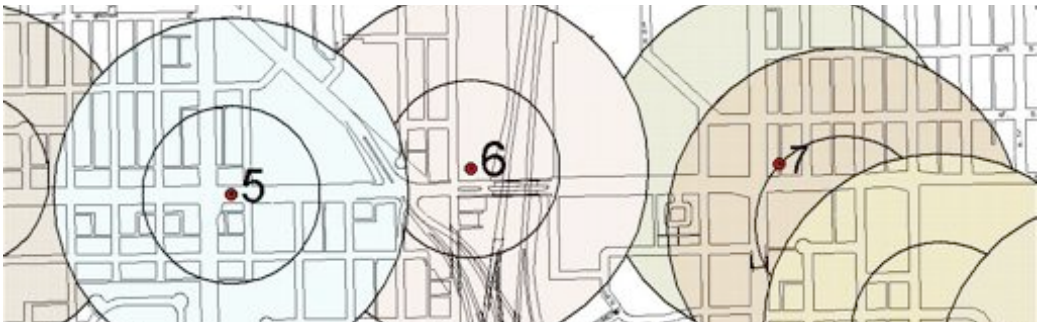
GPS HRN
The GLOBAL POSITIONING SYSTEMS in Health Research Network

NEWS UPDATE

January 2011



Revisiting conventional buffering techniques for assessing the built environment: Is there a better way?

Asst/Prof Bryan Boruff
University of Western Australia

Prof Billie Giles-Corti
University of Western Australia

The Centre for Built Environment and Health (CBEH) at the School of Population, The University of Western Australia was established in 2007, bringing together a program of research on the built environment and health which commenced in the early 90s. It involves a multi-disciplinary team of researchers across a number of fields, including population health and geography. One of the Centre's largest projects is RESIDE, a longitudinal study examining the impact of the built environment on walking, cycling, public transport and mental health commenced in 2003. RESIDE participants are home owners building homes in new neighbourhoods. They have completed three surveys, one before moving into their new home and will participate in a 3rd follow-up after baseline in 2011.

The CBEH team is always attempting to embrace the opportunity for new research directions and have recently become interested in information collected using Global Positioning Systems (GPS). Over the past several years our research has focused on how the built environment influences physical activity and have relied primarily on self-reporting questionnaires (with pedometer and accelerometer derived data) to provide information on the type, duration and location of activity participants engage in. Whilst self-reported data provides a valuable starting point, under and over reporting and geographical inaccuracies can propagate through the analytical process. This may impact the strength of relationships found between objective measures of the built environment and subjective measures of physical activity.

Recently, one of our PhD students, Andrea Nathan, undertook a survey of older adults living in retirement village housing to examine the relationship between village and neighbourhood environment and active living. As a subset of this study, 41 older adults living in 7 retirement villages agreed to wear a GPS unit, in addition to their accelerometer, for seven days. Whilst the sub-study was originally untaken as a proof of concept, researchers at CBEH realized the opportunities this additional data provided. Having information on where and how older people travel throughout their surrounding environment provided an opportunity to reevaluate some of the geographic assumptions used when developing **(cont.)**

Note from the editor

Hello everyone

I hope you have all had an excellent Christmas and New Year. The GPS-HRN continues to grow as we head into 2011: we now have 135 members from 21 countries.

This issue of the newsletter features some excellent contributions from GPS-HRN members. Asst Prof Bryan Boruff and Prof Billie Giles-Corti from the University of Western Australia discuss the possibility of new buffering techniques for examining the built environment. Assoc Prof Ingunn Fjørtoft profiles her research team at the Norwegian University of Life Sciences. Finally, Dr Melody Oliver reviews two new books very relevant to GPS researchers. There are also a number of new articles listed that you may find relevant.

I would also like to remind you that the 2011 Active Living Research Conference will be held at the Hard Rock Hotel in San Diego on February 22-24. Of particular interest is the dedicated GPS stream and the GPS-related workshop. We are still considering organising another informal gathering of members, and I will send out an e-mail if this goes ahead. For more information, please visit the following website:

www.activelivingresearch.org/conference/2011

As always, if you come across any GPS-related news, updates, or recent publications, please don't hesitate to post them on the website.

