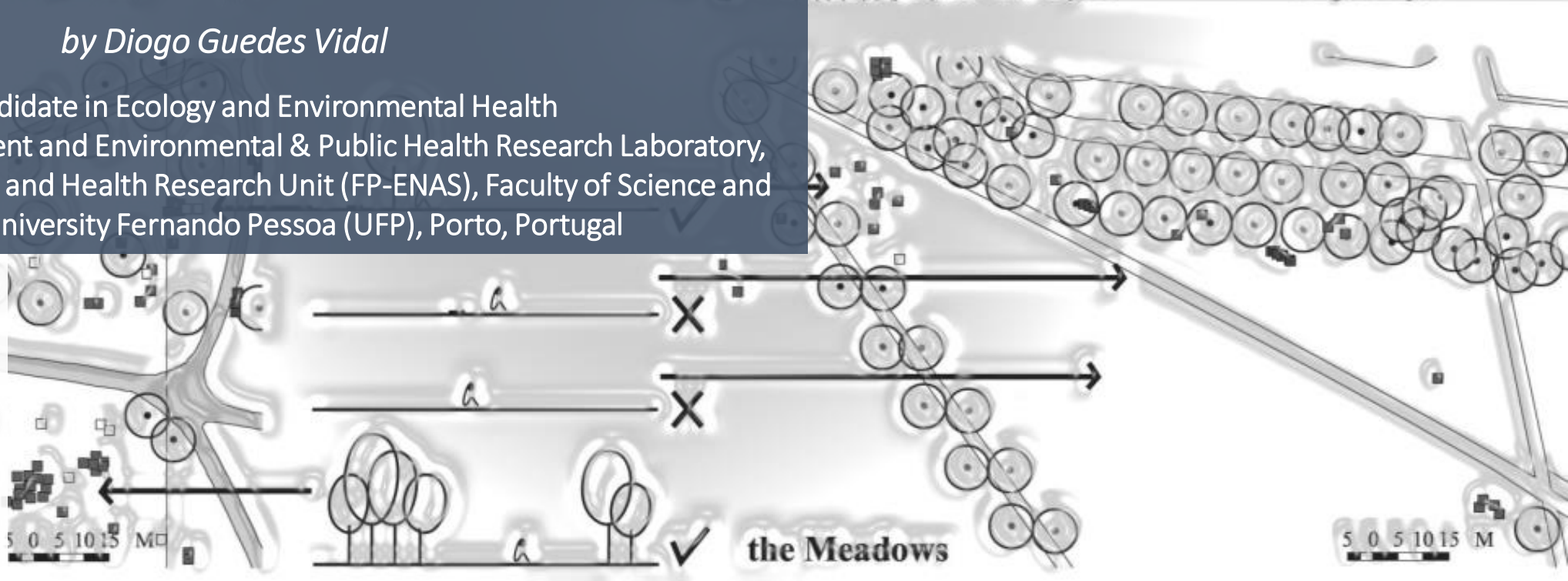
Changing the course of public urban green spaces planning and design: What can we learn from behavioural mapping application?

by Diogo Guedes Vidal

PhD Candidate in Ecology and Environmental Health
3ERL - Energy, Environment and Environmental & Public Health Research Laboratory, UFP Energy, Environment and Health Research Unit (FP-ENAS), Faculty of Science and Technology, University Fernando Pessoa (UFP), Porto, Portugal



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A Review on the Cultural Ecosystem Services Provision of Urban Green Spaces: Perception, Use and Health Benefits

Diogo Guedes Vidal, Ricardo Cunha Dias, Gisela Marta Oliveira, Maria Alzira Pimenta Dinis, Walter Leal Filho, Cláudia Oliveira Fernandes, Nelson Barros, and Rui Leandro Maia

1 Introduction

Due to the increase of the world population and its concentration in cities, a balance between humans and nature is necessary more than ever. Within the framework of sustainable urban planning, the health of the ecosystem is essential for all life on

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Development and Validation of a Grid to Evaluate Ecosystem Services of Public Urban Green Spaces in Porto (Portugal)

Authors Authors and affiliations

Diogo Guedes Vidal, Cláudia Oliveira Fernandes, Lilian Monteiro Ferrari Viterbo, Helena Vilaça, Nelson Barros, Rui Leandro Maia

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Combining an evaluation grid application to assess ecosystem services of urban green spaces and a socioeconomic spatial analysis

Diogo Guedes Vidal, Cláudia Oliveira Fernandes, Lilian Monteiro Ferrari Viterbo, Helena Vilaça, Nelson Barros & Rui Leandro Maia

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Usos e perceções sobre jardins e parques públicos urbanos.

