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Research Article

Challenges in Translating Neurourbanistic Research into Urban Design: Insights into Practice

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Abstract: The rise in mental health problems and the established link between urban living and increased psychosis risk underline the need for evidence-based urban design. Although the discipline of neurourbanism provides findings on brain responses to different urban environments, there remains a gap between research and its implementation in urban design. Conducting five semi-structured expert interviews with international researchers and a landscape architect, key challenges of translating evidence-based neurourbanistic research into urban design for mental health could be identified: a lack of interdisciplinary and audience-oriented communication between researchers and designers; the complexity of cities, especially in the context of methodological approaches; and a lack of sensitization among decision-makers and design studios to evidence-based design for mental health. Addressing these challenges, evidence-based urban design can realize its potential but its specific urban context must always be considered.

Implications: The identified challenges point to areas of action for researchers, designers, and decision-makers to improve the transfer of knowledge into practice: inter- and transdisciplinary communication; integration of new on-site methodological approaches; and sensitization of (future) designers and decision-makers to evidence-based urban design for mental health through education. Urban planners are asked to balance the implementation of evidence-based design with the uncertainties and complexity of urbanity.

Keywords: neurourbanism, mental health, research-implementation gap, evidence-based design

1. Introduction

Mental health challenges have intensified in recent years, particularly among young people in the WHO European Region (World Health Organization, 2023, p. 9). Because urban design directly shapes everyday spatial experiences, it represents a key interface between research on mental health and the lived realities of urban populations. As urban environments shape everyday experiences, increasing attention is being directed toward the role of urban design in supporting mental well-being.

Over the last decade, neurourbanism has emerged as a research field that investigates the relationship between urban environments and brain processes. It “aims to investigate the effect of built and social environments of cities on mental health, and ultimately on the brain” (Adli et al., 2017, p. 183). This “may help practitioners understand better the relationship between people and the places they inhabit” (Carmago et al., 2020, p. 282). In this new research field, the disciplines of urban planning, urban studies, urban design, and architecture, as well as researchers and practitioners from sociology, philosophy, medicine, and psychology, are involved (IFN e.V., n. d.-a). So far, neurourbanism is a mainly research-based discipline (Buttazzoni et al., 2022, p. 51). Despite thorough findings on how the brain responds to certain features of cities, there remains a gap between theoretical neurourbanistic knowledge and its transfer to urban design practice. Against this background, this article asks: *What are the challenges in translating neurourbanistic research findings into*

evidence-based urban design for mental health? This article presents insights into the transfer of neurourbanistic findings into urban design practice. It aims to identify current areas of action for researchers, urban designers, and decision-makers to narrow the gap between neurourbanistic research and urban design.

2. Methods

Since the knowledge of current challenges is linked to practical experience in the field, semi-structured expert interviews are an appropriate method for generating in-depth insights, which allow for both comparability across participants and openness to expert-specific perspectives. Semi-structured interviews are a qualitative method in urban planning which has "knowledge-producing potentials of dialogues by allowing much more leeway for following up" (Brinkmann, 2023, p. 1002).

Five semi-structured expert interviews were conducted with researchers from Canada, Denmark, Germany, Sweden, and a landscape architect working in Norway. Each interviewed expert had to fulfil the criteria of having a research background in mental health in urban planning, preferably from a neuroscientific perspective, or practical experience applying theoretical design criteria in practice (cf. Table 1). The interviewees were identified through a literature review, online research and one recommendation from another interviewee. All interviews were conducted via video call, four in English and one in German, translated by the author. Each interview lasted 50-60 minutes and was conducted in March and April 2024. An interview guideline (cf. Appendix A) was employed as a moderation tool to structure the interviews. Interviews were conducted flexibly, allowing the interviewer to respond to participants' answers, ask follow-up questions, and give space to topics raised by the interviewees. As a result, the conversations occasionally developed beyond the initial guide while remaining thematically oriented.