All the best

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objective measures of the built environment. To date, when relating measures of the environment to physical activity, radial buffers or network buffers are used to define the area around a person's residence in which they participate in physical activity (whether it be cycling, walking for transport or recreation). Without empirical evidence however, it has been difficult to provide an alternative approach.

A placement in Perth by Masters student, Sandra Nyenstein from Eindhoven University of Technology, The Netherlands, provided the human resources and opportunities to advance this important work. Using the GPS data collected for the 41 participants in the Active Living sub-study, Sandra with researchers at CBEH have attempted to redefine the neighbourhood (or buffer) used to calculate objective measures of the environment. First, as GPS measurements return information concerning time and position on the earth's surface (as a point), these data were processed to identify which of the GPS measurements were related to walking or cycling (as opposed to trips in a vehicle) and associated with a unique trip (sometimes referred to as a bout). Through a collaboration with the Center for Wireless and Population Health Systems at the University of California San Diego, the GPS data collected for the sub-study participants of the Active Living Study was analyzed using the Physical Activity Location Measurement System (PALMS). Using a series of evolving rules, PALMS disaggregates large volumes of GPS data into a number of discrete trips which are then classified by mode of transport (i.e. vehicle, bicycle, foot).

Once disaggregated and classified it was possible to identify the extents and locations each participant traveled around their residence. Focusing specifically on walking, it became apparent that participants only used small portions of their neighbourhood which appeared to be driven by the spatial arrangement of certain land-use and land-cover types. Visual assessment of these patterns led our research team to ask the following question: If only certain portions of a neighborhood are used for physical activity, do classic buffer (radial and network) based measures of the built environment return different results from those obtained using information derived from GPS measurements and subsequently impact correlations with physical activity?

Using the GPS derived data a series of four new buffering techniques were used to derive a set of objective measures which were then related to the amount of physical activity each participant (in the study) engaged in. The buffering techniques explored include variable width radial buffers (a concept borrowed from ecology), network based buffers controlled by destinations, convex hull buffers controlled by destinations and ellipse buffers controlled by destination. Whilst the final results were influenced by a small sample size, several of the new buffer techniques prove promising in redefining how 'neighbourhood' is defined in the context of this type of research. With larger sample sizes and refined trip identification algorithms it is believed that the burgeoning use of GPS collected activity data provides opportunity to reshape how the built environment is defined and measured as a correlate of physical activity.

Acknowledgement:
The analysis of our GPS data was supported in part through a collaboration with the PALMS Project (UCSD-Palms-Project.wikispaces.com) at the University of California, San Diego. Funded by NIH/NCI Grant 1 U01 CA130771. Andrea Nathan (PhD Candidate) and Dr Dick Saarloos (formerly a research associate of CBEH) collected the GPS data as part of the Active Living Project.

The eighth Active Living Research Annual Conference will be February 22-24, 2011 at the Hard Rock Hotel San Diego in downtown San Diego, CA.

The theme for the 2011 conference is Partnerships for Progress in Active Living: From Research to Action, which recognizes the importance of engaging experts from multiple disciplines to address critical public health issues, especially active living and obesity.

For more information, please visit www.activelivingresearch.org/conference/2011

Recent Research

I Fjørtoft, O Löfman & K Halvorsen Thorén
Schoolyard physical activity in 14-year-old adolescents assessed by mobile GPS and heart rate monitoring analysed by GIS. *Scandinavian Journal of Public Health*, 2010, 38(5 Suppl): 28-37.

HM Badland, MJ Duncan, M Oliver, S Duncan & S Mavoa
Examining commute routes: Applications of GIS and GPS technology. *Environmental Health and Preventive Medicine*, 2010, 15(5): 327-330.

R Maddison, Y Jiang, S Vander Hoorn, et al
Describing patterns of physical activity in adolescents using global positioning systems and accelerometry. *Pediatric Exercise Science*, 2010, 22(3): 392-407.

D Ogilvie, S Griffin, A Jones, et al
Commuting and health in Cambridge: a study of a 'natural experiment' in the provision of new transport infrastructure. *BMC Public Health*, 2010, 10: 703.

A Morabia, FE Mirer, TM Amstislavski, et al
Potential health impact of switching from car to public transportation when commuting to work. *American Journal of Public Health*, 2010, 100(12): 2388-2391.

AD Liese, N Colabianchi, AP Lamichhane, et al
Validation of 3 food outlet databases: completeness and geospatial accuracy in rural and urban food environments. *American Journal of Epidemiology*, 2010, 172(11): 1324-1333.