Resultados preliminares de um inquérito na cidade do Porto (Portugal)

Diogo Guedes Vidal
Unidade de Investigação UFP em Energia, Ambiente e Saúde, Faculdade de Ciência e Tecnologia, Universidade Fernando Pessoa
http://orcid.org/0000-0002-2777-2372

Cláudia Oliveira Fernandes
Departamento de Geociências, Ambiente e Ordenamento do Território, CIBIO-InBIO, Faculdade de Ciências, Universidade do Porto
https://orcid.org/0000-0001-6012-2729

Lilian Monteiro Ferrari
Unidade de Investigação UFP em Energia, Ambiente e Saúde (FP-ENAS), Universidade Fernando Pessoa

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Envisioning the future in public urban green spaces planning and design. Lessons from Porto

Diogo Guedes Vidal, Stefano Salata, Helena Vilaça, Nelson Barros, Rui Leandro Maia

Introduction

Located in the littoral north of Portugal, the city of Porto is the leading city of the second biggest metropolitan area of the country with an area of 41.42 km2 and a population density of approximately 5.000 inhabitants per km2 (Pordata 2020b). The city has a warm-summer Mediterranean climate, with an annual average temperature of 15.3 °C, being the maximum annual average of 19.6 °C and the minimum annual average of 11.1 °C (Pordata 2020a). Due to the intense urbanization process of the peripheral territories in the second half of the twentieth century, the city has lost a significant part of the green structure (Andresen 2001). However, several parks and public gardens are still scattered in the middle of the dense urban fabric, varying by to age, location, use, spatial quality, sur-

Porto a living lab to study Public Urban Green Spaces (PUGS) uses and functions and how this varies according to their location.

Porto has experienced profound social and urban transformations in the last century, resulting in changes in the urban landscape (Fernandes and Seixas 2018). Current trends in landscape urban planning and design should meet new life forms and patterns of urban societies and their reflection in urban space. This concern has been explicit in the need to move beyond a sustainable discourse to a regenerative one, which has been addressed in cities and urban planning (Crowley *et al.* 2021; Girardet 2010, 2014). A regenerative approach aims to restore nature-human connectedness and, most importantly, learn to live with nature (Mang and Reed 2013; Wahl 2016). The necessary transition should

Measuring Environmental Concern of Urban Green Spaces' Users (UGSU) Through the Application of the New Ecological Paradigm Scale (NEPS): Evidence from a Southern European City

Diogo Guedes Vidal, Ricardo Cunha Dias, Paulo Castro Seixas, Maria Alzira Pimenta Dinis, Cláudia Oliveira Fernandes, Nelson Barros, and Rui Leandro Maia

1 Introduction—Towards a (Not) New Ecological Paradigm

The relationship between humans and nature has been one of the most enthusiastic

Behavioural Mapping of Urban Green Spaces Users: Methodological Procedures Applied to Corujeira Garden (Porto, Portugal)

Diogo Guedes Vidal, Cláudia Oliveira Fernandes, Catarina Patoilo Teixeira, Ricardo Cunha Dias, Paulo Castro Seixas, Nelson Barros, Helena Vilaça, and Rui Leandro Maia

1 Introduction

1.1 Socioecology in Cross-Cutting Issues Research

Over the decades, the externalization of nature from human beings has led to the desire to control and overexploit it to meet human needs. This worldview, linked with the "Human Exceptionalism Paradigm" (Catton and Dunlap 1980), is now considered obsolete by some authors and novel frameworks have emerged (Grimm et al. 2008). The constant landscape changes that mainly derive from anthropogenic actions imply the need for a complex framework in line with a "New Ecological Paradigm".

From a Sociological to a Socioecological approach

Sociology

- Relationship between human behaviors/practices and the environment, especially in urban spaces;
- Chicago School - Human Ecology and the benefits of nature in cities (York and Mancus 2009);
- Human behavior is shaped by social structures and physical environments;
- Theory of evolution - the natural environment shapes human behaviors and practices (Park, 1915);
- Ecological metaphors - understanding the complex interaction between social and ecological systems - provide knowledge to be used in urban landscape planning (Abbott 2020).

Socioecology

- Man-induced changes in ecosystems;
- It derives from the framework of sustainability and knowledge, that is, the relationship between social and natural systems (Petrosillo et al. 2015; Olmos-Martínez e Ortega-Rubio 2020).
- It incorporates the man-nature relationship as a component that fully affects the evolution of the ecosystem, being inseparable and dependent (Skandrani 2016; Fitzhugh et al. 2019; Kluger et al. 2020);
- It recognizes that human interactions, perceptions and behaviors determine the structure and function of the ecosystem, which contributed to the valorization of the socio-ecological approach (Innes et al. 2013; Preiser et al. 2018).

