This could be an alternative to coercive management practices or privatization schemes, which is worth considering. To avoid that the increased attendance rate is experienced as stressful or unpleasant by residents, collective PO through residents' involvement in collective decision-making and management processes, should be favored of PO at an individual level.

As a reminder, at the outset, it was suggested that this was a "prima facie" solution. As with any real-life field situation, the situation in Seraing is complex. While I think the reasoning I have just put forward is worth considering as part of the solution in many public spaces that experience incivility issues, it could be ineffective, or even counter-productive in the APTB project, and probably in many other high-crime

places as well. This risk is particularly true if certain negative aspects of PO are not taken into account.

While the feeling of PO can lead to numerous positive outcomes, it is also necessary to reflect on its potentially negative side effects. Individuals with a strong sense of PO towards physical places (e.g. UGSs) may be susceptible to perceive infringements and reacting territorially when they infer that another person feels ownership of this same target (Kirk, Peck and Swain, 2018). Infringements are to be understood as an individual's perception that someone, without permission, has attempted to claim, take, or use the target of PO (Brown, 2009). While PO refers to the feelings of possession of a target, territoriality refers to behaviors that center on "constructing, communicating, maintaining, and restoring one's attachment" (Brown et al, 2005, p.579), in order "to communicate to others that something has been claimed so as to discourage access, usage, and infringement attempts" (Brown and Bear, 2015; p.1785). Territoriality, unlike PO which is a mental state, is therefore a social behavioral concept encompassing two main aspects (Brown et al, 2005). First, territoriality is tied to social actions derived from PO within a social context (Brown et al, 2005). It is not about general attachment to objects, but rather specific proprietary attachment that leads to territorial behaviors (Brown et al, 2005). Second, territoriality embodies the social interpretations of actions related to claiming and protecting objects within a particular social setting (Brown et al, 2005). An object becomes a territory only when someone publicly claims and guards it as their own in a social environment (Brown et al, 2005).

There are different types of territoriality behaviors (see Brown, 2009), but reactionary defending behaviors are of particular interest for the present project. When an individual perceives infringements, he experiences the threat of the loss of control over the territory and the psychological benefits associated with that territory (Brown & Robinson, 2011). Reactionary defenses, one of four basic forms of territorial behaviors (Brown et al., 2005), are triggered by anger-inducing events and are employed to communicate negative emotions while obstructing infringement or reclaiming territory (Brown & Robinson 2011). Examples of such behaviors can range from simple negative facial expressions showing disagreement or dislike towards the infringer, to more "actively reclaiming territory" behaviors such as explaining to the infringer that the "territory" is already claimed, involving other individuals to help reclaim this "territory" or even physically confront or exclude the infringer (Brown & Robinson, 2011; Nijs et al., 2022).

The reason why I bring up the territorial behaviors linked to the feeling of PO is that multiple conversations with field workers and field observations have led me to believe that the UGSs within the project area, Morchamps Park in particular, are

spaces for which specific groups already experience a strong sense of PO. These groups seem to claim this ownership through consistent degrading behaviors whenever an outside party intervenes in what they regard as their propriety, i.e. their territory. Park workers report many examples of systematic degradation and intimidation attempts when intervening in Morchamps Park. My own experience aligns with these observations, as evidenced by the (attempt) installation of the counting posts in Morchamps Park. These counting posts were not just damaged but removed using the proper tools in a highly methodical manner, from the very first night after installation. My reading of this field observation is that these UGSs, especially Morchamps Park, already have their informal "owners" who, despite not being the legal owners of these sites, have an informal but real management power within these spaces. In this sense, developing a strong sense of collective PO towards the UGS among another group of individuals runs the risk of creating an escalation of reactionary defending behaviors.

An escalation of territoriality behaviors between the different groups of owners (legal and non-legal, formal and informal) seems to be a legitimate risk to be considered. In two experimental studies manipulating the feeling of collective PO towards UGS, Nijs and colleagues (2022) suggest that collective PO can indeed lead to stewardship behaviors, due to an increased feeling of group responsibility, but can also result in higher territoriality behaviors (e.g. fencing the space or placing signs that the place is only for residents' use). Increasing collective PO in a new additional group of people could lead, in addition to stewardship behaviors, to territoriality behaviors towards the already existing group of informal owners. So, how could an increase in stewardship behaviors be favored, while controlling as much as possible for territoriality behaviors such as reactionary defenses, to prevent these behaviors from escalating?

Some avenues for reflection exist. It seems for example that infringers are held less accountable when they could not have known the target was owned due to a lack of clear marking (Kirk et al., 2018). Informal owners of the UGSs in Seraing clearly state their feeling of ownership by reactionary defending behaviors (e.g. degrading or stealing behaviors) as soon as interventions are carried out in these spaces, making this avenue of reflection not helpful in this case. Another experimental study, conducted by the same research team, also suggests that infringers are held less accountable when they acknowledge ownership before engaging in otherwise threatening behaviors (Kirk et al.,2018). After manipulating participants' feelings of PO towards a target, participants were asked to imagine another individual interacting with this target, either with or without asking for permission (Kirk et al., 2018). Results suggested that relatively high levels of PO set the stage for territoriality responses to these infringements, but that these territoriality responses

are muted when the other individual asked permission to "cross the property line" and thus acknowledged the participants' ownership of the target (Kirk et al., 2018). In addition, individuals will probably report feeling anger from an infringement to the extent that they feel their goals are thwarting, i.e. to the extent that the infringement involves an object that is important to one's goal accomplishment (Brown & Robinson, 2011).