H Zheng, C Nugent, P McCullagh, et al
Smart self management: assistive technology to support people with chronic disease. *Journal of Telemedicine and Telecare*, 2010, 16(4): 224-227.

JB Dear, MM Porter & AE Ready
Energy expenditure during golfing and lawn mowing in older adult men. *Journal of Aging and Physical Activity*, 2010, 18(2):185-200.

Research Profile

Norwegian University of Life Sciences

How the environment affords physical activity: A transdisciplinary study of the environmental correlates of physical activity in adolescents

The research group behind the project includes persons from diverse scientific disciplines making it possible to illustrate the complexity of how environments afford physical activity to young people. The project is a 4-year-long study funded by the Norwegian Research Council, Programme for Public Health. The research team has expertise within the disciplines of landscape architecture, geographical information science, epidemiology, physical education, science and outdoor education. The research group represents two Norwegian scientific institutions: The Norwegian University of Life Sciences (UMB) and Telemark University College (TUC).

Kine Halvorsen Thorén, Professor in Landscape Architecture at UMB, Norway. Project manager and also supervisor of the PhD student in the project. Their focus in this project is how the activity data from GPS and heart rate measurements can be used to identify urban landscape qualities of importance to young people. The traditional landscape interpretation is considered an image and not an arena of human locomotion and activity. We want to explore other approaches to describe how people move in the landscape both at neighbourhood level and within more limited areas. GPS positioning along with heart rate monitoring provides completely new possibilities for understanding human activity and movement in the landscape. Together with qualitative methods, such as digital child track mapping, field work and common approaches from landscape analysis methodology, we want to bring new perspectives into the field of landscape analysis methodology.

Renata Aradi, PhD student at UMB. Educated as landscape architect from Hungary, and in further education specialized in urban design and urban management. She has seven years experience in spatial development and planning. She joined in the research project as PhD student in 2008. Her main focus in the project is on landscape analysis processes and developing methods for describing adolescents' use of urban space. She took active part in the data collection phase, using an online digital mapping method for tracking childrens movements (child track, "barnetråkk") and doing fieldwork. In the analysis she works with GIS, doing spatial and landscape analyses as part of her PhD project as well as supporting the group with her planning and GIS competence.

From L-R: Renata Aradi, Owe Löfman, Kine Halvorsen Thorén, Håvard Tveite and Ingunn Fjørtoft

Owe Löfman, Professor at UMB in Geographical Information Science, MD, PhD, MPH.
Background: Medical degree from Karolinska Institutet, PhD in Clinical Chemistry with a thesis on Epidemiology and Diagnostic Perspectives of Osteoporosis in women. 25 years as chief medical officer in dept for Environmental Medicine and Epidemiology at the University Hospital of Linköping. Owe has been involved in prominent research programmes including spatio-temporal and epidemiological studies in various fields using GIS. His contribution into the project is within project design, data sampling, geostatistics and analyses in GIS.

Håvard Tveite, Associate Professor, Geographical Information Science, UMB, Norway.
Background: PhD on Geographical Data Modelling and Management, NTNU, Norway. He has published methods for measuring accuracy of geographical lines, and also on the use of open source software for geographical information processing. In this project, he has contributed with geographical data processing and data preparation. He has done some programming to accomplish the more non-standard space-time data preparation and analysis. Main tools: Java, Python, PostGIS on PostgreSQL.

Ingunn Fjørtoft, Associate Professor (TUC). PhD in landscape ecology, science and physical education linked to environment-child contextual learning and development. Areas of teaching are outdoor environmental education and early childhood development. Field of research is within landscapes for learning, childhood development, physical activity and health in children and youth. Perspectives into the research project are schoolyard physical activity in adolescents, assessed by GPS and heart rate monitoring, free-living activities in neighbourhood settings and how landscapes afford physical activity in young people.