The Observation in Sociology

Purpose

Identification of patterns of social relations has been the main focus of sociology, encompassing those that are established between individuals, groups and spaces.

Direct Observation

The direct observation of behaviors and practices is one of the most mobilized techniques in sociological research, highlighting the degree of demand and rigor that is inherent to its application, but also by the depth of the information collected.

Two potentialities that it are missing in this technique

- ❑ The relationship of individuals with space as an institution
- ❑ Mapping/Spatialization of behaviors/practices that configure this relationship

Behavioral Mapping - emergence and consolidation

EMERGENCE

- 1962 - individual-centered mapping performed by Weiss and Boutourline (1962); Observation and recording of the movement of individuals in "The Century 21 Exposition" where about 10 million people attended.

AIMS

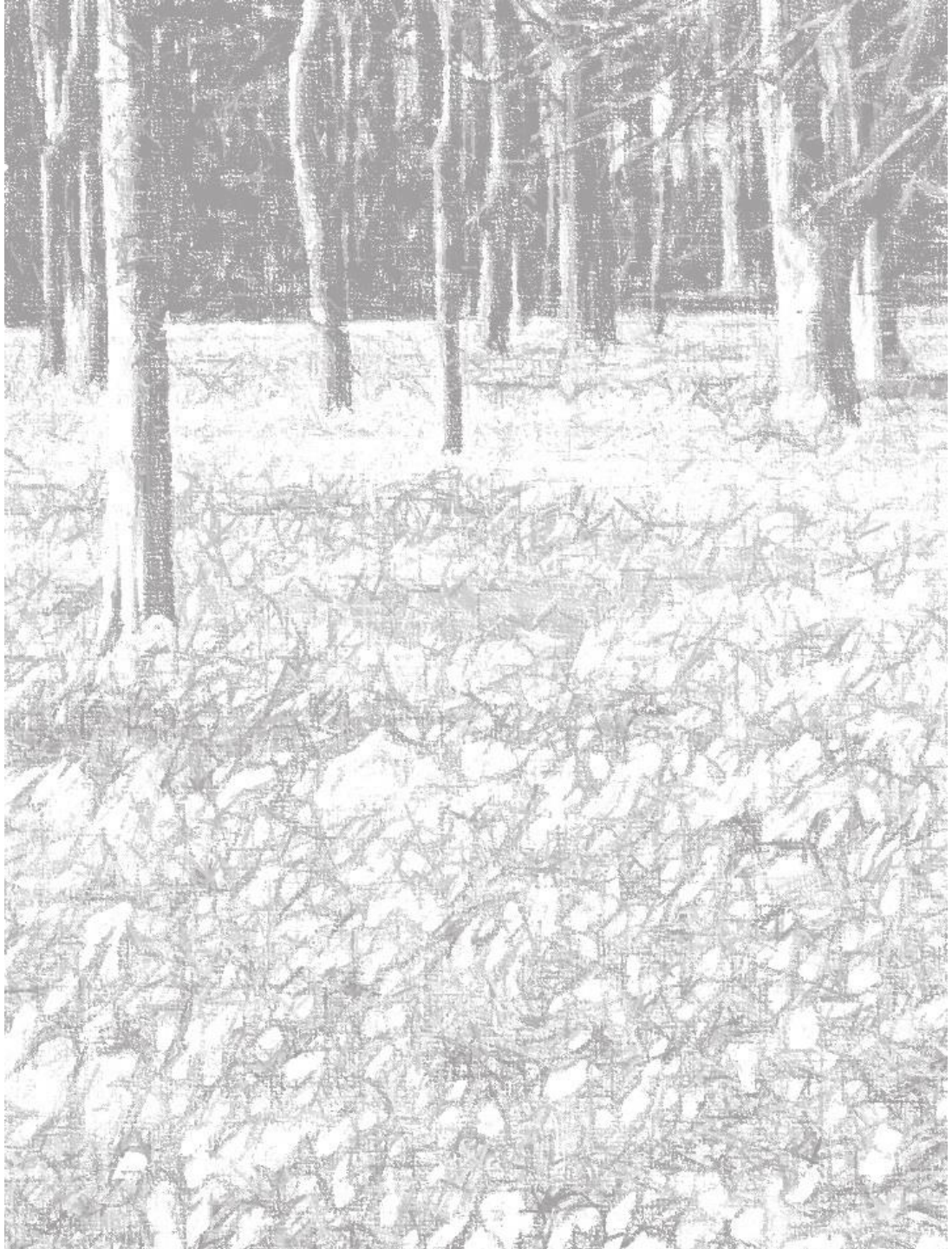
- New technique to observe human behavior in natural environments - Barker (1968) in his book "Ecological Psychology";
- Intrusion-free behavior, ensuring that the observations recorded are spontaneous reactions to the natural elements of spaces (Sanoff and Coates, 1971).

