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# Therapeutic place design for healthier ageing and neurological resilience

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## Introduction

### Background

Neuroplasticity is the brain's ability to undergo structural and functional change through interaction with its environment.

Recent research demonstrates the neurological consequences of spatial experience (Coutrot et al. 2022; Dahmani & Bohbot, 2020; Konishi & Bohbot, 2013).

### Research questions

1: How do environmental characteristics in the places we live influence ageing and cognition?

2: Can we design places that act in a preventative manner toward conditions of neurodegeneration?

3: How might we better critique non-drug treatment approaches to neurodegenerative disorders?

### What did we do?

A review of (1) neuroplasticity literature, (2) Parkinson's and Alzheimer's non-drug treatment approaches and (3) recent research at the intersection of geography and neuroscience examining the neurological consequences of spatial experience.

Applied de Certeau's (1988) tactic-strategy dichotomy to understand how neurorehabilitation approaches interact with place and power, using a mini case study.

Made design suggestions for healthier ageing and neurological resilience.

## Part 1: Parkinson's, Alzheimer's and the interface between place design and behaviour

Alzheimer's: linked to hippocampus degeneration

navigation tasks: spatial strategies considered hippocampus-dependent and allocentric

Konishi & Bohbot (2013): "Promoting the use of spatial strategies can be a potential avenue for intervention methods against hippocampal atrophy"

Parkinson's: linked to basal ganglia degeneration

navigation tasks: response strategies considered striatal-dependent and egocentric

Kearney & Brittain (2021): "it is better to train the underlying ability to identify and utilise contextual cues and to do so in a range of interesting environments that invite exploration and the use of task-relevant filtering to draw out cues to enhance movement"

Packard & Goodman (2013)

### Differential activation of hippocampal or basal ganglia circuits through environment

"Altering experimental factors such as those reviewed above differentially impacts the acquisition and expression of cognitive and habit memory, and biases animals toward the use of a certain memory system in tasks that may be acquired with either system. Evidence suggests that some of these effects may be partly attributed to a competitive interaction. In many learning situations, altering a factor may weaken a particular memory system, thus indirectly allowing a competing system to take control of learning. For instance, robust emotional arousal appears to enhance dorsolateral striatal-dependent habit learning indirectly by impairing hippocampal-dependent cognitive memory."

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## Part 2: de Certeau's tactic-strategy dichotomy to critique treatment approaches

Strategy	Tactic
Action of the powerful	Action of those with less power
Postulation of power	Use things beyond their purpose
Through land control	Improvised routes through land
Reduced mobility	Mobile, fast actions
Space advantage	Time advantage
Involves efficiency and ease once instated	Can take more energy
Often is the infrastructure	In competition with infrastructure

### Mini case study

Ben has Parkinson's, wants to do everything he can to slow symptom progression such as exercise and socialise. However he has had to give up his car and can no longer reach the exercise classes he would like to attend or visit his family and friends.

One approach might be to populate his house with gym equipment, employ a personal trainer and other service providers.

Another approach might be a volunteer taxi service.

Another might be to build benches around his home to help him walk further with safe resting points, and maybe even reach a friend's house.

Importantly – there can be mobility benefits to tactics, so there should be a variety of approaches.

## Part 3: Ways to incorporate brain and behaviour into urban design

Proximity to toxins, such as pesticides and pollution linked to neurodegenerative disorders.

Navigation behaviour: how complex are street networks? How does signage encourage exploration or reduce reliance on GPS and maps? What are the safety considerations if getting "lost" is encouraged?

How can motor skills be incidentally trained through complex walking terrains, car-free neighbourhoods, stepping stones (Boldina et al., 2023)?



Contextual factors such as where we live and who and what we are locally connected to all play a role in maintaining health through the lifespan, disease prevention and also disease management or treatment.

There are consequences to therapeutic design choices and improvisations which we can more richly imagine using neuroplasticity in combination with de Certeau.

Housing design often motivated by capital (Bryson, 1997; Knox, 2020). What other motivators should be included in the design process and how?

de Certeau: how do we habitate, not just design, our homes and local areas? Places get used beyond their intended use and people are always creating unique solutions (Nonnekes et al., 2019).

## Conclusions