Four interviews with researchers followed the themes of the interview guideline closely, whereas the interview with the landscape architect was less structured to hear more about her practical expertise.

Thematic analysis was conducted manually following an inductive approach outlined by Braun and Clarke (2021), which involves familiarization with the data, iterative coding, and the development of themes through comparison across interviews. Themes were reviewed and iteratively refined and grouped into themes through comparison across interviews. The analysis was conducted without the use of a qualitative data analysis software due to the small sample size. In here, findings on the themes "status quo of the integration of neurourbanism and mental health aspects in practice" and "common methods used in the field of research" are presented. For this publication, selected insights from interviews formerly conducted for a master's thesis are re-analysed and presented. All interview participants were contacted again and provided written consent for their statements and unanonymized names to be used in this article.

Table 1. Overview of interview partners.

Martina Andersson	Martina Andersson is a landscape architect for the city of Stavanger, Norway, where she is involved in public space projects related to mental health. The city of Stavanger is collaborating with researchers in the NORDGREEN project to improve citizens' health (Nordregio, n.d.).
Dr Adrian Buttazzoni	Dr Adrian Buttazzoni is a postdoctoral fellow at the University of Waterloo, Canada, and researches the "pathways by which different urban environments, characteristics, and designs impact the physical and mental health of people […]" (University of Waterloo, n.d.).
Zakaria Djebbara	Zakaria Djebbara is an assistant professor in architecture and cognitive neuroscience at Aalborg University, Denmark. Researching the intersection of these disciplines, he uses, among others, neuroscientific methods such as

	mobile EEG, VR, and computational neuroscience (ResearchGate, n.d.).
Amanda Gabriel	Amanda Gabriel is a lecturer and researcher at the Department of People and Society at Sveriges lantbruksuniversitet (SLU), Alnarp, Sweden, and Coordinator for SLU Urban Futures (Swedish University of Agricultural Science, n.d.). Gabriel's research explores "how environments shape people's experiences of health, well-being, and everyday life" (ebd.). She is a producer and host of the Human Land Podcast about environmental psychology.
Prof. Dr Klaus Gramann	Prof. Dr Klaus Gramann, experimental psychologist, is head of the Department for Biological Psychology and Neuroergonomics at the Technical University of Berlin, Germany, and director of the Berlin Mobile Brain/Body Imaging Labs. His interest lies "in the neural basis of spatial cognitive processes and the influence of physical activity on cognitive and neural dynamics" (IFN, n.d.-b). He is a team member of the Interdisciplinary Forum Neurourbanism.

3. Results

3.1. Status quo of evidence-based neurourbanistic design in practice

Talking about the relation of neurourbanism in theory and in practice, it must be considered that neurourbanism is still a very young field (Klaus Gramann, Interview, 2024; hereafter "Gramann"). This can explain why the integration of neuroscientific knowledge into urban design remains limited. Not just the translation from neuroscientific studies is lacking, but also from science to design practice from a broader perspective in urban design practice ("the integration of science in general is [...] not looking good" (Zakaria Djebbara, Interview, 2024; hereafter "Djebbara"). In accordance, Buttazzoni (Adrian Buttazzoni, Interview, 2024; hereafter "Buttazzoni") adds that the implementation of evidence-based design for mental health is "still at its beginning stages".

Contradictory, practitioners already aim for well-being through design. In landscape architecture, for example, well-being is commonly addressed in practice. Andersson (Martina Andersson, Interview, 2024; hereafter "Andersson") explains that landscape architects "usually work to improve the city for well-being and creating some exciting environments to spend time in and meet other people". This might be a starting point to wonder the other way round: how to enrich neuroscientific studies with landscape architecture practices instead of just focusing on the translation of science into design.

Andersson also emphasizes that evidence-based approaches are not yet systematically embedded into practice, noting that they are "not standardized in every checklist". Limited space and funding further restrict the integration of mental health research into everyday practice (Andersson). This shows that the ambitions of the discipline of architecture are limited by external factors as they do not value their scientifically proven implications. This might help explain why, from the perspectives of neuroscientists and environmental psychologists, "[planners] are not really doing too much" (Buttazzoni).