CONSOLIDATION

- Later explored by Ittelson et al. (1970) in the field of environmental psychology to capture and record the behavior that occurs in a specific environment to understand the interaction between people and space.

RECOGNITION

- 1970s - used by environmental psychology, being considered a research method in person-environment studies (Klein et al. 2018).



Behavior Mapping

Person-centered approach – the objective is to observe the activities of a person or group in relation to the place and time, for example, where and how adolescents spend their time after school (Ng 2015).

Place-centered approach – seeks to observe the locations of people in a given environment, at a given time, being more appropriate when the objective is to assess the use of a given area or location (Ng 2015).

Public Urban Green Spaces (PUGS) are "any vegetation found in the urban environment, including parks, open spaces, residential gardens, or street trees" (Kabisch & Haase, 2013, p. 113) managed by the government, fully accessible and that fosters communication and interaction (Kohn, 2004), being vital components of the urban ecosystem (Muqueeth, 2021).

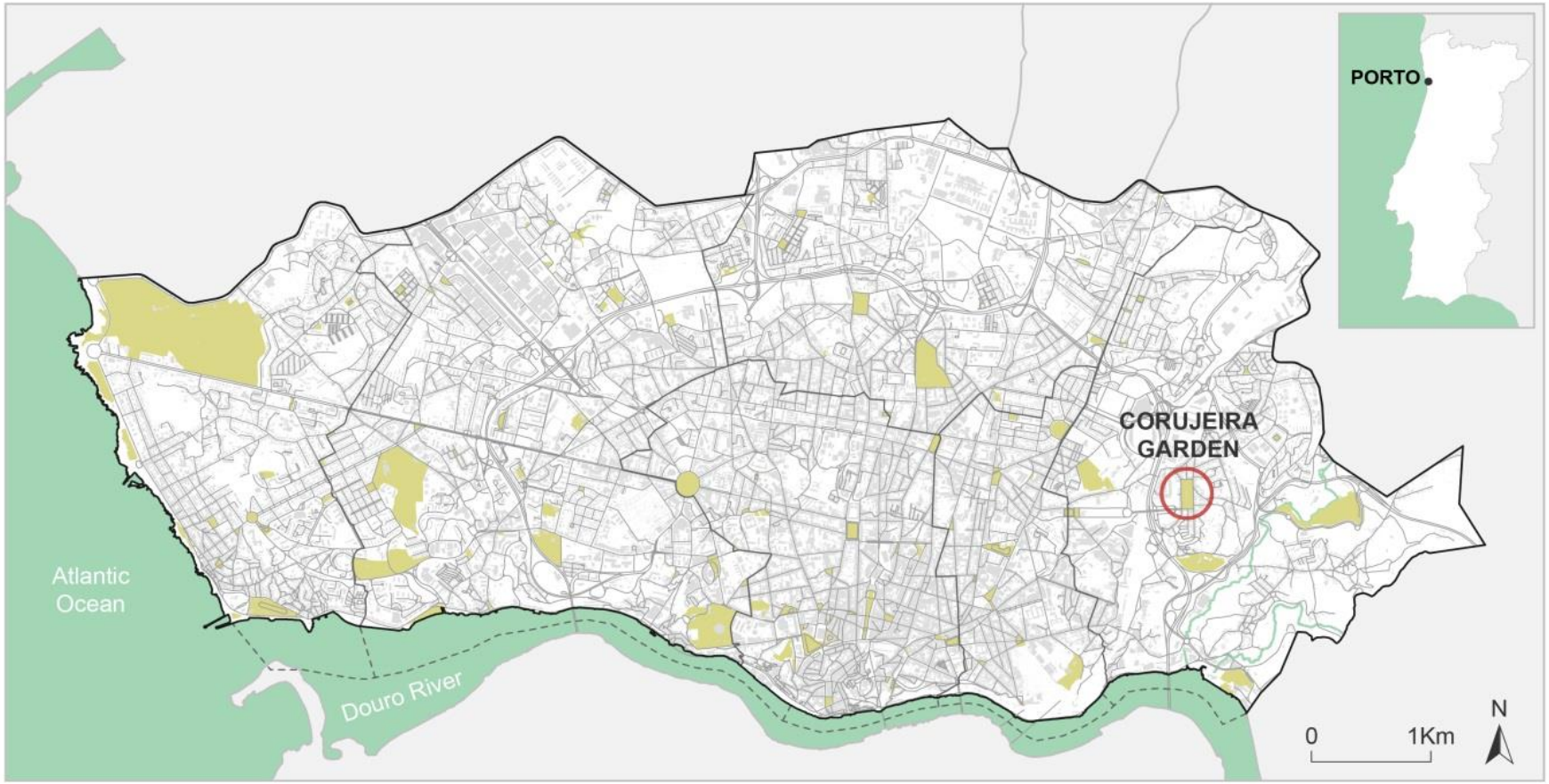
Behavioral mapping applied to public open spaces