These are obviously just avenues to explore, limited by the fact that the cited studies focused on PO at an individual level, and in the case of projects such as the APTB project, we are working on public spaces and so would rather focus on PO at a collective level. As proposed by Kirk and colleagues (2018) in their discussion part, reactions will maybe be different at the collective level, and it could for example be possible that when ownership is elicited collectively, other co-owners signaling ownership would not be viewed as infringers, but individuals who did not participate initially (e.g. in the collective management and decision-making processes) might be. However, given the similarities between individual and collective PO, I think these avenues are worth exploring for field applications.

Achieving increased collective PO towards UGSs may push this new group of owners to engage in territoriality behaviors as well, which runs the risk of creating an escalation of reactionary defending behaviors. It would be injudicious to implement UGS management interventions without acknowledging the idea that informal owners have already invested these spaces, which probably fulfill functions that are important to them. If interventions based on a sense of collective PO are to be implemented, it is necessary to ask how to avoid an escalation of territorial behaviors. One first step would be to understand the main function that these UGSs fulfill for informal owner groups, to avoid as much as possible an UGS-intervention that would be hindering their goals. Additionally, reflecting on the idea of how to acknowledge their ownership before engaging in interventions, while being aligned with crime management needs, is a path worth to be explored.

In my opinion, successful implementation of collective PO interventions in the project area needs to build on what has already been learned, while delving deeper into the problem by returning to the reconnaissance phase and rethinking the intervention plan accordingly. Therefore, I would suggest going through an entire new action research loop, to avoid implementing potentially ineffective or even counter-productive interventions.

4.2.2 Methodological background of the recommendations

In this study, several methodological choices were made. Before implementing a new action research loop, which is time-consuming and expensive, it seems

important to review which choices could be retained for future projects and which needs improvement. Only two of these choices will be discussed here, as these aspects seem most important for future action research projects.

This entire Ph.D. work, although mainly based on social and environmental psychology (SEP) theories and methods, is throughout tinged by contributions from other disciplines. The monitoring phase is consistent with this approach, and the decision was taken to stick with this multidisciplinary reading and occasionally incorporate insights from other disciplines when deemed beneficial. Theories in criminology, and more importantly crime-management theories, can offer interesting contributions to discuss some of the methodological choices made in this project, when nourished with theories and methods from SEP. While crime management and safety issues are neither presented as primary in the application form of the project nor within WP5, these aspects nevertheless permeate all the different Work Packages and remain important elements, constantly brought to the fore and emphasized by field actors and residents over these 4 years. Crime management theories will thus serve as the "binding agent" for the discussion of methodological aspects, enabling a fluid examination of the most important methodological choices to revisit.

- Focus on specific locations rather than on the entire project area

One primary decision we made in the WP5 was to focus the intervention on specific locations rather than the entire project area. I have already touched on the reason for this choice in Chapter 1, but given its importance, I would like to discuss it in more detail. Numerous crime-management theories are based on the concept of neighborhood, rather than on specific locations (Eck et al., 2023; Linning et al., 2022). However, the choice to focus on precise localization does seem more appropriate.

Macro-level theories in research about crime and place, such as the Broken Window Theory (Wilson & Kelling, 1982), seek to explain why some large geographic areas, mostly neighborhoods, have more crime than others (Eck et al., 2023; Linning et al., 2022). These macro-level theories frequently perceive a neighborhood as a singular unit, rather than a "pooled place" comprised of numerous smaller place units (Eck et al., 2023; Linning et al., 2022).

This overemphasizing of neighborhoods seems however methodologically questionable. First of all, it is important to realize that neighborhoods cannot be coherently and consistently defined, which does not allow us to study them scientifically (Linning et al., 2022). In addition, such a view implies that the

mechanisms leading to crime are uniformly distributed across a neighborhood and that crime occurrence should be relatively even (Eck et al., 2023). Yet, this is not the case. Instead, crime is highly concentrated in a very few small places, indicating that within high-crime areas, only a few number of places, known as hotspots (HS), actually experience crime (e.g., Sherman et al., 1989). This pattern of high crime HS within neighborhoods is so common, with no known exceptions to date, that it is now recognized as a fundamental law in criminology (Weisburd, 2015). The theoretical and practical benefits of focusing research on micro places rather than on large analyze-units had already been raised earlier (e.g. Sherman 1995; Taylor, 1997; see also Hipp, 2010).

The main idea is therefore that instead of looking at a top-down approach whereby wider neighborhood effects influence offenders' microspatial target selection decisions, we should look at bottom-up processes whereby criminal activity originates at places and radiates out to the surrounding areas (Linning & Eck, 2021). Some evidence for this bottom-up process exists, showing that these high-crime HS drive crime and give areas their reputation (Eck et al., 2023). What happens in one specific place diffuses into the surroundings. This was studied in criminology by looking at the opposite effect, i.e. whether the beneficial effects of an intervention positively influence the surrounding areas (rather than creating a crime displacement). In a study conducted in New Jersey, two high-crime sites (i.e. drug selling and prostitution) were selected for intensive police interventions and monitored during an experimental period of several months (Weisburd et al., 2006). These police interventions solely focused on the selected sites, not on their nearby areas (Weisburd et al., 2006). Results suggested that crime does not simply "shift" to areas outside the immediate targets of interventions, but merely that the crime control benefits radiate to the surroundings (Weisburd et al., 2006). More recently, a systematic review, using meta-analytic techniques, looked at the displacement of crime or the diffusion of the crime control benefits through focused police crime prevention interventions, and favored the diffusion effect over the displacement effect (Braga et al., 2019).

However, we feel it is important to discuss this from a more psychosocial perspective. When focusing on the need to take into account HS, i.e. "micro-places" within the larger areas that constitute neighborhoods, and the influence that these HS can have on the surrounding areas, the relationship with the Theory of Affective Judgment in Spatial Context (AJ-space; Blaison, 2022; Blaison & Hess, 2016) developed earlier (see 3.1.1, pp. 115-119) becomes a matter of course. This theory

is part of the emerging research in social psychology, exploring how places or the larger spatial context can impact both judgment and behavior (Blaison, 2022).

