

Conceptualising affordances in multi-species niche construction in urban landscapes

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Landscape and Urban landscape

“**landscape** means an area, as perceived by people, whose characters is the result of the actions and interactions of natural and/or human factors ” (Council of Europe, 2000, Article 1)



Urban landscape as “the traits, patterns and structure of a city’s specific geographic area, including its biological composition, its physical environment and its social patterns.” <https://www.eionet.europa.eu/>

What is niche? urban landscape are evolving multi-species niche (architecture)

“it is an environmental factors or location *Or* its not just an an environment but a behavioural-ecological conjunction” (Marlowe, 2005: 54)

“the conditions and resources needed by an individual or a species in order to practice its way of life”. (Begon, M., & Townsend, C. R. (2020).

“the niche summarises the the environmental factors that influence the growth, survival, and reproduction of species”. (Molles, 2016)

*** Landscape as assemblage of places provide affordances**

*** landscape of affordances present in a place**

Urban landscape as a niche (- const...)

- Human are prolific niche constructors create constraints for wild species but also create novel opportunity for other species to create their own niche (gaining a different direction or speed of evolutionary change along side the natural selection as an evolutionary process.)
- Urban landscape produces “a complex variety of behavioral-resource niches... not all of which are intended by their builders ([Downey, 2016](#)).
- As a multi-species niche construction , urban landscape e.g. urban gardens planned by and maintained by human provide niche for nesting sites for birds, mammals, pollen for insects, and damp microclimates for soil organisms leading to a more co-evolved habitats ([Niesner et al., 2021](#)).
- Planners and landscape architects must focus on human agency and adaptive response of animal species ([Downey, 2016](#))
- Urban environments alter selective pressure (affect both humans and non-humans positively and negatively).



Niche construction theory

Niche construction is a process whereby organisms actively modify their own and each others' evolutionary niche (Odling-Smee et al., 2003).

Is the sum of all natural **selection pressure** to which the population is exposed to, defined an “*evolutionary niche*”, which is also explained by how organisms **construct developmental environment** for their offspring, and modify the environmental state that will be experienced by future generations create a process “*ecological inheritance*”.

Niche construction suggest how selection is affected both by physical change that organism that bring about in the environment, and when they move in space and exposed to new conditions. (Laland et al., 2016)

Matthews et al. (2014) proposed a set of criteria to understand the presence of *niche construction*:

1. Organism must modify an environment
2. Organism-mediated environmental modification(s) influence selection process on the recipient organism.
3. And there must be an evolutionary response and feedback.

Theory of affordance

In Gibson's words, "the affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill... (Gibson, 2014).

In simple terms: Affordances denote the *action possibilities* the environment offers to an organism (Gibson, 2014).

It's a framing perception as an active process of discovering what the environment *allows* one to do, and the perception and action are tightly intertwined.

According to Norman (1999), when we see affordance for design thinking: affordance has come to mean the *perceivable hint* of an object's use (e.g., a door handle "suggests" pulling)



Affordances are context and species specific

Without seeing environment as a set of objective property, affordance suggests for relational view i.e. i.e. an *object or space or surface* has affordances in relation to the organism's capabilities, needs, and intentions. Gibsonian idea of affordance is rather original suggest for "*natural fit between an animal and its environment.*"

Cultural niche construction and affordance

With a focus on the urban landscape, and form the human-nature relationship and eco-social recovery focus: [Kaaronen and Strelkovskii \(2020\)](#) & [Nagatsu et al., \(2023\)](#)

- Human inhabits a cultural-ecological niche that provide behavioural opportunities (affordances).
- The affordances in ecological niche enables behaviour and learning and propagation of learning.
- Behaviour patterns enabled by these affordances can reinforce learned behaviour, converting into to knowledge and practices, attitudes and behaviour.
- These affordances in an ecological niche can be altered and refined via intentional cultural niche.

Why affordances?

Affordance as concept is compatible with two strands of evolutionary mechanism niche construction and natural selection ([Heras-Escribano, 2020](#))

In niche construction, **Affordance** can be considered both as *resource within* natural selection process and *as aspects within* niche construction process ([Heras- Escribano, 2020](#))

It implies the *complementarity* of the animal and the environment” that lead to the **niche construction** for that specific animal,



Western Turku waterfront NOW



Western Turku waterfront for Vision 2050

Urban Planning relevance of social affordances that promote cultural niche construction

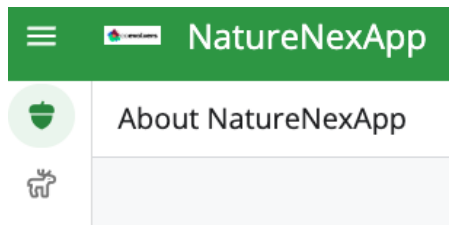
1. What **types of activities and/or services** would you hope for the maritime western Turku area to provide in the future?
2. How do you think the maritime western Turku area should develop as a residential area? **What kinds of housing options do you think the area should offer in the future?**
3. What kinds of **experiences and attractions** could the area offer to **tourists** and visitors in the future?
4. What **solutions and activities** that promote well-being, community, and **quality of life** would you like to see developed in the area?
5. In what **concrete ways** could the sea, water, and nature be **more prominent and experienceable** in the area in the future?
7. If the **waterfront area** were to become available for new **activities in the future**, how would you like to see it develop? What kinds of activities would you like to see near the waterfront?
8. And **what kinds of activities** do you think should be **established** in the Turkuhalli (Gatorade Center) and Exhibition Center spaces/area if they become available in the future?
9. What **distinctive features of the area** do you think should be **preserved in future development** of the area?
10. What else do you **hope for the future** of the maritime western Turku area?



The maritime vision of western Turku, Survey, <https://kerrokantasi.turku.fi/merellinen-visio/Osu2LG5CmBxcrodUVNUW8jvzb3oQpqZ?headless=false&lang=en>

Methods Used In Pansio-Perno Living Lab i.e. Umwelt and Affordance Analysis For Eco-Social Niche Construction.

- Behaviour observation and mapping - A non participatory method to understand environmental affordances
- Storytelling (subjective assessment) i.e. NatureNexApp
- Umwelt analysis (an expert assessment)



Behaviour observation and mapping is an on-site assessment technique that objectively links *place affordances with behaviour settings* (Ward Thompson, 2013). "**Behaviour settings**" are ecological units that determines individual's or collective actions that inhabit that and shapes their perceptions.