- **Zacharias et al. (2001, 2004)** conducted an intensive observational study of San Francisco squares correlating user behaviors with microclimate, contact with others, and environmental design;
- **Goličnik e Ward Thompson (2010)** applied the technique to two green spaces in two European cities to identify patterns of behavior and understand how they correlate with layouts and details, providing useful information to urban planners;
- **Rodrigues (2015)** mapped the pattern of occupation of the contemporary Portuguese urban park to suggest which type of model is best suited to the case studied;
- **Fernandes (2017)** studied human behavior in the Botanical Gardens (Porto) to know the real use of the space, highlighting the pattern of distribution of users in the garden.

Behavioral mapping protocol

- Base map creation
- Definition of observation categories and their codes
- Development of an observation schedule
- Definition of the observation procedure
- Observer training and pre-test

Corujeira garden – Porto, Portugal



- Long tradition of a **demographic decline**, losing more than 10.000 inhabitants in 10 years (1991-2001) (Alves 2016);
- Experiences a **higher incidence of the unemployment rate** (three times more than the western parishes of the city);
- **43% of its population living in social estates houses** which highlights the poverty risk (Alves 2016);
- The Socioeconomic and Environmental Deprivation Index (Monteiro et al. 2013) also corroborates this pattern by **integrating this parish in a high socioeconomic and environmental deprivation cluster**;
- For these reasons, this UGS could play a **vital role by providing recreational activities** and to **enhance the social cohesion** and **wellbeing** of nearby residents, especially in a **deprived community** (Jennings and Bamkole 2019).

Base map creation

- Rectangular configuration
- 2 ha
- Massive presence of plane trees
- Intense shade during spring and summer;
- Bypassed by a wide promenade (with car parking) and crossed by one main path and 10 diagonal small paths that connect the main surrounding arteries;
- Many benches along the sidewalks that create opportunities for rest, relax and socialize, some of them needing maintenance;
- Many garbage is present in the grass, close to the trees, reflecting poor maintenance of the UGS;
- Small bridge that crosses a fountain without water
- One multipurpose pavilion
- pavement in cement is in good condition
- In the middle of the UGS two small squares connects different diagonal paths.

Observation categories and codes definition

Dimension	Category	Code	Description (when needed)
Age	Child	C	Clearly below 10 years old
	Teenager	TEN	Clearly below 18 years old
	Young Adult	YA	Looks between 18 and 30 years old
	Adult	A	Looks between 30 and 65 years old
	Elderly	E	Cleary above 65 years old
Status	Alone	AL	When a user is isolated without making contact with anyone
	Accompanied	AC	
	Two persons	2	
Social Interaction	Small group	SM (n)	A group with more than 2 persons and less than 10 persons.
	Big group	BG (n)	A group with more than 10 persons.
Behaviour	Using the mobile phone	PHONE	When a user is only using the mobile phone
	Talking	TAL	
	Eating	EAT	
	Doing a picnic	PIC	
	Sleeping	SL	
	Photographing	PHOTO	When a user is photographing themselve, others or photographing the spaces and their elements.
	Dating	DAT	When a couple is withholding hands, kissing, hugging or intimately talking
	Observing	OB	When a user is only contemplating, looking to UGS, to the sky or another place
	Doing maintenance	MAN	When a user is doing maintenance work on the UGS
	Crossing	CROSS	When a user is only crossing the UGS, using it as a place of passage, not staying there
	Other	Other	
Physical activity	Walking	WAL	
	Running	RUN	
	Laying	LA	When a user is laying down on the grass, bench or in another place
	Stop	STOP	When a user is standing upright, not sitting
	Seating	SET	When a user is standing and sitting somewhere (bench, wall or other)
Mobility	Walking stick	STICK	
	Wheelchair	WHEEL	
	Baby carriage	BABY	
	Without restrictions	WR	

Development of an observation schedule

Period	Week	Weekend	Total
	N	N	N
9:00-13:00 AM	3	3	6
13:00-19:00 PM	3	3	6
Total	6	6	12

- Behavioural observation can be event or time-contingent at each fixed intervals (e.g., every 20 minutes) or random intervals;
- The main goal is to observe every time that an area is used;
- Sommer and Sommer (2002) suggest spreading out the sessions throughout the day to minimize the probability to observe the same people performing the same activity more than one time;
- UGS should be visited, at least, during the morning and the afternoon, and during the week and weekend as well;
- Rodrigues (2015) suggests 12 observations in total to register the main UGS behaviours patterns.