As a reminder, AJ-Space posits that the evaluation of a specific place depends on the affective meaning attached to the surrounding places, creating an "affective field" (Blaison, 2022; Blaison & Hess, 2016). However, the other way around, this field is disproportionately influenced by emotionally prominent places known as "hotspots", which impact the evaluation of nearby areas through assimilation and contrast effects (Blaison, 2022; Blaison & Hess, 2016). For instance, places close to positive HS appear more positive than usual due to assimilation, while more distant places seem more negative through contrast effects (Blaison, 2022; Blaison & Hess, 2016).

According to this reasoning, it could (at least partially) be the affective meaning attached to specific HS that would influence the surrounding areas and explain why the crime control benefits spread to nearby places. It is possible that crime management interventions contribute to the modification of the affective meaning of the high-crime HS, and thus also influence the emotional value of the surroundings through assimilation effects, and thus individuals' (non-civic) behavior. Indeed, individuals' behavior is a function of the affective meaning they attach to their environment (e.g. Blaison & Schröder, 2019; Heise, 2007), and therefore potentially also their criminal behaviors.

Based on this theory, if high-crime HS produces an affective polarization of the places distributed in the surroundings, and if individuals' behavior is function of the affective meaning they attach to their environment, then direct adjacent areas should be the scene of criminal behaviors as well, through the assimilation effect. The number (and/or seriousness?) of these crimes should, however, diminish as we move away from HS. The question in this case is obviously, what defines a HS? In criminology, after studying entire neighborhoods for a long time, it seems like smaller places like street segments are often studied (e.g. Andresen & Malleson, 2011; Braga et al., 2011; Weisburd et al., 2004, 2012). However, it is possible that these smaller places, such as the street segments or housing blocks, do not actually constitute the HS, but the area adjoining the HS (which would be, for example, a specific bar in this street segment or a specific store in the housing block, where drug dealing takes place). It is therefore possible that the unit of measurement needs to be further reduced, from blocks of houses and street segments to even more precise locations. An UGS may constitute a specific HP on its own, but beyond a certain

surface area, it is more likely that it will be a "pooled place" of several smaller place units.

If we go back to the application of the AJ-Space theory (Blaison, 2022; Blaison & Hess, 2016) to our reasoning, then we should pay greater attention to the issue of crime displacement. Literature in criminology seems to support the idea that crime management interventions in high-crime HS will not "move the crime around the corner" (Braga et al., 2019; Weisburd, 2006). However, if HS create an assimilation effect in directly adjacent areas, they also create a contrast effect for more distant areas (Blaison, 2022; Blaison & Hess, 2016). Given the contrast effect that a HS can generate when a certain distance is exceeded, it would be interesting to see if the crime issue, not moving "around the corner", would not move into areas further away from the target. The crime displacement should then be the result of the gradient of influence of the HS, the intensity of the positive or negative affect it evokes, as well the size of the area under consideration (i.e. the frame of reference, all the elements considered relevant to the judgment). The reach of influence from a HS will appear shorter in smaller spatial frames of reference than in larger spatial frames of reference, which also will lead the contrast effect to emerge closer to the HS (Blaison & Hess, 2016).

This presupposes, however, that the initial high-crime HS remains a place with a high affective value after an intervention. It is, however, also possible that the valence of this place will simply be less emotionally charged after the intervention and no longer constitute a HS. This will probably depend on the type of crime intervention applied to the place, but also how the intervention will be received by the people living in or using the site, and how they will (or not) appropriate the place after the intervention.

Another aspect to consider is that, like many urban requalification projects, the APTB project does not target one HS in particular, but many places in parallel, i.e. an entire area. Depending on the type of intervention and the financial investments involved, this will change the affective value of these places and the whole neighborhood, and thus perhaps contribute to a more general problem of gentrification. The idea here is not to suggest that crime management interventions on a single HS will lead to a displacement of crime into outlying areas and to gentrification issues, but rather to bear this in mind when planning the rehabilitation of entire territories, as in the case of the present project. For the sake of simplicity, in this discussion, we develop the notion of HS isolated from their context. However, as a reminder, they are part of a much broader affective field and of all the interactions with other places and the

overall environment in which they are embedded (Blaison, 2022; Blaison & Hess, 2016).

Literature in social psychology reinforces the importance of taking micro-places, i.e. HS, into account within larger geographic areas and thus supports the limit addressed the overemphasizing neighborhoods. In this sense, recent literature in criminology and social psychology converge and support the idea that focusing interventions on some specific places can have a meaningful impact.

- Focus on residents rather than on structural factors

Another limit that recent literature in criminology highlights in numerous crime-management theories is the idea that residents are the main (if not the sole) source of control and that this informal social control emerges spontaneously (Eck et al., 2023; Linning et al., 2022; Linning & Eck, 2021). In the BWT, for example, residents (referred to as the "community" in the original work) are seen as key actors, and informal community control as an important mechanism contributing to the (non-) development of crime (Wilson and Kelling, 1982).

This emergent literature in criminology suggests that the ability of a community to control deviance/crime (usually through some residents' actions) is directly dependent on some structural factors (physical and legal context), controlled by few people, the place managers (Eck et al., 2023; Linning et al., 2022; Linning & Eck, 2021). In the eyes of these authors, most crime management theories neglect to consider the potential impact these place managers (mainly non-residents, such as businesses or administrations, who operate properties in the neighborhood) have (Linning et al., 2022).