Across all interviews, a clear gap between neurourbanistic research and its application in urban design practice was consistently identified.

3.2. Lack of communication and sensitization

One key reason for the gap between research and practice lies in insufficient communication between disciplines. In particular, neuroscientific research is often not easily accessible to designers and practitioners outside the field (Djebbara). As Djebbara explains, "we tend to write in certain ways. We write for other academics, we write for other researchers, we rarely keep the studios in mind". This academic mode of communication can limit the transfer of research findings into design practice.

To address this issue, closer engagement between researchers and designers could be a potential solution. Djebbara proposes to engage directly with designers to offer open courses for designers to explain theories and how they were tested (Djebbara). However, he also emphasizes, that the restricted human and financial resources in urban design studios must be considered, which might hinder this approach. While some studios in Denmark have established their own research departments and integrate research as part of their studio identity, this remains the exception rather than the norm (Djebbara).

Beyond professional practice, challenges also emerge at the policy level. A lack of sensitization to mental health across sectors was highlighted by Andersson, who noted that "most sectors agree that [mental health] is important, but then if you prioritize a tree or a bicycle lane, it is always a conflict". This illustrates how mental health considerations often compete with other planning priorities. One potential strategy to address this tension is to link mental health–promoting interventions to other policy goals, such as climate adaptation. As Andersson emphasizes, "we have to work hard and argue well why this should be prioritized".

At the academic level, however, developments appear more interdisciplinary. According to Buttazzoni, there is already a "big push to do interdisciplinary or multidisciplinary research" at universities.

3.3. Complexity of cities: methodological challenges

The complexity of urban environments poses a central methodological challenge for evidence-based neurourbanistic research. In this context, Gabriel (Amanda Gabriel, Interview, 2024; hereafter "Gabriel") stresses that evidence-based approaches need to be understood through the lens of place to account for different histories, cultures, and spatial logics. Rather than promoting a normative design perspective, she argued that openness to contextual differences is essential when translating research into practice.

At the same time, Djebbara highlights, that the research process should move closer to "evidence-based medicine. This is where we want to go with architecture and design." This ambition, however, contrasts with the methodological difficulties of studying complex urban environments under controlled conditions as the following shows.

One major limitation concerns the validity of standard experimental indoor study settings. As Gramann points out, indoor laboratory studies often reduce three-dimensional urban environments to two-dimensional images, omitting sensory dimensions such as sound or smell. This reduction shows why the complexity of urban environments is a challenge for the validity of neurourbanistic research findings.

Conducting experimental research in real-world urban settings introduces further difficulties. Djebbara notes that "it's always very difficult to do true experimental research in an actual real-world setting because you can't control the environment," a concern shared by Gabriel, who emphasizes that "there are a lot of confounding factors". For instance, there are changing, uncontrollable factors in the setting, such as the number of people and traffic, as well as individual personality traits or potential genetic factors (Gramann). Thus, a statistical assessment of thousands of probands across gender identities and age groups would be required in real-life settings (Gramann). As a result, Gramann stresses that established urban research methods should continue to play a role, noting that for measuring emotions, a subjective interview is still the best method.

In the context of these challenges, the potential of emerging technologies and mixed-method approaches was highlighted. Gabriel states that the technological equipment required to conduct neurourbanistic studies outdoors, rather than relying on indoor image-based experiments, is still very new. O9One example of such a methodological approach would be to synchronize physiological measurements such as heart rate, breathing rate, skin conductance and eye movement while being in different outdoor settings and integrating that data into GPS (Gabriel).

To "get at the truth the association between space and mental health", Buttazzoni argues that a triangulation across methods would be sufficient. Combining biophysiological measures with subjective accounts can provide complementary insights, as the focus should be on "how we can use the different methods to do complementary studies" (Buttazzoni). Similarly, Gabriel argues for a complementation of quantitative and qualitative methods. Overall, new technologies enable the integration of physical or qualitative data with geographical data, potentially yielding more substantial evidence.