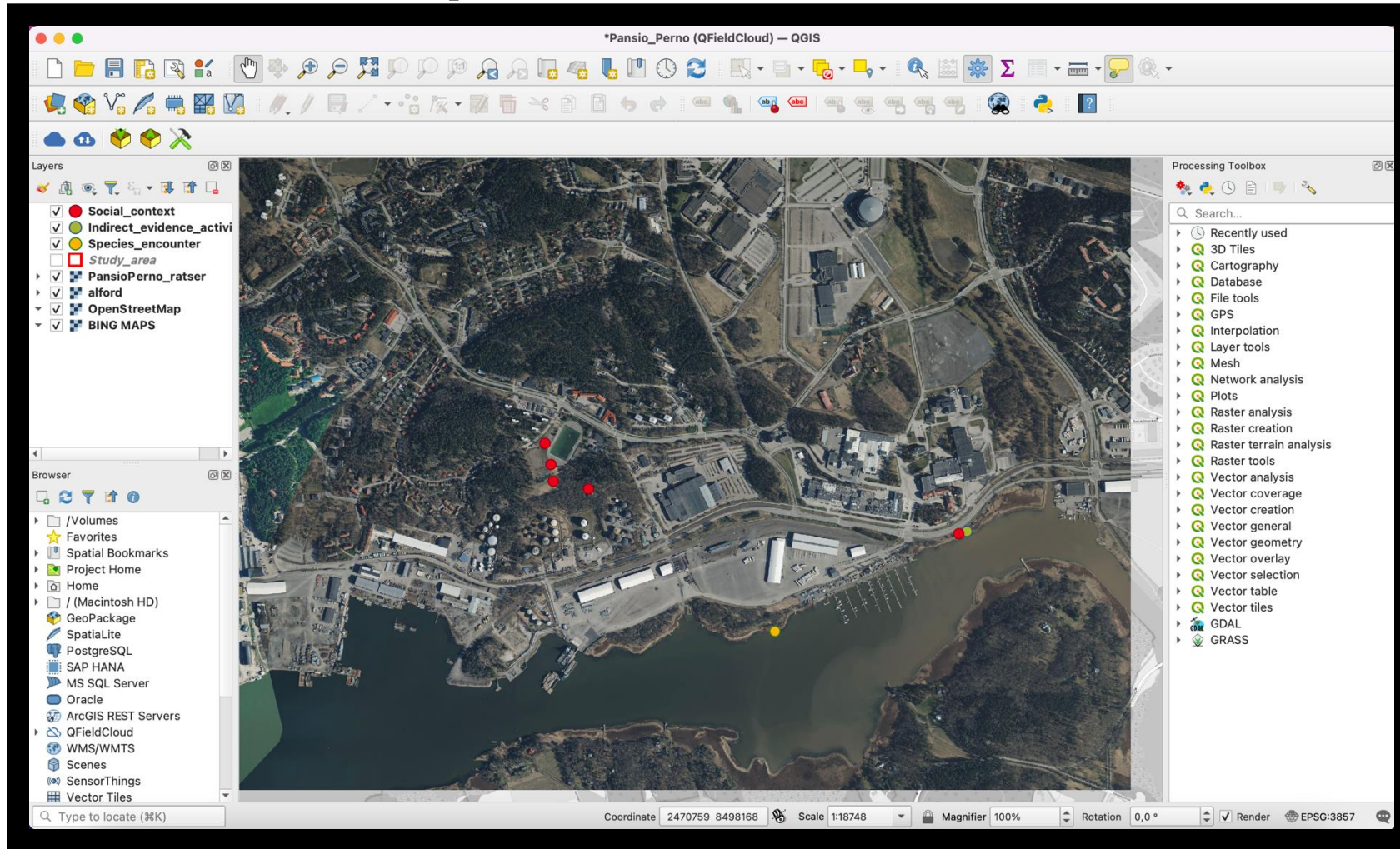
ESBMT- Eco-Social Compensation Behaviour Mapping
Tool that maps social activities and presence of non-humans in Pansio-Perno green and blue space

The observation were carried out in May-September 2024 over 12 weeks, for equal number of representative weekdays and weekends, and time of the day i.e. morning, lunchtime, afternoon, evening

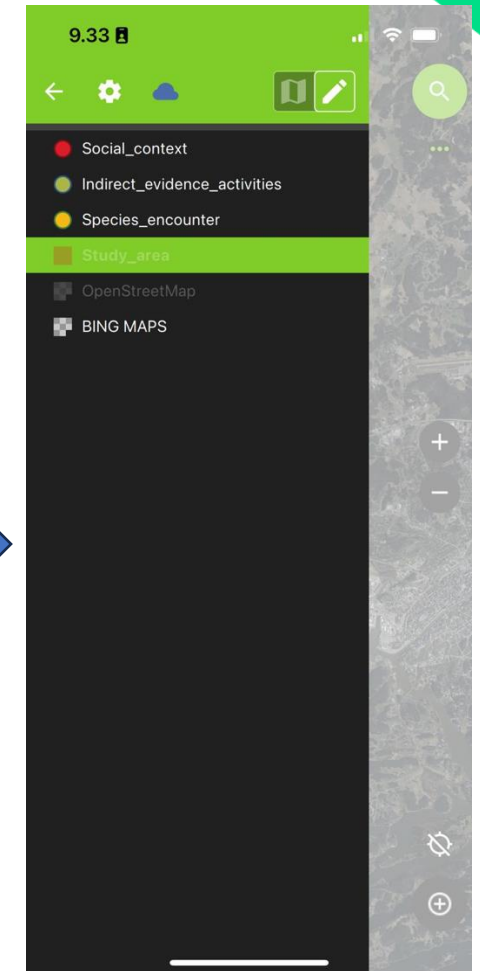
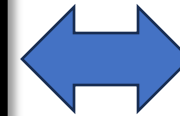
Behaviour data was collected by human observers (4 nos) using an Open GIS platform: QGIS and observation was carried out using a hand-held device. Used a non-participatory means of observing activities.

Observation episodes were for one hour.

Behaviour data collection protocol



Desktop Version/ local file



Phone or tablet version



The screenshot shows a software interface for recording observations. On the left, a map displays a green area with a blue path. A large dropdown menu is open, listing various activities. The menu is organized into sections: 'Sitting and relaxing', 'Sitting and observing', 'Performing postures or therapeutic act e.g. Yoga', 'Sleeping', 'Sunbathing', 'Walking (quickly)', 'Strolling', 'walking with a pram', 'Cycling', 'Other wheeled activities', 'Walking with a dog' (highlighted in orange), 'Playing with a dog', 'Nordic walking with sticks', 'Playing freely with friends', 'Child playing freely', 'Child playing on an equipment', 'Other games of informal sports e.g. frisbee', 'Fishing', 'Swimming', 'Boating or kayaking and other similar', 'Educational or reading', 'Conservation activity', 'Barbequing', 'Picnicking', 'Foraging', 'Other forest activities', 'Other activities not listed', and '(NULL)'. At the bottom of the form are 'Cancel' and 'OK' buttons.

ESBMT- Observation form showing a dropdown menu for human activities that can be recorded onsite.

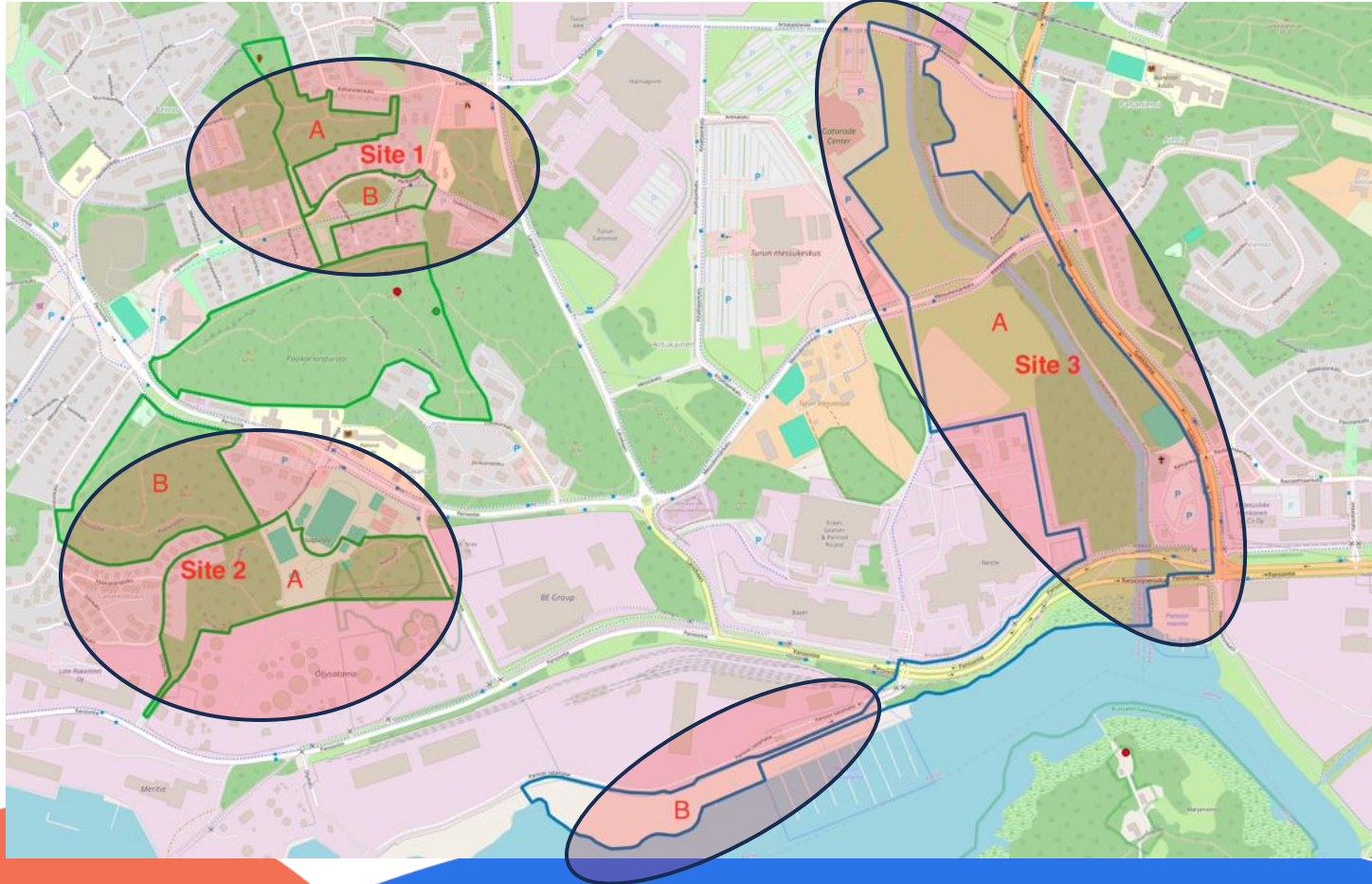
The screenshot shows a 'Species_Info - Feature Attributes' dialog box. It contains the following fields: 'Species_en' with the value 'NULL', 'Encount_ty' with the value '(NULL)', 'Photo' with the value 'NULL' and a camera icon, 'Id' with the value '{0ae633d4-82ee-4937-a5ae-4136866ecb25}', and 'Time' with the value '3.6.2024 15:24:44'. At the bottom are 'Cancel' and 'OK' buttons.