A place manager is the legal owner of the place or someone to whom the owner has delegated authority to operate the place (Eck et al., 2023). Place management refers to the actions undertaken by these place managers to effectively operate the place and fulfill its intended purpose (Eck et al., 2023). Place management that acts on these structural factors could be actions of space organization (e.g. remove benches if they encourage people to linger there in groups), conduct regulation (e.g. prohibit alcohol consumption in the place), access control (e.g. close the place at night), and resource acquisition (e.g. answering project calls to raise funds needed for the above-mentioned interventions). In summary, for these authors, legal owners and operators who use their property rights to manage their places will shape neighborhoods, and residents will largely adapt to this (Eck et al., 2023).

However, if I agree that measures such as relying only on residents and expecting a spontaneous emergence of informal social control for crime management is probably unrealistic, I think that relying solely on legal owners and their structural management power will probably be equally insufficient. Real-world situations are complex and require a balanced approach.

Although legal ownership confers a considerable management power, and therefore the possibility of operating that place in the best possible way to control crime, I think it is important to take into account the very specific situation of public spaces such as UGSs. Public spaces are not comparable to private spaces such as bars or parking lots and fulfill essential public health functions.

I see two limits in relying solely on legal place managers (non-residents) and in influencing only structural factors:

- I am not suggesting that this will necessarily always be the case, but examples of crime-management policies aiming to bring about structural changes in high-crime HS include most of the time coercive measures. As already suggested previously, such coercive actions can lead to public health and social justice concerns when they limit in any way either the access to the spaces or the behaviors within these spaces. This is especially true in low socioeconomic status (SES) neighborhoods, where most people lack access to private green spaces and are thus entirely dependent on publicly accessible UGSs (see 2.1.2, pp. 13-17).
- Even if legal owners may be important by the structural changes they have the power to implement, we should not forget that perceived ownership is a tangible reality and that informal owners already often exist in a location, showing real informal management power. Imposing this type of measure in a high-crime HS such as Morchamps Park, where some groups already claim informal property rights, runs the risk of repercussions due to territoriality behaviors, such as reactionary defending behaviors.

Certainly, it is not being suggested that structural changes are intrinsically ineffective; they can indeed be beneficial. Structural changes can for example influence place appraisal, and research shows that in a general way positively evaluated stimuli (e.g. places), are inherently associated with approach intentions or behaviors (e.g. attendance), whereas negatively evaluated stimuli are associated with avoidance intentions or behaviors (e.g. Elliot, 2006). However, caution must be exercised regarding the types of measures adopted and how they are implemented.

In light of the studied SEP theories, residents remain an important factor in place management through the perceived ownership attitudinal factor (among others) and the possible resulting informal yet tangible management power and collective stewardship. So while the attitudinal factor of perceived ownership is maybe not sufficient to get the best results on the field, it probably remains important and worth studying and using.

4.2.3 Recommendations for the next action research loop

The next steps can involve continuing in the same direction as the intervention we carried out, or delving deeper into the problem and starting a new action research loop from the first phase on.

This work does not claim to offer a turnkey solution to the multiple problems of attendance rate, criminality issues and multiple (formal and informal) owners, observed in the UGSs of the project area. This would be unrealistic for complex real-world issues. As suggested in 4.2.1, in my opinion, the successful implementation of collective PO interventions in the project area needs to be well-studied before the intervention, which supposes to go back to the reconnaissance phase and rethink the intervention plan accordingly. Going through an entirely new action research loop should reduce the risk to implement potentially ineffective or even counter-productive interventions.

Rather than focusing on how to increase UGS attendance, focusing on existing and not existing ownership relationships towards these high-crime HS and the impact of these relationships on collective stewardship and territoriality behaviors could be considered.

Research question:

- How can UGS interventions based on collective PO be effectively implemented in high-crime HS, where some groups are already claiming ownership rights?

Sub-questions:

- What are the primary functions that UGSs serve for informal owner groups?
- Can and should these crime-management interventions effectively acknowledge and integrate the functional importance of these spaces for informal owners, to prevent an escalation of territoriality behaviors, while ensuring that the goals of the crime-management intervention are met? If so, what strategies can be used to acknowledge and validate the informal ownership of UGSs before initiating interventions?

From a methodological point of view, when implementing new action research loops special attention should be paid to the followings:

- Sticking to a micro-level approach by focusing on specific places (HS), and avoiding a macro-level approach (i.e. working on large areas such as the entire project area).
- Identifying other potential HS within the project area, given that affectively prominent places have an important impact on the surroundings and interact with one another (Blaison and Hess, 2016; Blaison, 2022).
- Including place appraisal variables in addition to the attitudinal variables (e.g. PA, place ownership) to enhance the understanding of the individual/place relationship.
- Using place appraisal measurement methods that go beyond a positive/negative appraisal and considering the three fundamental affective dimensions of evaluation, potency and activity (Osgood et al., 1975; Scholl, 2013), to overcome standardization issues due to broad and fuzzy conceptualized concepts.
- Enabling long-term monitoring of the evolution of the project area and enhancing transparency by sticking to the same psychosocial indicators as those used in the present work. Ensuring to use the same measurements and wordings.

CHAPTER 5: GENERAL DISCUSSION

Public UGSs are increasingly recognized as being a cost-effective, high-return investment, resulting sometimes in billions in savings for health services (MacKinnon et al., 2019). Research tends to agree on the fact that few public health interventions can achieve the same amount of benefits as UGS intervention, i.e. "*urban green space changes that significantly modify green space availability and features by creating new green space, changing or improving existing green space, or removing or replacing green space*" (Hunter et al., 2019; WHO Regional Office for Europe, 2017). However, there is presently limited knowledge regarding the optimal way to implement UGS interventions that minimize potential side effects and maximize environmental, societal, and health benefits (Hunter et al., 2019; WHO Regional Office for Europe, 2017).