3.4. Future Visions

Lastly, interviewees were asked what urban planners and municipalities should consider more strongly in the future. Buttazzoni suggests that urban planners have to be patient and understand people's lifestyles. In this context, he also highlights the importance of multidisciplinary collaboration, suggesting that urban planners should increasingly consult experts from fields such as epidemiology, neuroscience, and sociology. This suggestion is shared by Gramann, who stresses the value of multi-disciplinary approaches for future urban planning. He describes collaboration across disciplines as an essential tool and underlines the need to develop a "common language" between different scientific communities. In addition, he points out a lack of neuroscience in architecture and urban planning education.

From a design perspective, Gabriel expresses that her "wish was that landscape architecture would have a larger place in urban planning". Similarly, Andersson emphasizes the role of evidence and knowledge in practice. She notes that having stronger evidence bases would make it easier to create spatial qualities that support feeling good and being healthy. Overall, these statements can be interpreted as fields of action to tighten the gap between research and design.

Based on the interview results, a general overview of the current challenges in the transfer of neurourbanistic research into practice can be outlined (cf. Figure 1). The areas of action are concluded below.

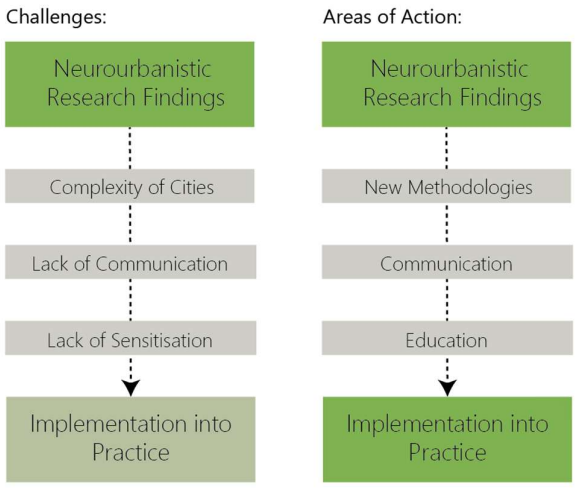

Figure 1. Challenges and areas of action in overcoming the gap between neurourbanistic research findings and its implementation into practice

4. Discussion

It must be considered that the insights presented in this article were not the primary focus of the interviews, which may have limited the depth of the given responses. Although all statements were reconfirmed, they must still be placed in the context of the year in which the interviews were conducted, as neurourbanism is a highly dynamic field. Through

the interviews conducted, the gap between research and practice could be confirmed and supplemented by the underlying challenges and their potential areas of action.

Despite different backgrounds, all interviewees agree on the problem formulation that there is a gap between neuroscientific research and design. In doing so, they all align with research findings saying that neurourbanism is a mainly research-based discipline so far (Buttazzoni et al., 2022, p. 51). The interview responses differ regarding explanations and suggestions, which are clustered as fields of action in the following:

First, the lack of inter- and transdisciplinary, audience-targeted communication must be addressed, as it is crucial to translate research findings into practice. Yet, it must be considered that a direct translation from studies to a design norm without taking its context into account might be insufficient.

The Contemplative Landscape Model (Olszewska-Guizzo et al., 2023) illustrates how neuroscientific research can be operationalized into an evidence-based evaluation tool for urban green spaces, thereby addressing parts of the research–practice gap. Targeting a broad audience of placemakers, the Neuroscience for Cities Playbook (2021) aims to transfer neuroscience into planning practice. The playbook helps cities to identify mental stressors, understand the consequences of urban trends and improve user experience. Due to the young research field, the playbook is "still within the confinements of exploration" (Catapult, 2021, p. 15) which calls for further initiatives and research transfer, too.