ESBMT- Observation form showing how to record information on species encountered in the area.

In Total 53 affordances were mapped at 4 locations or ecosystems In Pansio-Perno includes : terrestrial, riverine, coastal

Affordances	Affordances
Boat	Sawing branches from a fallen tree
Cycling, wearing a hiking backpack	
Dancing	Sheltered from the rain under an equipment
Driving a motorcycle	Sleeping in a pram
Fixing the play area	Smoking
Football	Smoking cigarette
Gardening	Standing
Graffiti in the middle of the sand road	Standing, observing nature, taking pictures with the phone
Hanging out with a dog in a dog park	Swinging
Horse back riding	Taking a picture
It is a hot day. Nature is very peaceful.	Talking on phone with someone and smoking cigarette
Animals are resting.	Training at the outdoor gym
Jogging	Using outside exercise equipment
Kicking ball	
Maintenance	Using a electronic scooter
Nordic walking	Using an electronic scooter
Observing	Using exercise equipment
On a playground in a group	Using outside exercise equipment
On a playground with a toddler	
Outdoor gym workout	Waiting for the bus
Outdoor workout	Walking a cat
Outdoor gym workout	Walking as a workout
Peeing	Watering vegetable garden
Peeing, perhaps	Went peeing from garden lot, I think
Physical exercise	
Physical training with equipment	Workout
Physical training	Workout walk
Playing football	
Rainy day	
Rainy weather. Not a lot of people outside	
Running	

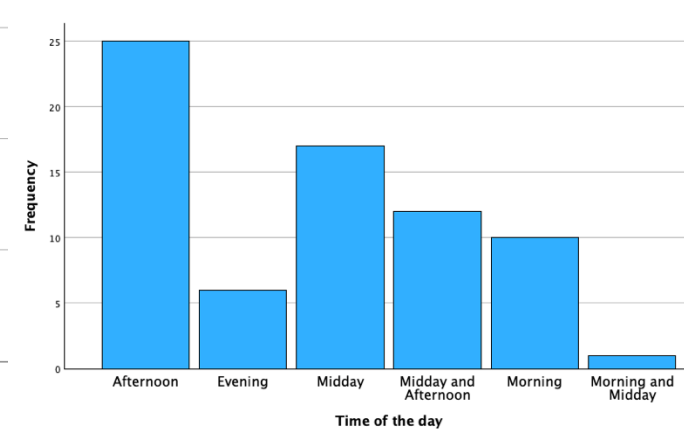
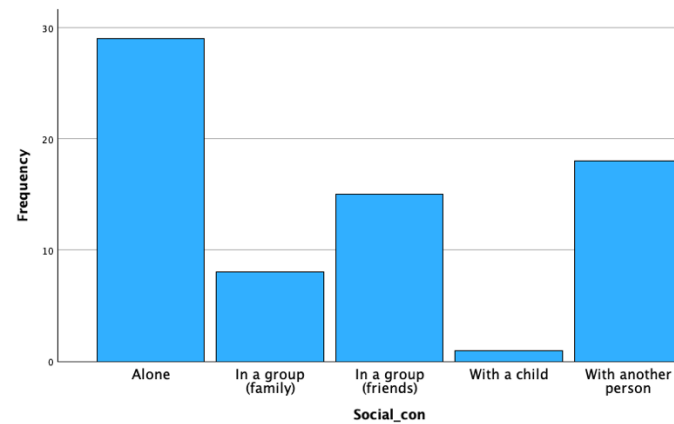
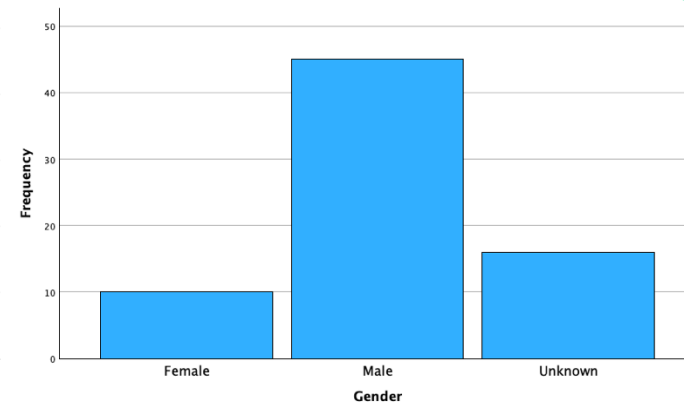
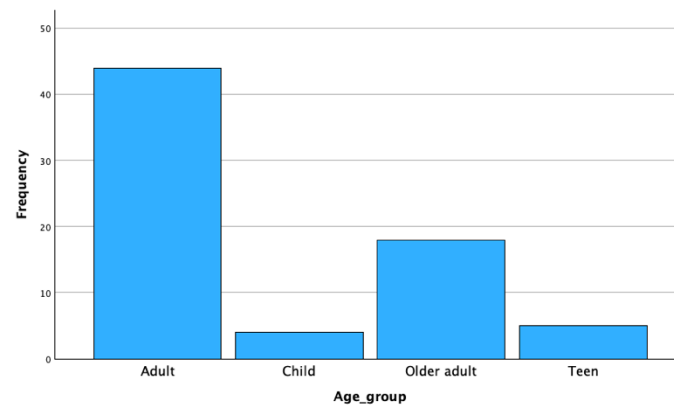
Behaviour Observations data to support eco-social niche construction (evidence)