The definition provided by the WHO regarding UGS interventions typifies a general limitation often seen in research focused on the impact of UGSs, i.e. the overemphasizing of the attributes of the UGSs (e.g., quality, maintenance, size) and the way individuals will use them (e.g., minimal dose of needed exposure, type of activities). Presently, there seems to be limited evidence supporting interventions that solely rely on physical modifications to increase UGS attendance (WHO Regional Office for Europe, 2017), but relatively strong evidence that effective strategies should incorporate dual approaches, combining physical changes and social engagement/participation elements that promote the UGSs (Hunter et al., 2019; WHO Regional Office for Europe, 2017). Throughout this work, which has evolved based on the outcomes of each action research phase, one can reasonably argue that effective UGS interventions for public health and social justice purpose requires one more step and should include an analysis of the relationships individuals already have with the space and the existing social dynamics in place, to avoid counterproductive interventions. More specifically, based on the results from the present work, it is essential to consider the sense of ownership that any individual or group might develop towards a public space they regularly attend to and interact with. These ownership relationships can lead to both positive (like stewardship behaviors) and negative behaviors (like territorial behaviors) within these spaces and therefore contribute to turn these places into so-called hotspots, potentially having a significant impact on the urban landscape.

Incorporating such factors when designing UGS interventions introduces a psycho-socio-environmental perspective into an area that, at first glance, appears to primarily belong to fields such as ecology, urban sociology, spatial planning, environmental science, or public health. The value of introducing a psycho-socio-

environmental perspective, and specifically of integrating tools and methods from experimental psychology, lies in its ability to study the mechanisms underlying observations based on social interactions. Public places, and more specifically in this case UGSs considered as high-crime HS, can therefore benefit from being studied from a psycho-socio-environmental perspective.

The APTB project area is a good example of a specific field situation that benefits from a psychosocial interpretation and analysis. Several investments have already been made in the UGSs, but to no avail. Consistently focusing only on investments related to the structural aspects of these spaces, such as working on the UGS' features, runs the risk of getting trapped in an endless investment-degradation cycle, sometimes doing more harm than good despite underlying good intentions. Such situations clearly highlight the importance of moving beyond day-to-day solutions, to a long-term perspective. This means taking the time to invest in a proper field analysis, allowing for a better understanding of the issue before committing public funds to potentially ineffective or even counterproductive interventions. The example of Seraing cannot be directly replicated elsewhere, each field being unique. However, even if many UGSs do not face the same issues as the UGSs of the project area, Seraing remains an example that likely combines many characteristics of UGSs in precarious districts. The proposed reading of the situation in the UGSs from Seraing, therefore, deserves to be explored in other UGSs that are caught in systematic intervention-degradation cycles.

The research aspect coupled with the action aspect of WP5 was therefore crucial in understanding the barriers preventing UGSs from becoming effective public health infrastructures in the project area, allowing an analysis that delves deeper than simple observation. This perspective of the benefits of such an approach is echoed by other researchers who, noting the widespread agreement on the benefits nature exposure and UGSs offer for public health and social equity, argue for a transition towards intervention-based research (Hunter et al., 2019). In SEP, the action research methodology seems like the most suited one to meet this objective.

Although not presented in this sense in the rest of this work, two main objectives actually underpin this Ph.D. work.

First, to address the needs of the field, the goal was a better understanding of the relationship between the residents and their local environment, in order to transform this environment into a resource that enhances the quality of life within the Seresian region. This aspect was discussed in Chapter 4. As stated, at this point, I am unable to provide a scientifically sound answer to this question. However, the applied methodology does pave the way for a new cycle of action research, which allows us to build upon the learnings from the past four years.

The second objective is a methodological one. Action research is a rarely used methodology in SEP and is mostly considered as a heterodox idea (Simon & Wilder, 2018). This Ph.D. work is therefore also to be seen as an attempt to field-test this methodology, which is particularly underdeveloped in SEP, and to confront it with specificities of multidisciplinary contexts.

5.1 Impact-oriented SEP action research

Although theories of SEP are initially intended to apply to the social world outside the lab (Simon & Wilder, 2018), it often takes a long time for fundamental-research-derived knowledge to percolate down to the field (Hunter et al., 2019). Intervention-based research may speed up this process, guiding policymakers and practitioners toward applying informed decisions in the field. To achieve this, researchers should develop partnerships with key stakeholders involved in the management and maintenance of UGSs (Hunter et al., 2019), but also with "participants", i.e. residents (Simon & Wilder, 2018).

I agree on the need to bridge academic knowledge with practical application, and on-site action research seems a valuable method for doing so, and I also agree on the importance of conducting field studies to enhance the ecological validity of the obtained results. However, it is essential to offer as objective a critique as possible of this approach after truly testing it in real-world situations. This ensures that as researchers, we are aware of both the strengths and limitations of this approach before deciding whether or not to adopt it.

The question that arises, after this Ph.D. work, is whether it is indeed possible to carry out action research projects and claim both scientific validity and significant field impact. In addition, it can be questioned if multidisciplinary contexts should be seen as a constraint or an opportunity.

5.1.1 Balance in scientific validity and field impact in SEP action research

Focusing on scientific validity in field interventions presents numerous challenges, arising from the complexities of real-world environments compared to controlled laboratory settings. First, unlike highly controlled laboratory settings, real-world environments are continuously changing and unpredictable, unanticipated or uncontrollable variables may affect the outcomes of the study. Second, having a control condition is sometimes challenging or even impossible, making it difficult to attribute observed changes solely to the intervention. This can also raise ethical concerns, on which field to select for the intervention, and which one should remain untouched. Third, as was the case in the APTB project, multiple stakeholders might

be involved in field interventions, each with their own objectives, methods and agendas. These influences can introduce biases or restrict certain research methods. Fourth, gathering accurate, consistent, and unbiased data in the field can be challenging, as well as time- and cost-consuming. It seems obvious that we could not get a majority of people to fill in the psycho-socio-questionnaires without having a verbal exchange with them, even writing down their answers for them. Filling in the questionnaire with participants automatically induces influences. This also highlights the resource constraints associated with action research, which demand more resources in terms of time, manpower, and finances to maintain as rigorous scientific protocols as possible. This all leads to less generalizable findings.