Second, the complexity of cities, with numerous uncontrollable factors, poses a challenge for conducting neurourbanistic studies that yield valuable findings. This challenge can be addressed by integrating new on-site methodological approaches to strengthen the evidence base. This resonates with ongoing research practices. Lately, an increasing number of studies follow a mixed-methods approach integrating GIS, epidemiological, and psychological tools with neuroimaging methods (Ancora et al., 2022, p. 3; Buttazzoni et al., 2021, pp. 2–49). In contrast to self-report measures, body and brain measurements also consider the sub- and unconsciousness (Hu & Shepley, 2022, p. 31). The mentioned methods help to investigate the relationship between the urban environment and mental health and will expand in the upcoming years to aim for more valid findings as stated in the interviews, too.

Third, a lack of sensitization among decision-makers and design studios to mental health and the effects of evidence-based design limits the translation of research into practice. Thus, greater sensitization among students, designers, and decision-makers through education on evidence-based urban design for mental health is needed. Neurourbanistic perspectives are not yet systematically embedded in the education of future urban planners and designers. While this field of action may seem intuitive, it remains largely underrepresented in current neurourbanism research, highlighting the added value of the interview findings.

Despite the potential of the fields of action, it must be emphasized that research can provide evidence on patterns and overall mental health outcomes across different environments and their impact on mental health, but not in every context or for every individual. Cities are dynamic and cannot be understood solely as the products of projections. Future research should therefore focus on translating and communicating neurourbanistic research findings targeting urban designers, decision makers and designers; integrating a mixed-method approach combining biosensing and qualitative methods; and educating students and professionals about neurourbanism and its application.

5. Conclusions

Ultimately, the interviews indicate that it is not only about implementing normative evidence-based research findings in practice but also about working with complexity and uncertainty in urban design. Perhaps, such undefined spaces might give people the opportunity to appropriate it, to be creative together, have encounters, and build communities, which, in turn, contributes to creating cities that support mental health.

Nevertheless, it is the responsibility of urban planners to plan to the best of their knowledge, which includes considering evidence. Therefore, it would be the task of urban

planners to assess, based on the context, how and to what extent research findings can be translated into the final design output. Based on that it can be suggested that, urban planners need to balance the provision of health-promoting, evidence-based design with the accommodation of uncertainties. Overall, the experts' perspectives suggest that evidence-based design can fulfil its potential once the gap between research and practice is narrowed, thereby contributing to the creation of healthy living environments in cities.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study. Written informed consent has been obtained from the interview partners to publish this paper.

Data Availability Statement: The interview data are confidential and not publicly accessible.

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Appendix A: Interview Guideline

Interviews were conducted as part of a master's thesis; questions relevant to this article are written in bold letters.

Background/Status Quo

- **How are the aspects of neurourbanism/mental health already integrated into public space design practice?**
- **What are its difficulties?**
- **Is there still a lack of consideration of neuroscience/mental well-being in public space design among researchers/municipalities, and designers?**

Theory

- Through which pathways is the urban spatial environment connected to mental health? (e.g. physical activity, recreation, nature)
- **To what extent do you think the influence of urban environments on mental health is individual? (e.g. based on culture, genetics, individual perceptions)**
- Is there a framework/theoretical model for the connection between urban environment and mental health that you follow in practice?
- Are there specific spatial features which have a direct influence on mental health?

Methodology

- **How can public spaces be evaluated from a mental health/neuroscientific perspective (without biosensing or neuroscientific methods on-site)?**
- **Is it sufficient to apply common urban planning methods such as interviews, observations, mental maps and put them into the context of mental health?**
- How can soft factors such as atmospheres/perceptions/emotions be captured and visualized?

Practice

- Do you have examples of public spaces which have a positive effect on people's mental health?
- **How do you integrate theoretical design knowledge into practice?**
- Which projects related to mental health have you already worked on?
- How was the feedback from its users?
- How do you deal with winter conditions?

Young people

- Do you think young adults have specific needs in public spaces for mental health?
- How could the surroundings of schools or universities be improved?

More

- **What would you wish municipalities and urban planners would consider more in practice?**