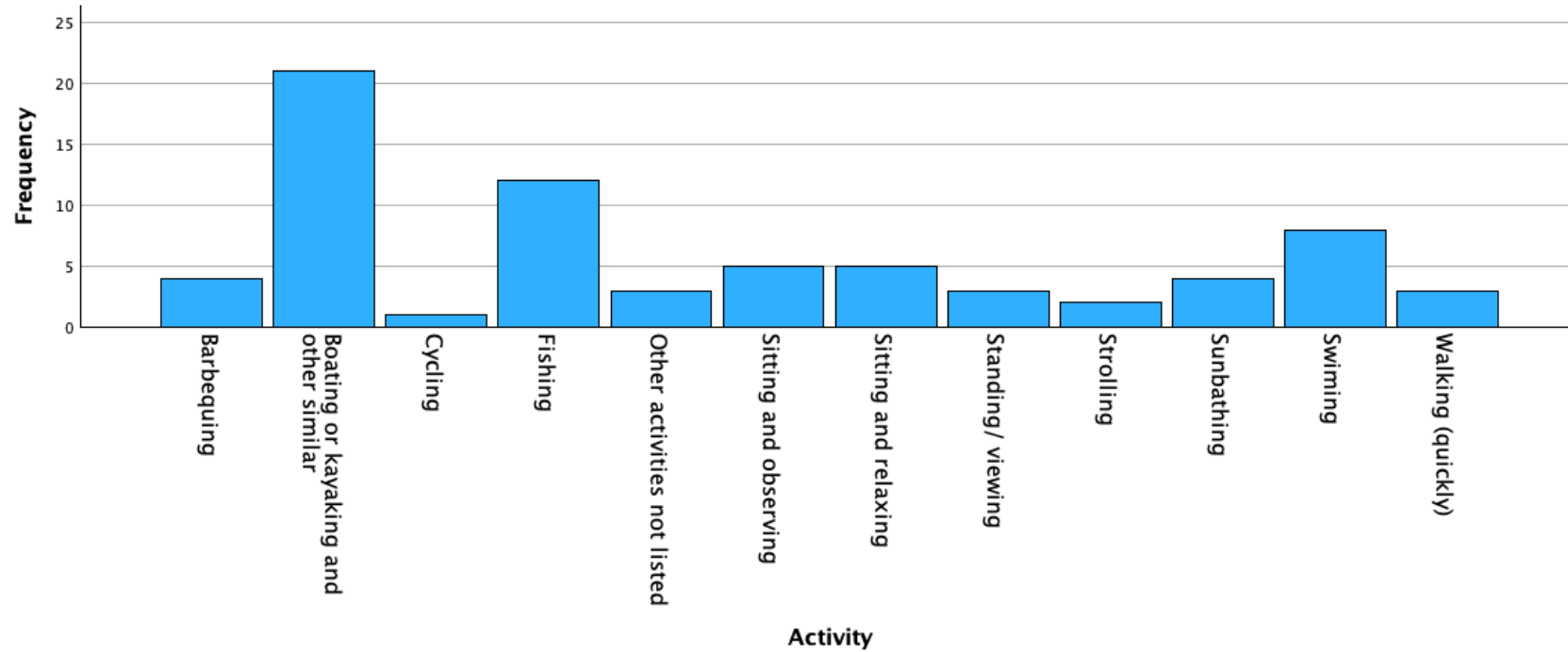
1. Perno- housing area with urban forest
2. Pansio-perno central park with community and sports facility, housing with urban forest
3. Raisiojoki (Raisio river corridor)
4. Pansio Satamatie waterfront recreation area

These site offer diversity of ecological and behaviour settings to understand cultural affordances of Pansio-Perno urban nature.

Site 4: Pansio Satamatie waterfront recreation area



Total number of observations - 71.



Cultural niche construction opportunities (affordances): for older adults, teens and children, female users, visitors with children, and opportunities for sitting, relaxing and viewing water, sunbathing, barbeque, places to stand and view water etc.



Example: Cultural niche construction in a derelict Waterfront



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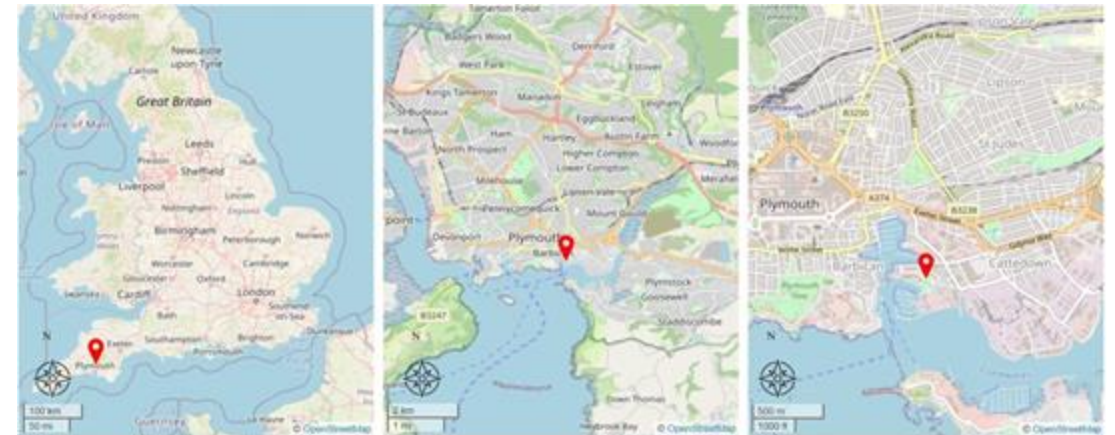
Theory-based design for promoting positive behaviours in an urban blue space: Pre-and-post observations of a community co-created intervention in Plymouth, United Kingdom

Himansu Sekhar Mishra ^{a b} ✉, Simon Bell ^{b c}, Bethany R. Roberts ^d, Mathew P. White ^{d e}

(Mishra et al., 2023)

- The site is located along a busy pedestrian and cycle access path within a community.
- The densification of the surrounding area of Teats Hill, the construction of a marina and the abandonment of an old slipway made the site less usable.
- A lack of investment in facilities and overgrowing vegetation also led to a run-down atmosphere and illegal and anti-social behaviour.
- As a result, the site lacked place quality and community identity and offered visitors a less attractive outdoor destination with few affordances for recreation.

The site, Teats Hill in Plymouth, UK a public green and blue space, was identified for the intervention (co-created blue space intervention was part of of active neighbourhood project run by City of Plymouth and H2020 project Blue Health).



Teats Hill Site condition: Pre-Intervention



1. Access path



2. The park



3. The upper slip road



4. The Lower slip road



5. The water interface area



Niche construction through affordances using landscape design

Observation Year 2017 (T1)



Pre-intervention site condition, 2017 (T1)

Observation Year 2018 (T2)



Post-intervention site condition, 2018 (T2)

Teats Hill Site condition: Post-Intervention

The intervention and the design



1. Access path

Intervention includes installation of site information board along the access path.



Author: Himansu Mishra

2. The park

Interventions include vegetation clearance and site management, installation of information board (Plymouth marine life).

ers

Teats Hill Site condition: Post-Intervention



3. The upper slip road

Interventions include installation of gate, and play and recreation improvements.