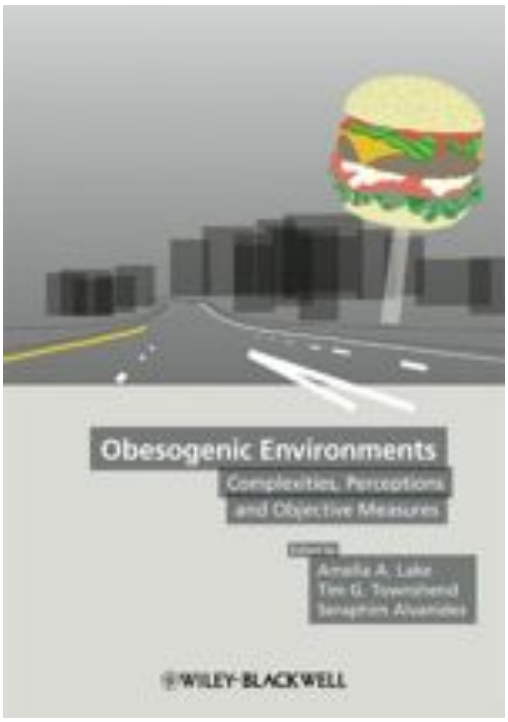
The project team is developing new methodology on how the application of GPS, HR-monitoring and implementation in GIS can support new knowledge on free-living physical activity in adolescents and how this is related to environmental contexts.

Book reviews

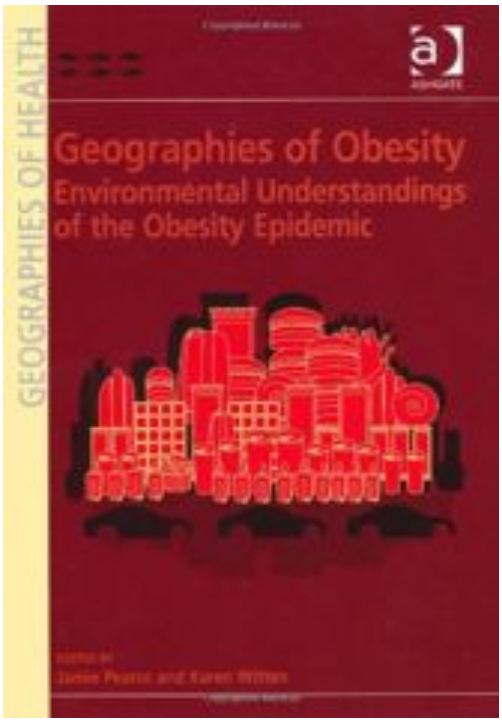
Dr Melody Oliver
AUT University
New Zealand

In evolutionary terms, human overweight and obesity is a relatively recent phenomenon, but has fast become one of the most significant lifestyle-related and somewhat preventable health issues of the contemporary developed and developing world.[1] Research responses to the obesity epidemic have moved from early investigations of prevalence, measurement issues, and co-morbidities[2] to focusing on understanding the broader ecological determinants of obesity in children and adults alike.[3, 4] Increasingly, a focus has moved from individual determinants to acknowledging the complexities of obesity development and the potentially over-riding influence that broader social and built environments may have on individual behaviours and health outcomes.[5] It is now widely acknowledged that understanding how environments support or inhibit healthy behaviours for reduced obesity risk across the lifespan is important to informing interventions for sustainable behaviour change.[6-8] In particular, research measuring and understanding the effect of obesogenic environments ("the sum of influences that the surroundings, opportunities, or conditions of life have on promoting obesity in individuals or populations"[4]) on physical activity, nutritional behaviours, and obesity has come to the fore.

Given the burgeoning interest in this area, it is timely that two books that accumulate and summarize research evidence in this field were published in 2010: *Obesogenic Environments. Complexities, Perceptions, and Objective Measures*, and *Geographies of Obesity Environmental Understandings of the Obesity Epidemic.* Both books are interdisciplinary, with leading authors from numerous fields including nutrition, epidemiology, geography, pediatrics, planning, and health promotion, exemplifying the shift towards acknowledging the importance of trans-disciplinary collaboration to contend with the global obesity issue. An in-depth review of *Geographies of Obesity* by Freudenberg was published earlier this year in Preventive Medicine.[9]



Lake AA, Townshend TG, Alvanides S, editors. *Obesogenic Environments. Complexities, Perceptions, and Objective Measures.* Sussex, UK: Wiley-Blackwell; 2010, ISBN-10: 1-4051-8263-6, 248 pp. £40.



Pearce J, Witten K, editors. *Geographies of Obesity Environmental Understandings of the Obesity Epidemic*. Surrey, UK: Ashgate Publishing Limited; 2010 ISBN 978-0-7546-7619-5, 331 pp. £65.