On the other hand, focusing on the real-world impact while being as scientifically rigorous as possible can be challenging as well. Real-world problems are complex, and having the most significant impact on the field means playing on several levels simultaneously, combining place-based and people-based approaches, which requires several partners to intervene simultaneously. Having to control the field settings as much as possible will necessarily limit the scope for action, and therefore the potential impact. Time and resource constraints are also discussion points. Rigorous scientific methods often require longer timeframes for careful design, implementation, and analysis. However, waiting for the "perfect" situation might not always be the best solution to have quick results or straightforward solutions for the field. Scientific rigor can also be more resource-costly in terms of money, expertise and equipment, especially in field interventions. When focusing on real-world impact, these resources might need to be balanced against other priorities. As already highlighted, scientific validity needs an untouched control condition. Intervening simultaneously on the entire population would have the biggest field impact. Also, the real-world impact often involves iterative processes where interventions are refined based on the constant "field feedback". Strict adherence to a rigorous scientific method might make it harder to be flexible and adaptive.

In summary, while scientific rigor ensures reliability and validity in research findings, and allows to isolate the impact of single variables and to analyze the underlying mechanisms, the controlled conditions and methods will also limit the actions that can be implemented on the field, and lead to less straightforward and quick solutions. These two objectives seem, therefore, difficult to reconcile.

5.1.2 Multidisciplinarity in SEP action research

As highlighted by the WHO Regional Office for Europe (2017), advocating for the use of existing green spaces should be perceived as a multifactorial challenge. This needs

an interdisciplinary approach, encompassing fields like urban planning, landscape architecture and environmental science, as well as a collaborative effort involving various sectors such as academia, government and non-governmental organizations.

As seen, SEP has its place in such interdisciplinary UGS interventions as well. Indeed, including the human factor through disciplines like SEP allows us to consider UGS interventions that go beyond working on the physical attributes of the UGSs (e.g., quality, maintenance, size) and the way individuals will use them (e.g., minimal dose of needed exposure, type of activities). In addition, including an experimental approach allows us to study the underlying mechanisms of a given social phenomenon. Including variables and measurements from SEP seems even more important when considering that there is often little correlation between the objective urban quality of life characteristics (e.g. security indicators) and the subjective evaluation of them (e.g. Mancus & Campbell, 2018; Paydar et al., 2017; Pérez-Tejera et al., 2022)).

As the general context of this work is multidisciplinary, whether in terms of the project itself, or the scientific literature underpinning the approach in WP5. It can be questioned if the multidisciplinary context was a constraint or an opportunity.

Multidisciplinarity can be a real challenge from a scientific point of view. The narrative review conducted as part of this project (refer to Box 2, pp. 55-97) provides a glimpse into the complexity that emerges when distinct disciplines tackle the same research question. The relationship between perceived safety and UGS attendance has been explored by an array of disciplines, including social psychology, sociology, geography, architecture, urban planning and ecology. Consequently, a wide range of methodologies and measurements can be found, introducing inconsistency that undermines the meaningfulness of this research area. For genuine advancement, precise and standardized measurement methods are imperative, allowing for comparisons between studies and the generalization of results.

Additionally and as briefly mentioned previously, working with diverse partners can introduce challenges in the field as well. As previously mentioned in the evaluation phase (pp. 178-181), the interventions of different project partners in the target area prevent us from considering the conditions in the initial year of the project as identical to those in the final year. This limitation impedes the ability to draw concrete conclusions regarding the impact of the intervention of the WP5. Such situations typify the difficulties inherent in applied research, particularly when conducted over multiple years. The ever-evolving nature of the field and the involvement of various partners inevitably have broader implications for the entire neighborhood.

Despite these challenges, I firmly believe that multidisciplinarity, when centered on problem-solving, can also be a real asset and should at least be considered in projects like the present one. Most of the problems seen in urban contexts are complex and often make a single approach or intervention insufficient. Regeneration projects of deprived neighborhoods, such as the APTB-project, are no exception. Addressing comprehensive objectives like "fighting urban poverty", in large areas, inherently involves multifaceted challenges. Given this complexity, including several partners, working towards a common objective by combining place-based and people-based approaches, seems indeed to be the most effective way of achieving an observable outcome. For instance, it is more than likely that the increase in self-reported UGS attendance and the improved perception of beauty in the target UGSs are largely attributable to Natagora's interventions (refer to Appendix 1 for an overview). This collaboration with Natagora becomes all the more compelling when considering that if the number and size of UGSs influence people's physical, psychological, and social health; biodiversity and naturalness rates seem important as well (Reyes-Riveros et al., 2021). However, quantifying these improvements would have been impossible without integrating the research aspect of WP5, including the measurement of indicators at the project's outset and conclusion.

Furthermore, multidisciplinarity offers alternative perspectives on certain phenomena and, in this regard, serves as a potent source of theoretical reflections and hypotheses (such as the dive in the recent criminology literature in Chapter 4). In the same way that action research in SEP can broaden fundamental research, insights from other disciplines can also contribute to the generation of novel hypotheses and the identification of extraneous variables that have to be considered in laboratory-based SEP studies.