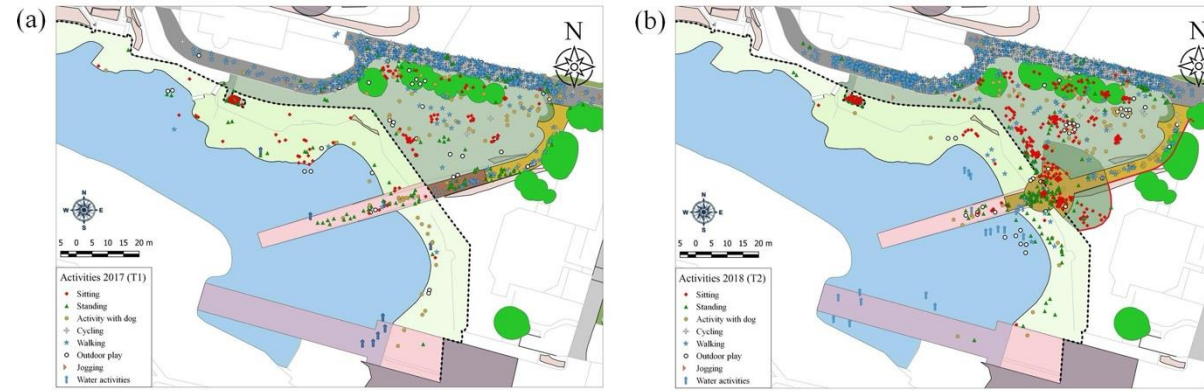
Author: Himansu Mishra

4. The lower slip road

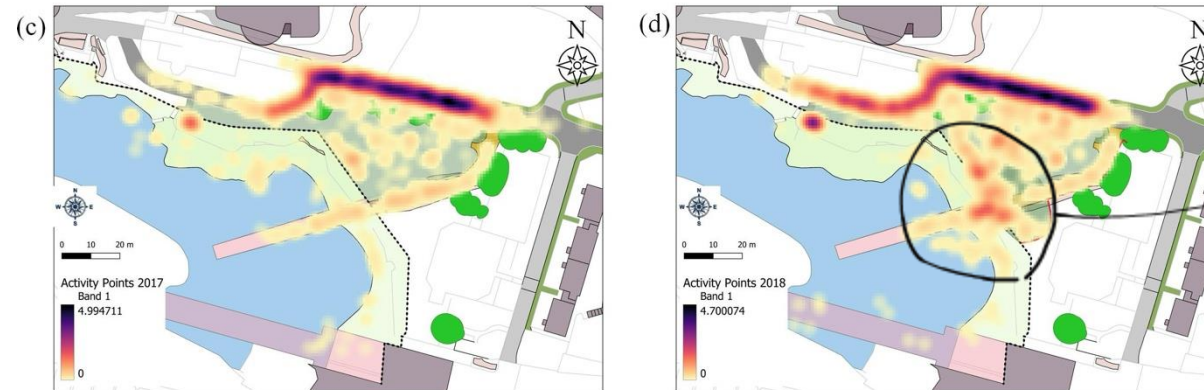
Interventions include open-air theatre, resurfacing of damaged slip way, sloping grass area for sitting and relaxing.

Observation Year 2017 (T1)

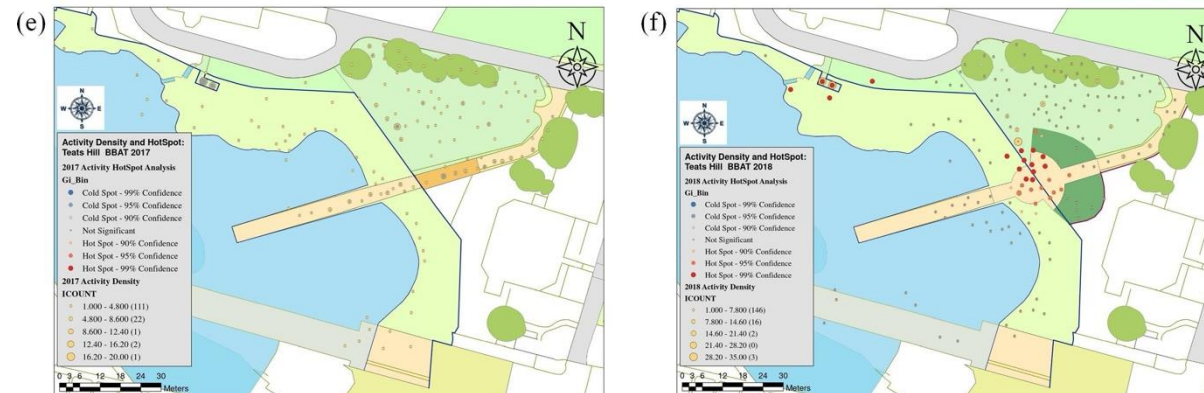
Observation Year 2018 (T2)



Figures compare the distribution of different activity points at T1 and T2.



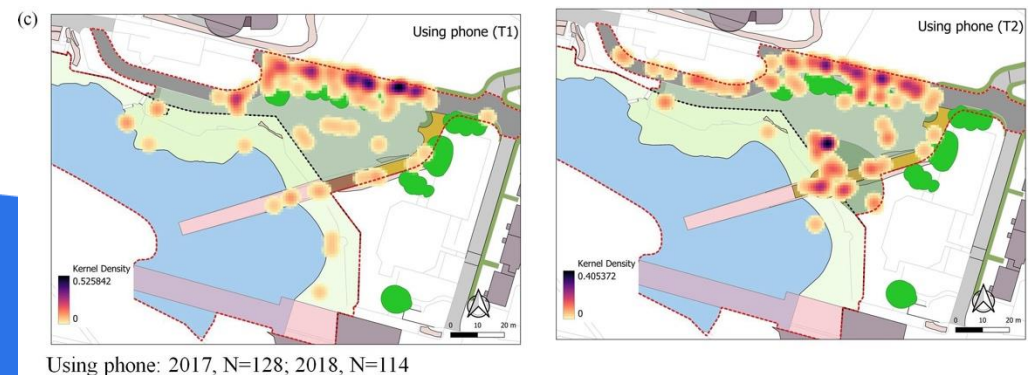
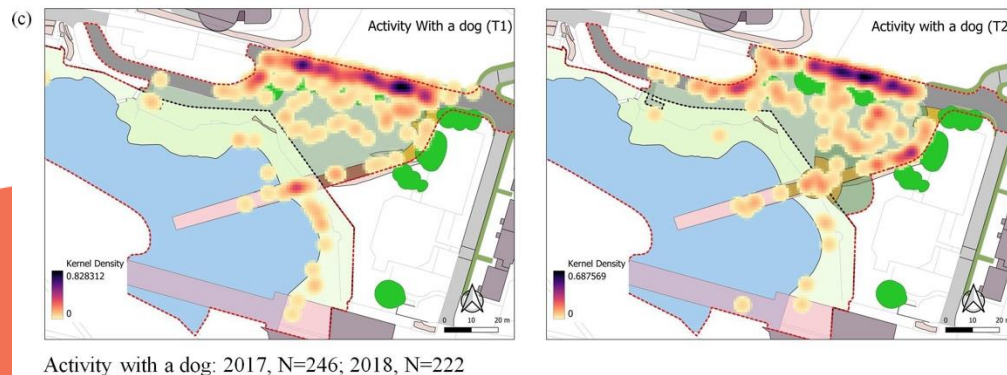
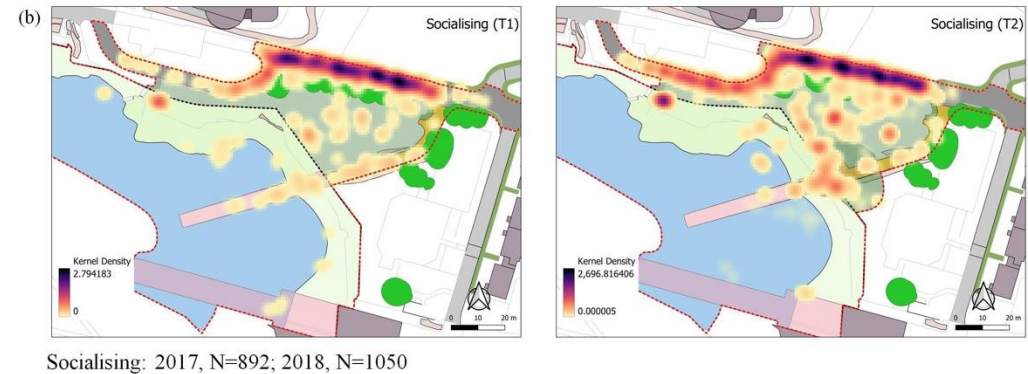
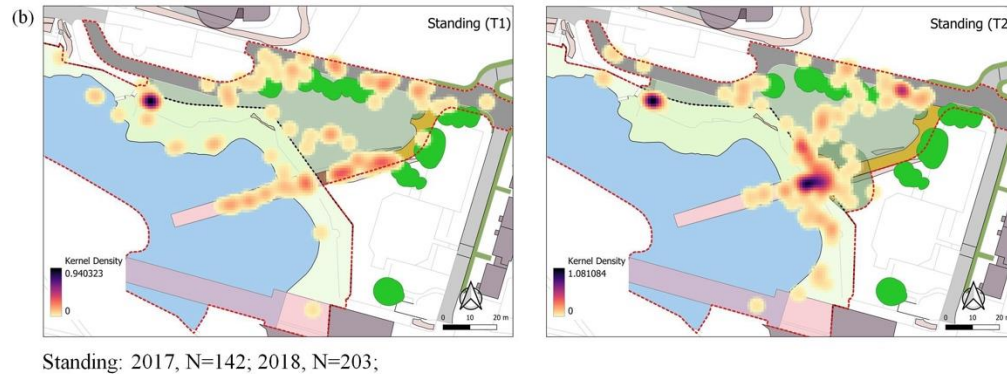
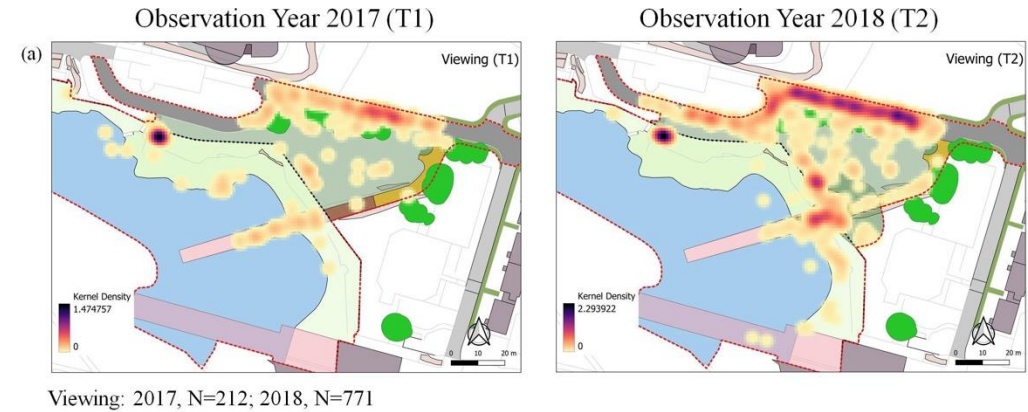
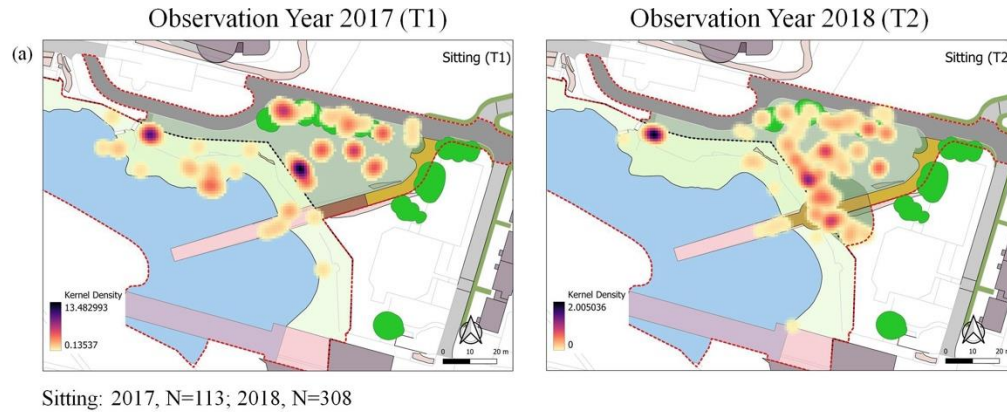
Figures compare the density of observed activity points using kernel density heat maps with a 4 metre radius around each point and 1 metre raster cell size.