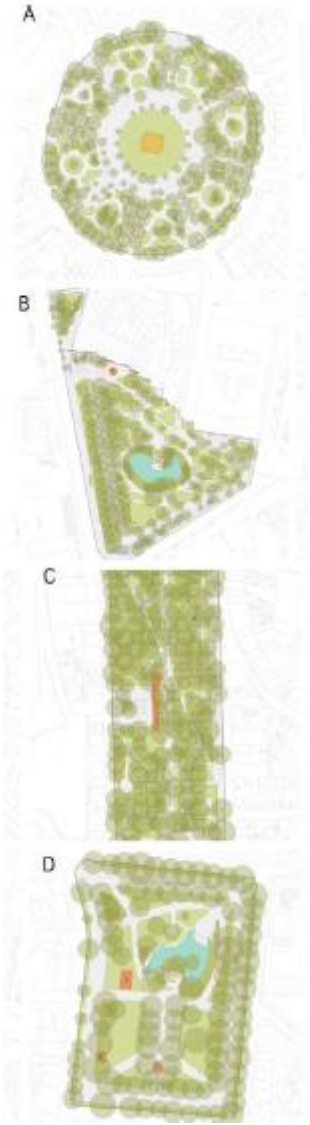
UGS								
Date		Hour			Temperature			
N	Gender	Age	Status	Social Interaction	Behaviour/Practice	Physical activity level	Mobility	Obs.

Observation procedure definition

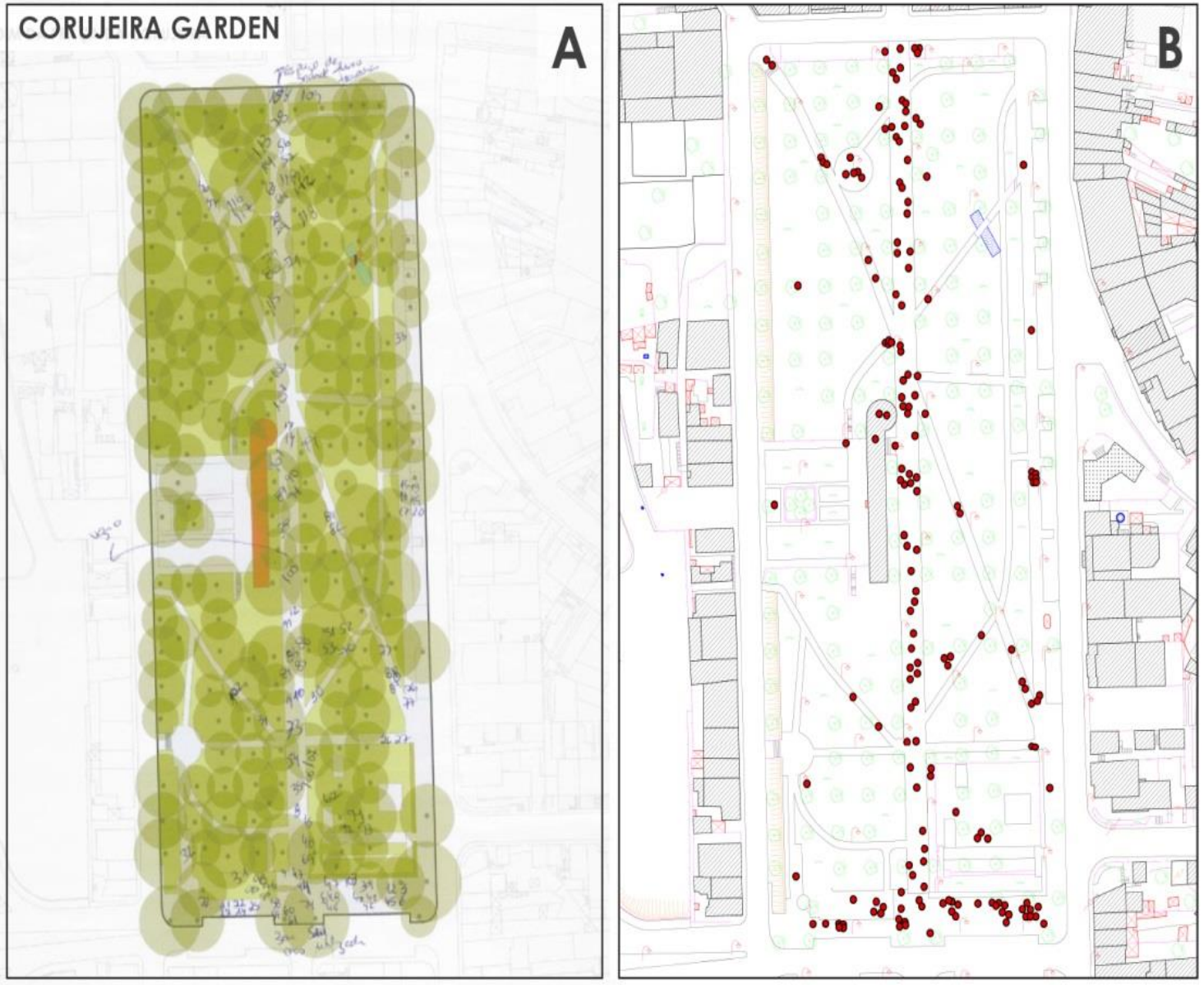
- Should be based on the UGS characteristics and on the free rounds;
- UGS is relatively small (i.e., it is possible to see, from one corner, the entire UGS and walk through it in about 10 minutes), the round should be **of 15-30 minutes to reduce the bias**;
- It is also crucial to observe during the free rounds who are the users of the UGS, i.e. if is a UGS that is mainly used by the same users;
- UGS is usually used by the same users: the observer needs to be careful to not be recognized, which could result in its identification as an intruder and lead to a change in users behaviours when they feel they are being observed (Ittelson et al. 1970);
- To minimise the bias: the observer needs to change the observation routine and route;
- It must end when theoretical saturation is reached, i.e. **when no new properties and dimensions emerge during analysis in terms of observed behaviours** (Bloor and Wood 2006).