5.2 Is action research the most appropriate approach?

In this pilot project, there were by definition many unknowns, and I had no expertise concerning the territory in which I had been asked to intervene. With this in mind, action research seemed to be the most suitable approach for the present project. However, all the discussed challenges inherent to action research raise the question of whether, in the end, this choice still has to be considered the most appropriate. To determine if this approach was ultimately suitable for the present project, it is important to consider whether the practical outcomes were actually achieved and if this approach allowed enhancing theoretical knowledge.

Based on the analysis of the evolution trend of the indicators, practical outcomes can be considered as achieved. However, to be fair, it is probably more accurate to

suggest that the numerous actions from the various partners involved in the project and using place-based and people-based approaches simultaneously, explain these positive evolutions rather than the action research intervention from the WP5 itself. More than the action research methodology itself, it is the multi-disciplinary approach that has enabled this project to achieve the desired results. The psychosocial intervention represents just one facet of the overall project, likely exerting a modest influence on the indicators' evolution. Nonetheless, the methodology adopted for WP5 facilitates an evaluation of the entire project's impact and provides a clearer understanding of the implemented actions.

The enhancement of theoretical knowledge is limited, suggesting that the practical impact topped the theoretical one. Indeed, this work does not claim to bring new solid theoretical knowledge, due to the various field constraints. However, thanks to the inclusion of more controlled studies at some key moments of the process, some new theoretical perspectives can be made, even if the results need replication and experimental studies to be considered as being "solid". The inclusion of experimental laboratory studies alongside the field intervention seems to be a minimum requirement to achieve theoretical enhancements in action research.

However, this approach is still considered appropriate in impact-oriented projects, since it proposes a methodology that goes through various phases enabling analysis of a specific field situation and, if including several cycles, probably also a possibility of a significant impact on the field. If some experimental studies are included at key points of the process, a better balance between field impact and theoretical enhancement can be expected.

In light of what we just discussed, it seems challenging to claim a high degree of scientific validity while also aiming for the most significant possible field impact. One aspect will inevitably overshadow the others. In this sense, action research would not claim to have the dual objective of increasing theoretical knowledge and field impact, but should primarily be seen as a methodology enabling the implementation of field interventions on the basis of a solid analysis of the field of intervention. Action research obviously needs to be coupled with more experimental methods, as already proposed by some authors (e.g. Simon & Wilder, 2018), and include experimental laboratory research if it should provide scientifically solid results.

CHAPTER 6: CONCLUSION

The main objective of this Ph.D. work was to gain a better understanding of the relationship between residents and their environment, aiming to make this environment a resource that improves the quality of life in the territory of Seraing. This objective translated into two sub-goals: first, a field objective, i.e., to increase the use of UGSs by the residents, and second, a theoretical objective, i.e., to identify and study factors that positively affect UGSs attendance.

This work allowed to highlight the following 3 theoretical points:

- First, introduce a new variable, "perceived crowdedness", in studies to investigate the relationship between UGS attendance and prosocial behavior. Since this study is correlational, it will be is necessary to validate these results with causal studies. However, this raises questions about the relevance of increasing the UGS attendance rate for public health purposes, because the relationship between UGS attendance and prosocial behavior was only significant when the most frequently attended UGS was perceived as uncrowded. The suggestion made in the monitoring phase to increase PO at the collective level could address this potential contradiction.
- Secondly, it should be recognized that even though safety concerns are often cited as being an important barrier to UGS attendance, it is not currently possible to draw any definitive conclusions regarding this relationship. This field of research continues to lack accuracy and cannot be generalized at this time. Researchers would benefit from defining the spaces studied as precisely as possible, using omnibus measures of perceived safety and precisely define how they conceptualize "attendance", while distinguishing between observational and self-reported attendance measures.
- Thirdly, to explore and introduce a new variable: the notion of "psychological ownership" in place loyalty research. The results suggest a significant relationship between PO and UGS attendance, making this variable, if causality could be confirmed, worth considering in UGS interventions with a public health purpose.

The action research process, iterative by nature, has enabled us to provide an analysis specific to the project areas and led us to propose a new action research loop, no longer focusing primarily on UGSs attendance, but rather on the ownership relationships that individuals and groups can, and may have already established with these spaces. Based on the field analysis, I hypothesize that informal owners have already invested in UGSs in the project area. Effective UGS interventions should take into account the presence of multiple owners, both formal and informal, and the

potential for friction arising from their competing claims on the same spaces. Further field testing is required to validate this hypothesis.

This document concludes with a critical discussion of the action research approach, which the Ph.D. work aimed to field-test. The action research methodology presents challenges in claiming a high degree of scientific validity while at the same time aiming for the most significant possible field impact. One aspect will inevitably overshadow the others. In this sense, action research should be seen primarily as a methodology enabling that enables the implementation of field interventions based on a solid analysis of the field of intervention. When coupled combined with experimental methods and studies, this analysis may also apply to other contexts, experiencing similar issues.

GLOSSARY

[1] **Master Plan:** The Master Plan is an urban planning tool that specifies a strategy for action on a territory and relies on the coordination of a large number of public and private actors who come together to fundamentally transform the spatial structures of the target territory (Teller, 2017). The master plan is of a non-regulatory nature (Teller, 2017).

[2] **Gentrification**: The process by which a place, especially areas in towns and cities, changes from being mainly occupied by low SES groups to being mainly occupied by high SES groups (Cambridge Dictionary, 2023).

[3] **Public places:** Public spaces are properties in the hands of public authorities, managed and maintained by public services and freely accessible to anyone who wishes to use them (Dessouroux, 2003).

[4] **Privatization:** Privatization, defined in contrast to the qualities generally associated with public spaces, therefore amounts to depriving the space of at least one of these three previously mentioned characteristics (Dessouroux, 2003).