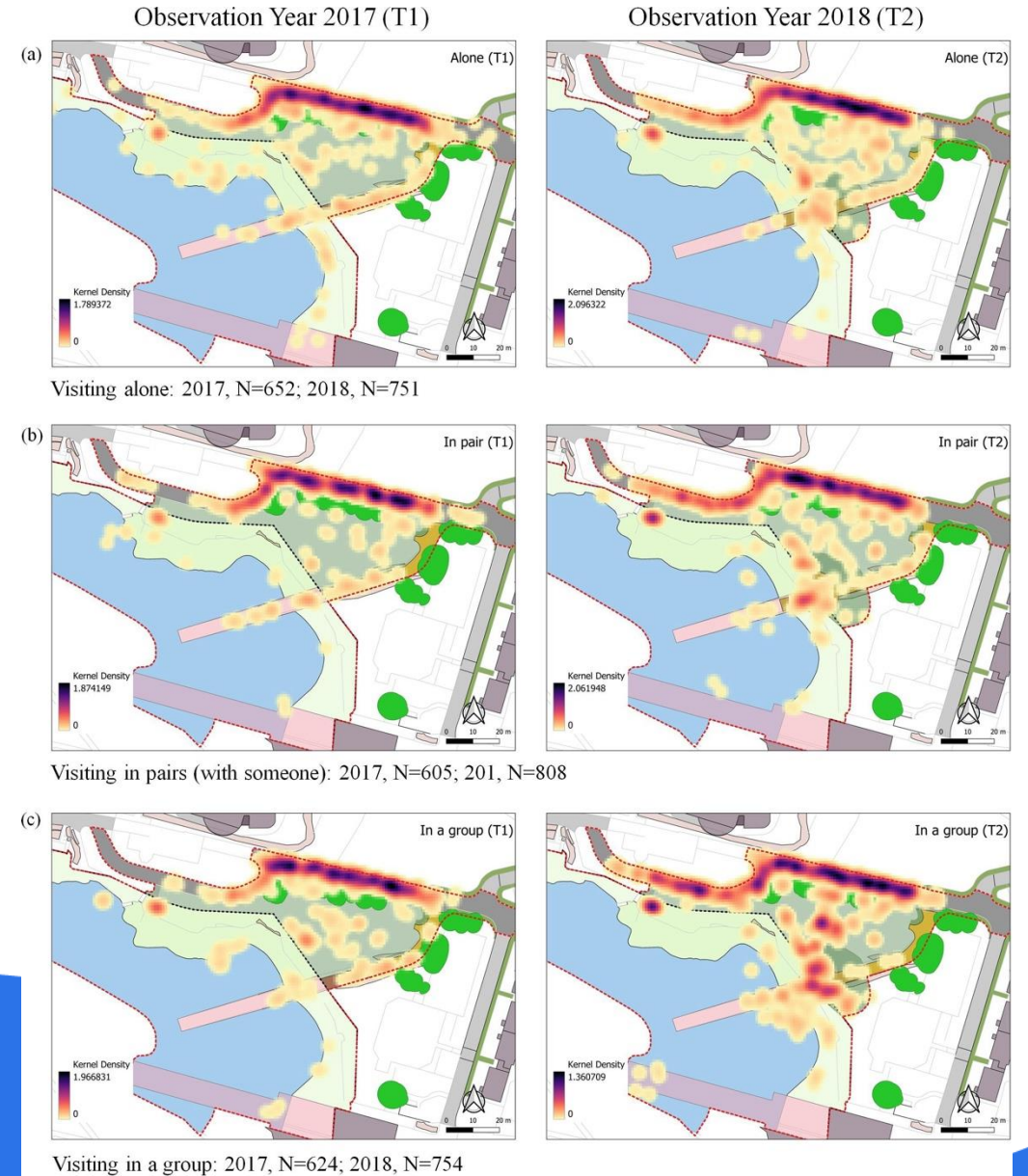
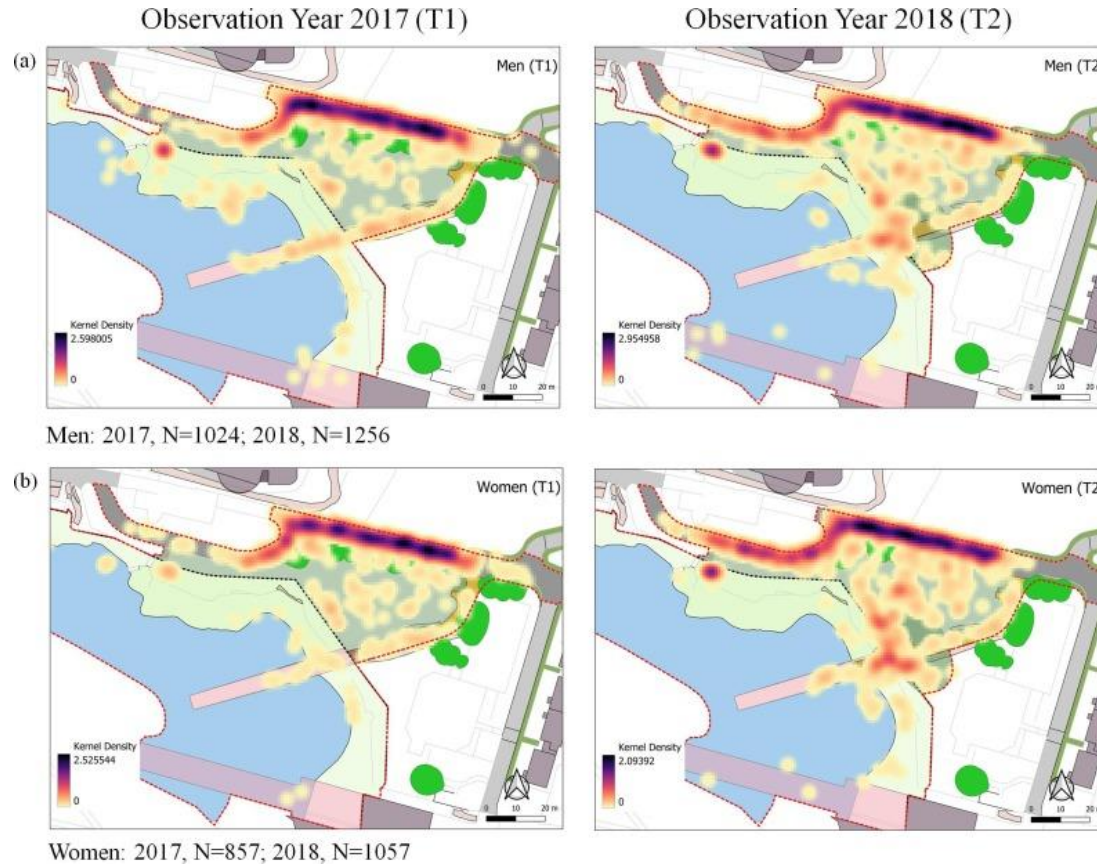
The red dots represent the clustering was statistically significant