Training observers and pre-test

- The final step consists of the observer training and pre-test application. This allows the familiarization of the categories and their codes, with the UGS layout and the designed protocol. Also, the pre-test is useful to identify certain problems regarding the protocol and categories that could need an adjustment, alongside the determination of the time required to scan the UGS.



Corujeira garden



Figure

A: Example of Corujeira garden base map with behaviours registered in situ

B: Cartographic representation through ArcGIS of user's behaviours.

Preliminary outcomes of BM applied in Corujeira garden

- 175 users were observed;
- Garden with a relatively low frequency intensity that is partly related to its location, in the middle of the urban fabric, but not in a central or tourist area of the city;
- Its users are mostly nearby residents;
- Male (56.6%);
- Elderly (42.3%);
- They frequent the space with another person (70.9%);
- Mainly in groups of two (44.4%).

Preliminary outcomes of BM applied in Corujeira garden

- Male users tend to be in the UGS with a larger group than females (more than 6 people) ($p < 0.005$) - pattern was previously identified in an ethnographic study carried out in a public garden in the city of Porto by Gouveia (2016), where elderly males prevailed;

- Female users tend to walk in UGS (52.6%), while men prefer to stay seated (67.7%) ($p<0.05$).

Preliminary outcomes of BM applied in Corujeira garden

- Green space is mainly used through the urban furniture, that is, paths and benches - activities are mostly performed seated (57.1%);
- Natural elements, such as grass, are not appealing - it may explain the poor exploration of the natural elements of the space;
- Many built elements discourage exploration of the natural elements - Ferret (2020) suggests that nature should be dominant, allowing the use imagination to explore the UGS;
- The south part is used more than the north, emphasizing that sunny areas are more desired by users. These areas are regularly used by older male groups for conversation;
- The presence of groups of trees is important as it is under and around them that users settle.

Potentialities and challenges

Sommer and Sommer (2002) state that this technique is more effective than interviews or questionnaires, especially when dealing with sensitive populations such as children.

On the other hand, the observation in this case is systematic.

It is necessary to question to what extent the non-consented observation of users' behavior is correct?

Wouldn't it be more ethically correct for the observer to be identified as such, even if this implies a change in the behavior of users?

It is a non-intrusive technique, resulting in accurate data collection, recording behavior in its context.

Respondents may not give an honest answer, particularly those related to daily practices or who they normally are.

In socio-ecological research, it offers the opportunity to combine social and ecological variables and to analyze how they are mutually influenced.

Policy recommendations to improve Corujeira garden

- The **poor quality of urban furniture** and the **deficient overall maintenance of the garden** strongly **discouraged its full exploration by its users**;
- Instead of lying on the grass to restore, talk, or relax, the UGS users prefer to seat on the benches mainly located in the paths and, also, close to the warm area (south side).;
- It is relevant to remark that this UGS is located in the middle of the urban fabric but outside the city centre, more often used by nearby residents, namely by the elderly to socialize with their friends and neighbours;
- It would be important **to improve both built and natural elements, as well as urban furniture, to attract more users, especially the younger, which are those that less use this UGS;**
- The opportunity to play on the grass and explore the UGS enhances creativeness and promotes physical activity, contributing to increasing well-being.