Obesogenic Environments is an accessible text that in its 14 chapters provides readers with a broad overview of obesity prevalence, determinants, and measurement issues related to the accurate quantification of built environments and obesity associates. Practical issues such as funding processes and criteria, lead-in times for research, and research design decisions are acknowledged throughout.

Chapters 1 and 2 present an overview of obesity prevalence and the importance of transdisciplinary approaches to effectively tackle obesity.

Robertson-Wilson and Giles-Corti's chapter on walkability (Chapter 3) is an especially useful text for understanding measurement issues related to defining walkability (e.g., determining appropriate geographic scales, self selection issues) and the importance of this variable in research on neighbourhood design and obesity. The Chapter also identifies the importance of considering differing needs of subgroups in urban design, and the importance of forming partnerships with policymakers and practitioners for translating research findings to practice.

In Chapter 4, Jones and Panter discuss the association of availability and accessibility of environments for physical activity and identify the numerous issues related to measurement (e.g., perceived vs. objective), and the inequitable provision of resources.

Particularly pragmatic solutions to mapping obesogenic environments and modelling environmental data are suggested for children and adults alike in Chapter 5.

Chapters 6-7 provide reviews of physical activity associates and measurement, with a focus on the UK and US, respectively. Cooper and Page's discussion on Global Positioning Systems use for measuring mobility in children highlights the advancing capability of technology (and researchers) to better understand the physical activity profiles of the modern child. **(cont)**

A detailed overview of active transportation prevalence and barriers to active transportation (with a particular focus on the UK) is supplied by Mackett in Chapter 8, alongside numerous environmental solutions to overcoming these barriers. Importantly, Mackett identifies a number of problems related to a lack of systematic evaluation and a need for high quality research to inform future environmental design.

Chapter 9 concentrates on availability and use of greenspace in relation to obesity and other physical and psychological health outcomes, and examines the role of institutions and policy makers in ensuring greenspace availability.

Chapters 10 through 12 focus on food retailing, nutritional policy, and issues with equality. Similar to earlier chapters concentrating on environmental associates of physical activity and obesity, measurement issues related to subjectivity vs. objectivity, appropriately defining 'areas' and 'neighbourhoods', and access, availability, and use of settings by social gradient are raised. Importantly Ball et al. note the paucity of research that investigates the influence of cultural norms and practices on eating behaviours – a key underlying variable that goes beyond simple consideration of ethnicity and indeed requires more consideration in future research endeavours.

The book concludes with chapters 13 and 14 providing a cohesive summary of the research field, future research directions, and opportunities and challenges for researchers and practitioners in the field.

As with *Geographies of Obesity*, *Obesogenic Environments* has a predominantly Western focus, with research predominantly sourced from developed nations such as the UK, US, Australia, and New Zealand. Nonetheless, the generally consistent findings across a broad range of research disciplines provide a strong argument for the influence that environments have on human behaviours and health outcomes, which can be used to inform urban design in developed and developing countries alike. Measurement issues and the lack of longitudinal research in this area are overwhelmingly evident throughout both books, as are the need for more inter-disciplinary approaches and ecological research approaches.

Together, these bodies of research also identify a clear need for determining appropriate approaches for defining and classifying built and social environments, and for objectively measuring physical activity and nutritional behaviours.

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IPEN was launched by Professor Jim Sallis (USA), Dr Ilse DeBourdeaudhuij (Belgium) and Professor Neville Owen (Australia) at the International Congress of Behavioral Medicine in Mainz Germany in August 2004.

Physical activity habits are determined by multiple levels of influence – personal, family, social, environmental, economic and other factors. Ecological models of health behaviour have been used to synthesize research at these different levels, and to focus attention on relationships of particular physical activities with specific attributes of physical environments, including the built environment.

While physical activity environments will vary within countries, the greatest and most informative sources of variation in the relationships of environmental attributes with physical activity are likely to be between countries. The IPEN initiative seeks to stimulate, inform, and support systematic and rigorous studies of physical activity and the environment, in as many countries as possible.

Please contact Jacqueline Kerr (jkerr@ucsd.edu) or Nicole Bracy (nbracy@projects.sdsu.edu) if you would like more information.

www.ipenproject.org

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