Figures compare the hot spot analysis of activity points at T1 and T2 and statistically confirms the significance of the clustering of visitors at the lower slip road (the open-air theatre) in T2 despite overall low visit predictability.

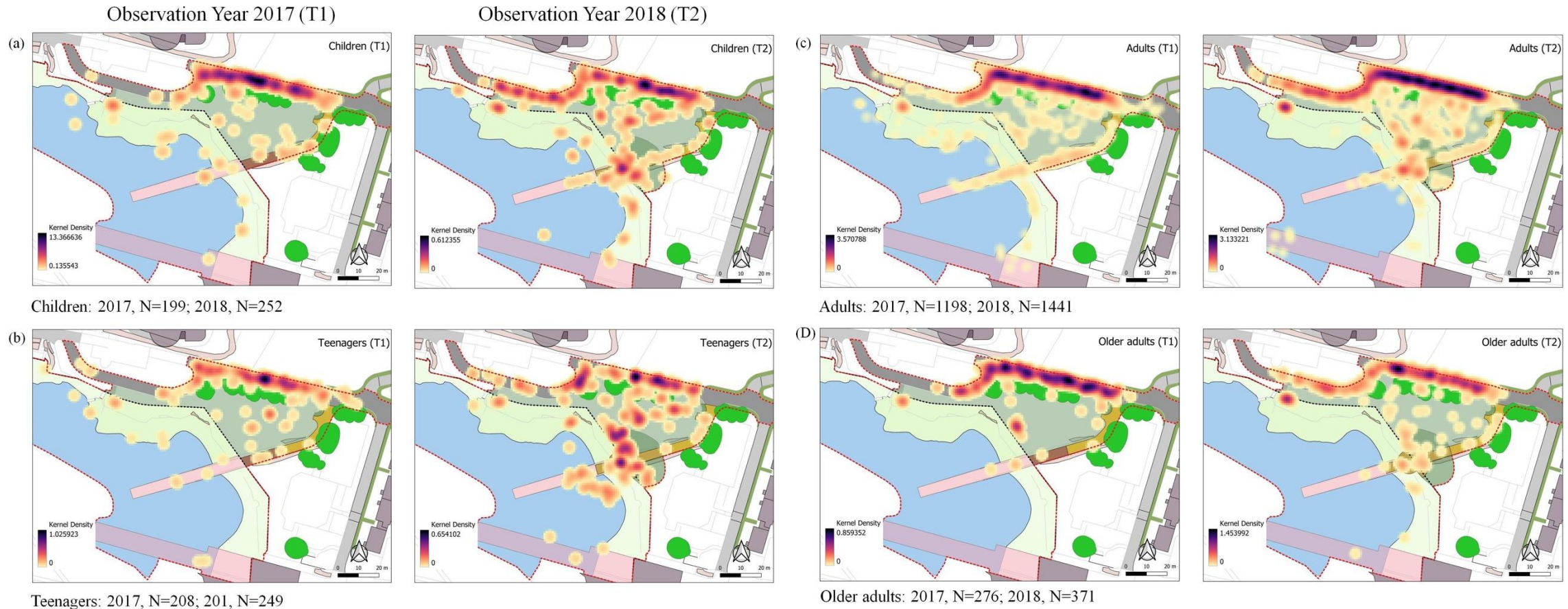
Cultural niche constructed through affordances as resource within the natural selection process as Well as aspects within Niche Construction Process (continuous niche construction)

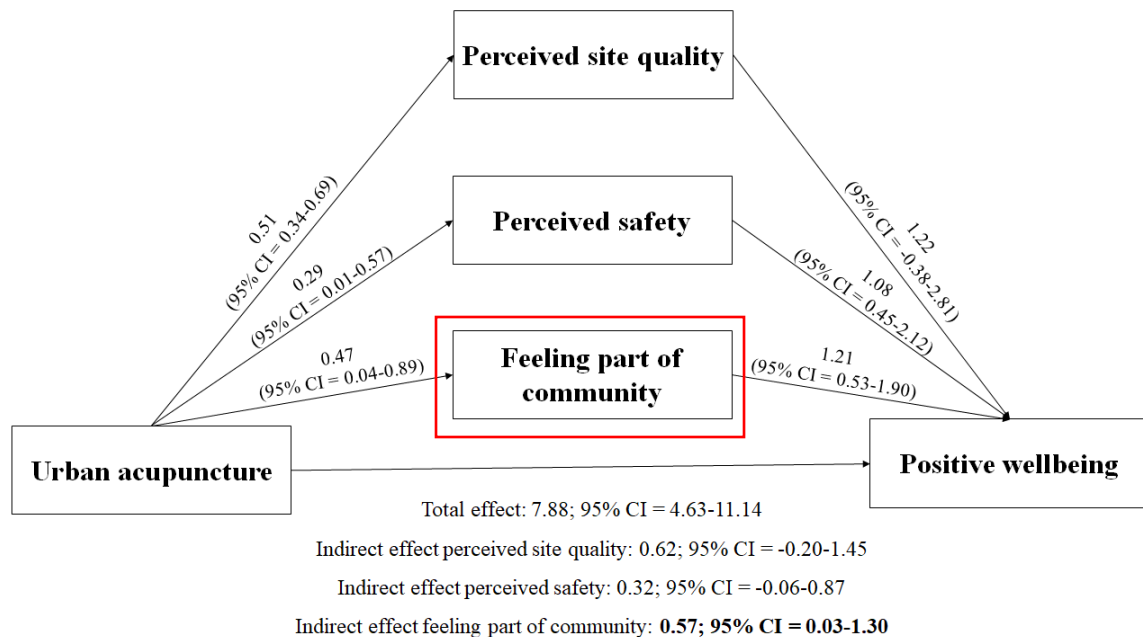


Improved niche conditions improved the perception of safety and adaptability by vulnerable groups



Improved cultural niche niche construction in the place improved the place sociability and diversity





Mediation model for Intervention vs **Positive Well-being** , only “feeling part of the community” partially mediated the association between the (Intervention indirect effect = 0.57; 95% CI = 0.03–1.30) and explained 7% of total effect.
(n = 533).