Final remarks

- BM represents a **technique that combines both social and ecological views** by recording UGS users' location on a map to identify behaviours patterns.;
- The main advantage of this technique is to be a **more objective measure of behaviours than self-reports,** by studying it in their physical and social contexts;
- Several steps need to be followed to assure the *data accuracy and reliability,* especially to reduce bias, ethical issues, intrusiveness and reactivity;
- BM could be potentiated when **combined with other techniques**, such as surveys and interviews;
- Due to the need for systematic observation, the **time consuming** needs to be taken into account;
- Once the data collection depends on the observer/researcher, **the familiarization with the map, categories and UGS needs to be guaranteed;**
- Useful for **environment-behaviour research and supports landscape planners and decision-makers** with empirical evidence on the relationship between UGS design and its uses.

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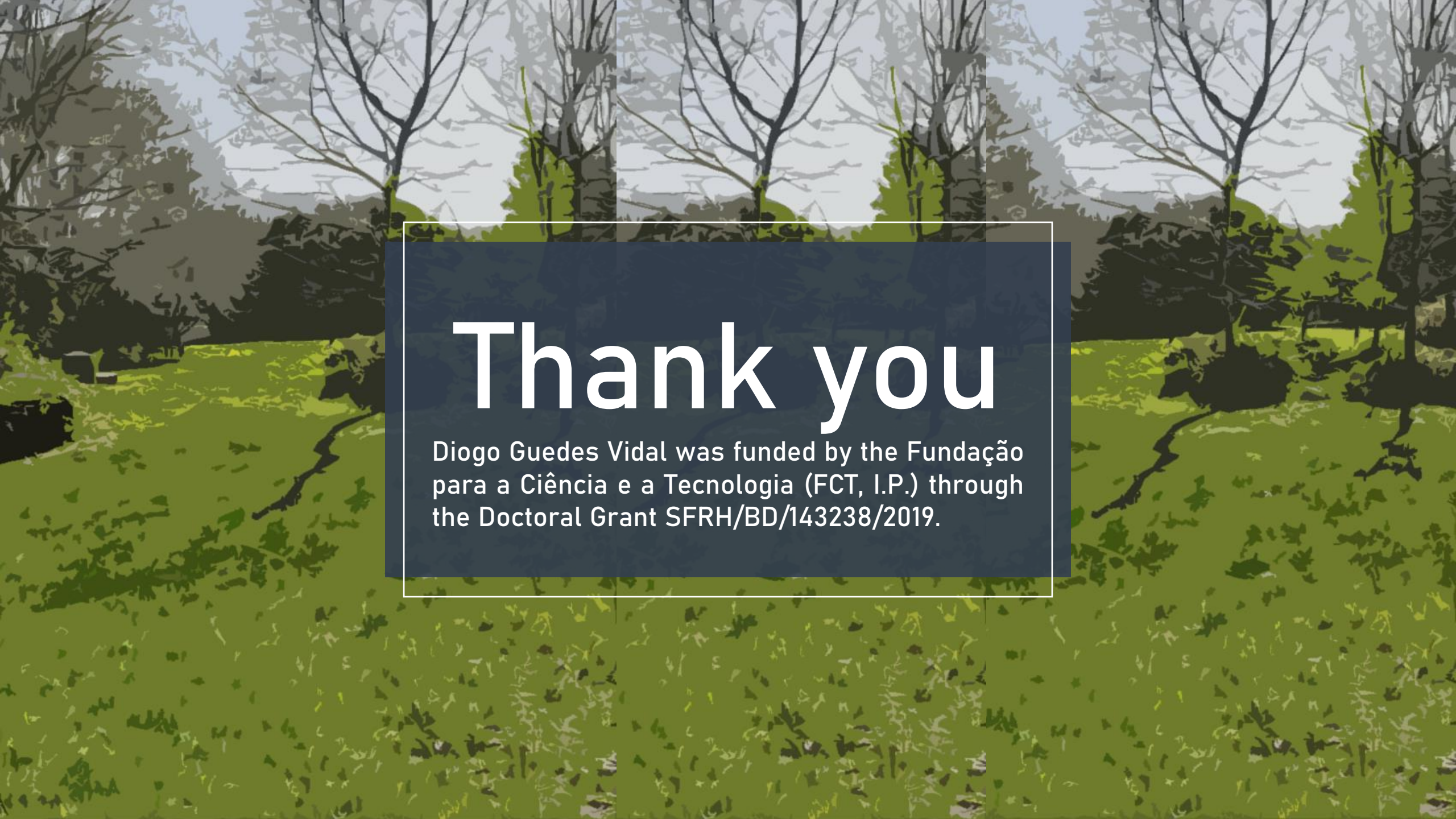

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