[5] **Social capital:** There is to time no unanimous definition of social capital. The concept is recognized as having multiple dimensions, with definitions that often focus on different aspects of it. These definitions can be broadly categorized into two groups: (i) social networks and relationships, including both formal and informal connections, and (ii) beliefs and norms, such as trust, civic responsibility, and adherence to laws. Some scholars emphasize one category over the other when defining social capital, while others argue that it is a combination of both (Durante et al., 2023).

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APPRENDIX

Appendix 1. Non-exhaustive list of activities and interventions carried out outside WP5, between September 2019 and August 2022, related to the UGS of the project area.

COMMUNICATION				
Canal	Date	Description	Organizer/ in charge	Target UGS
Social media	July 2020	Photo of the park workers hired for the project	Arebs	- Marêts - Morchamps - Bernard Serin
Social media	July 2020	Video of the maintenance of Morchamps Park by the workers hired for the project.	Arebs	- Morchamps
Social media	April 2021	Explanation of the nature workshops organized by Natagora.	Arebs + Natagora	- Marêts - Morchamps - Bernard Serin
Signs in parks	May 2021	Signs explaining the new improvements in the UGS (improvements made within WP4).	Arebs + Natagora	- Marêts - Morchamps - Bernard Serin
Social media + city website	June 2021	Presentation of the new improvements made within WP4.	Arebs + Natagora	- Marêts - Morchamps - Bernard Serin
Distribution of flyers (mailboxes)	July 2021	Explanation of the nature workshops organized by Natagora + packet of seeds t scatter in the parks + comic book explaining the new improvements.	Arebs + Natagora	- Marêts - Morchamps - Bernard Serin
Social media + website APTB + Newsletter	July 2021	Introduction to the team of park workers.	Arebs	- Marêts - Morchamps - Bernard Serin
Social media + website APTB	August 2021	Video about the APTBC project (Zoom-in) filmed in Morchamps Park.	Arebs	- Morchamps

Social media + website APTB	September 2021	Video about the nature workshop at Morchamps school (interview in the parks).	Arebs + Natagora	- Morchamps
Social media	September 2021 + April/May 2022	Instructive video on the differentiated UGS management and presentation of the nature workshops organized by Natagora.	Arebs + Natagora	- Marêts - Morchamps - Bernard Serin
Distribution of flyers (public places) + Newsletter	January 2022	Explanation of the nature workshops organized by Natagora.	Arebs + Natagora	- Marêts - Morchamps - Bernard Serin
Social media + Newsletter	January 2022	Introduction to the new team of park workers.	Arebs	- Marêts - Morchamps - Bernard Serin
Social media + Newsletter	April 2022	Communication campaign "#parcserain". Photos of park visitors.	Arebs + PsyNCog	- Marêts - Morchamps
Social media + Newsletter	From January to November 2022 (every 7/15 days)	Regular communication about the work of the team of park workers.	Arebs	- Marêts - Morchamps - Bernard Serin
Distribution of flyers (mailboxes)	June 2022	Communication about the guided walk in the parks on July 3.	Arebs + Natagora	- Marêts - Bernard Serin
Distribution of flyers (events)	August 2022	First communication on the promenade of the UGS improvements made within WP4 (inauguration during the final event in 2023).	Arebs	- Marêts - Morchamps - Bernard Serin
Social media	September 2022	Awareness video on the developments in the UGS.	Arebs	- Marêts - Morchamps - Bernard Serin

Distribution of flyers (mailboxes and public places) + social media	November 2022	Explanation of the nature workshops organized by Natagora (participative workshop in the three parks on Sunday 13/11 to rebuild with the citizens the vandalized installations)	Arebs + Natagora	- Marêts - Morchamps - Bernard Serin
Social media + website APTB + Newsletter	February 2023	Interview article on the experience of the team of park workers.	Arebs	- Marêts - Morchamps - Bernard Serin

ANIMATIONS				
Public	Date	Description	Organizer/ in charge	Target UGS
Citizens	19 April 2022	Guided walk, discovery, and explanation of the UGS' biodiversity.	Natagora	- Marêts - Morchamps - Bernard Serin
Project partners	26 April 2022	Guided walk, discovery, and explanation of the UGS' biodiversity.	Natagora	- Marêts
Citizens	25 May 2022	Guided walk, discovery, and explanation of the UGS' biodiversity.	Prevention service (city employees)	- Morchamps
Citizens	2 June 2022	Learn how to make slurries for pest management. (Apprentissage de confection de purins pour la gestion de nuisibles).	Natagora	- Marêts
Citizens	3 July 2022	Guided walk, discovery, and explanation of the UGS' biodiversity.	LEMA	- Marêts
Citizens	13 November 2022	Guided walk in the UGS.	Natagora	- Marêts - Morchamps - Bernard Serin

IMPROVEMENTS AND WORKS				
Type	Date	Description	Organizer/ in charge	Target UGS
Improvements made within WP4	Between the beginning and end of the project	Various improvements and changes (e.g. planting, flower meadows, willow constructions, insect hotels, late mowing...)	Natagora + park workers	- Marêts
Improvements made within WP4	Between the beginning and end of the project	Various improvements and changes (e.g. planting, flower meadows, willow constructions, insect hotels, late mowing...)	Natagora + park workers	- Morchamps
Improvements made within WP4	Between the beginning and end of the project	Various improvements and changes (e.g. planting, flower meadows, willow constructions, insect hotels, late mowing...)	Natagora + park workers	- Bernard Serin
Parkour Park	Start: 2020 End: October 2022[1]	Construction of a sports field (substantial work)	City	- Marêts
Street workout area	Start: 2020 End: October 2022[1]	Construction of a sports field (substantial work)	City	- Morchamps

[1] Work started in 2020 and was continuously halfway running or on standby, until a break in July 2022 and a final restart in August 2022.