Author: van den Bogerd et al., 2021



Mediation model for Intervention vs **Life Satisfaction** partly explained by the satisfaction with community belonging (indirect effect = 0.06; 95% CI = 0.01–0.14), explained by 16.4% and by satisfaction with personal safety (indirect effect = 0.09; 95% CI = 0.04–0.19) explained by 22.6% .
(n = 548)

Niche construction can be understood as a key leverage point for triggering collective behavior change as well as change in attitudes and social norms.

Humans inhabit cultural-ecological niches which provide behavioral opportunities (affordances).

The affordances in ecological niches enable (and constrain) behaviors, which can spread in social networks through the key cultural evolutionary mechanism of social learning (e.g., the copying of others or conformism).

Behavioral patterns enabled by these affordances can reinforce learned behaviors through individual learning (development of know-how, habituation, attitude change, affective change, etc.).

These affordances in an ecological niche can be altered and refined via intentional cultural niche construction (such as the design of everyday environments and infrastructure).

Cultural niche created (altered or modified):

- Installation of site information boards
- Vegetation clearance and site management
- Installation of gate and play and recreation improvements
- **Open-air theatre**
- Resurfacing of damaged slip way
- Sloping grass area for sitting and Relaxing

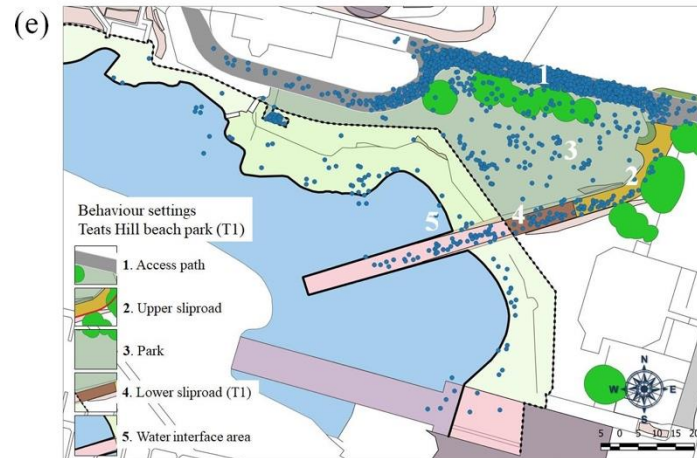


Figure showing mapped activity points using the BBAT at Teats Hill behaviour settings during the warm period (July-September) for T1- 2017: 1881 observation points, 28 observation episodes, 56 hrs of observation time.

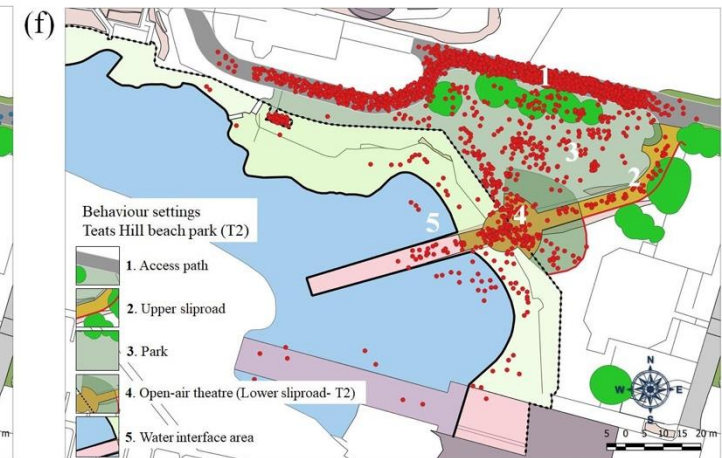


Figure showing mapped activity points using the BBAT at Teats Hill behaviour settings during the warm period (July-September) for T2-2018: 2313 observation points, 29 observation episodes, 58 hrs of observation time.

Kaaronen and Strelkovskii (2020) & Nagatsu et al., (2023)

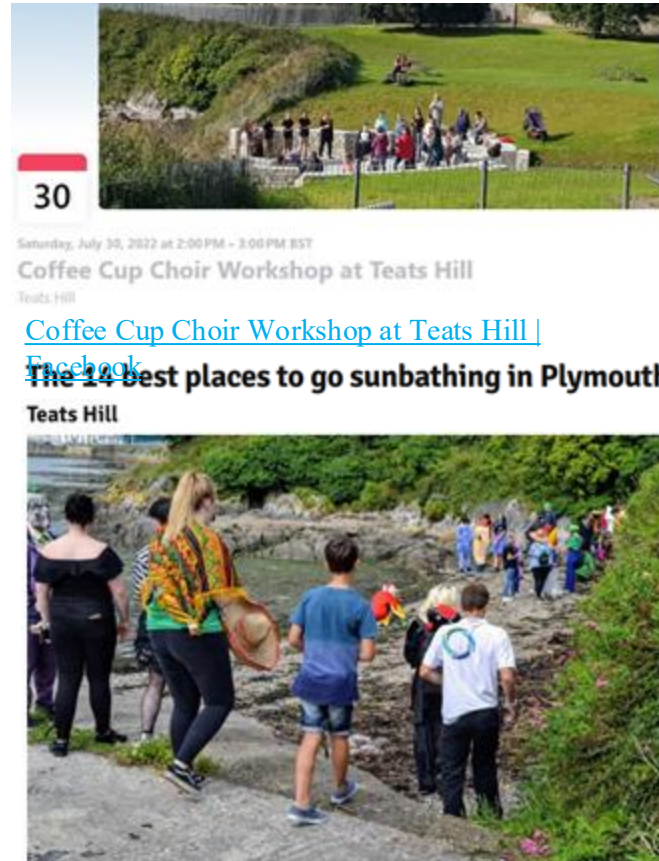
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Well-managed green spaces + cleared waterfront + new attractive vegetation + cultural elements



People organise events/nature walks/recreation
- Slowly behaviours spread through social networks
- New culture of use and practices and habits emerged

Kaaronen and Strelkovskii (2020) & Nagatsu et al., (2023)

[The 14 best places to go sunbathing in Plymouth - Plymouth Live](#)

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Kaaronen and Strelkovskii (2020) & Nagatsu et al., (2023)



Active Neighbourhoods —
Urban nature delivering healthier
communities for people and wildlife
Final Report (2016–2019)

https://bluehealth2020.eu/wp/wp-content/uploads/2017/01/Active_Neighbourhood_Report.pdf

So a big thank you also to you and your team for the facilities and the amphitheatre - it gets quite a lot of use particularly at times of celebration and festivals - Eid saw it in use a great deal. All ages, genders and cultures playing together was lovely to see. The football pitch gets a lot of use both for football and for bike riding for the very young ones.

David, local resident at Teats Hill

We went to Teat's Hill today and my son had a great time hunting bugs and making his own rope. The staff are really helpful and welcoming. A great way to get out and keep summer holiday costs down!

Anna, local parent

I have lived here 14 years and it really has changed my outlook on Plymouth, seeing the open spaces and the varied wildlife.

Kate, local volunteer



“The landscape was structured to afford repeated, meaningful individual engagement—enabling behavioral patterns such as daily walking, quiet reflection, or community gathering, which reinforce themselves over time through direct learning and emotional association.”

SHAPED BY DESIGN -
SUSTAINED BY
BEHAVIOR



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Kaaronen and Strelkovskii (2020) & Nagatsu et al., (2023)



“*Intentional cultural niche construction* in landscape design alters and refines affordances by reshaping the physical, ecological, and symbolic layers of a place—enables new patterns of behaviour, learning, and cultural expression to emerge and thrive, and evolve.”



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Thank you for your attention!

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