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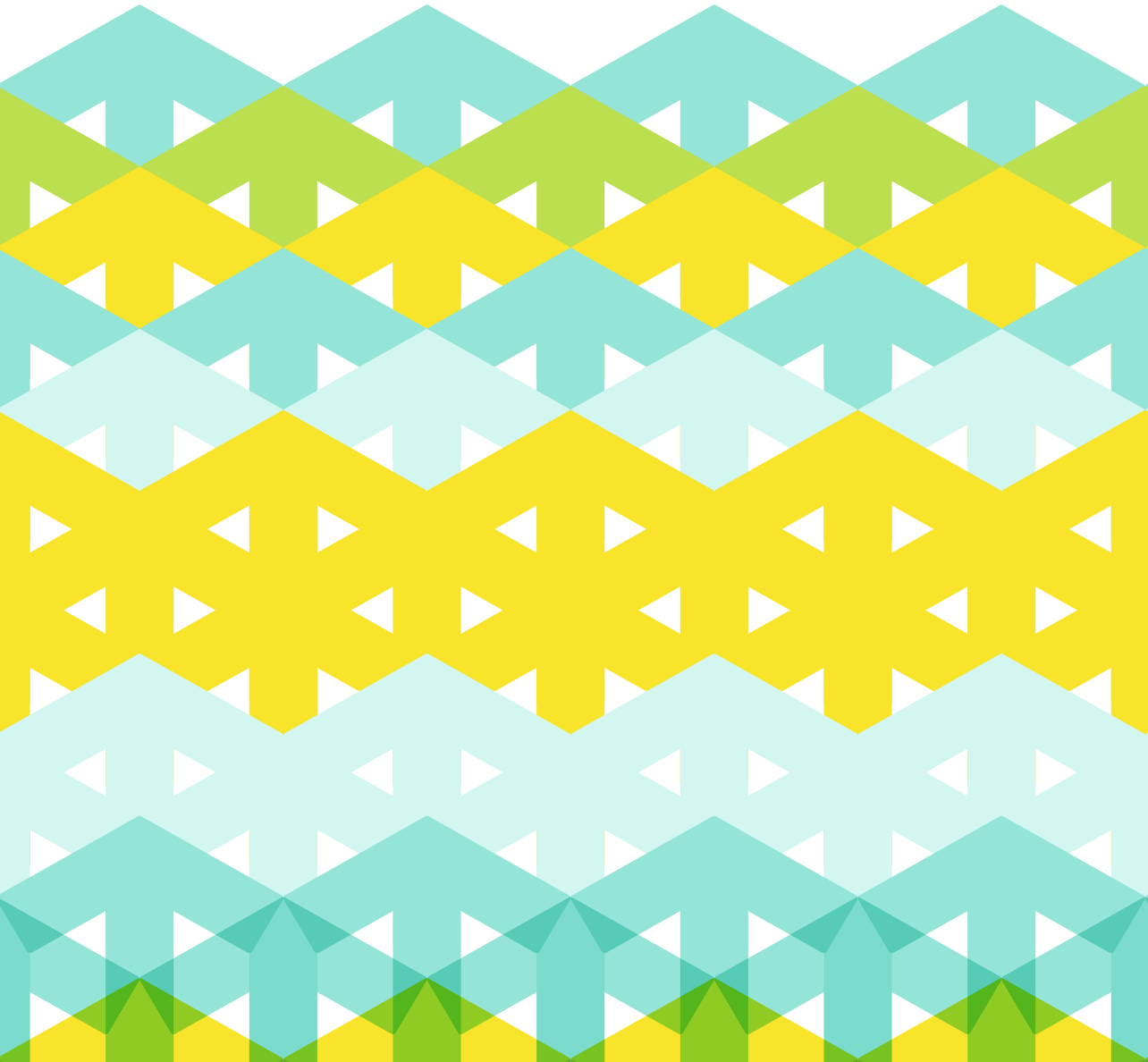
Future designs for responsive transport environments

GARDNER HAEUSLER MAHAR



INTER*CHANGING*: Future designs for responsive transport environments

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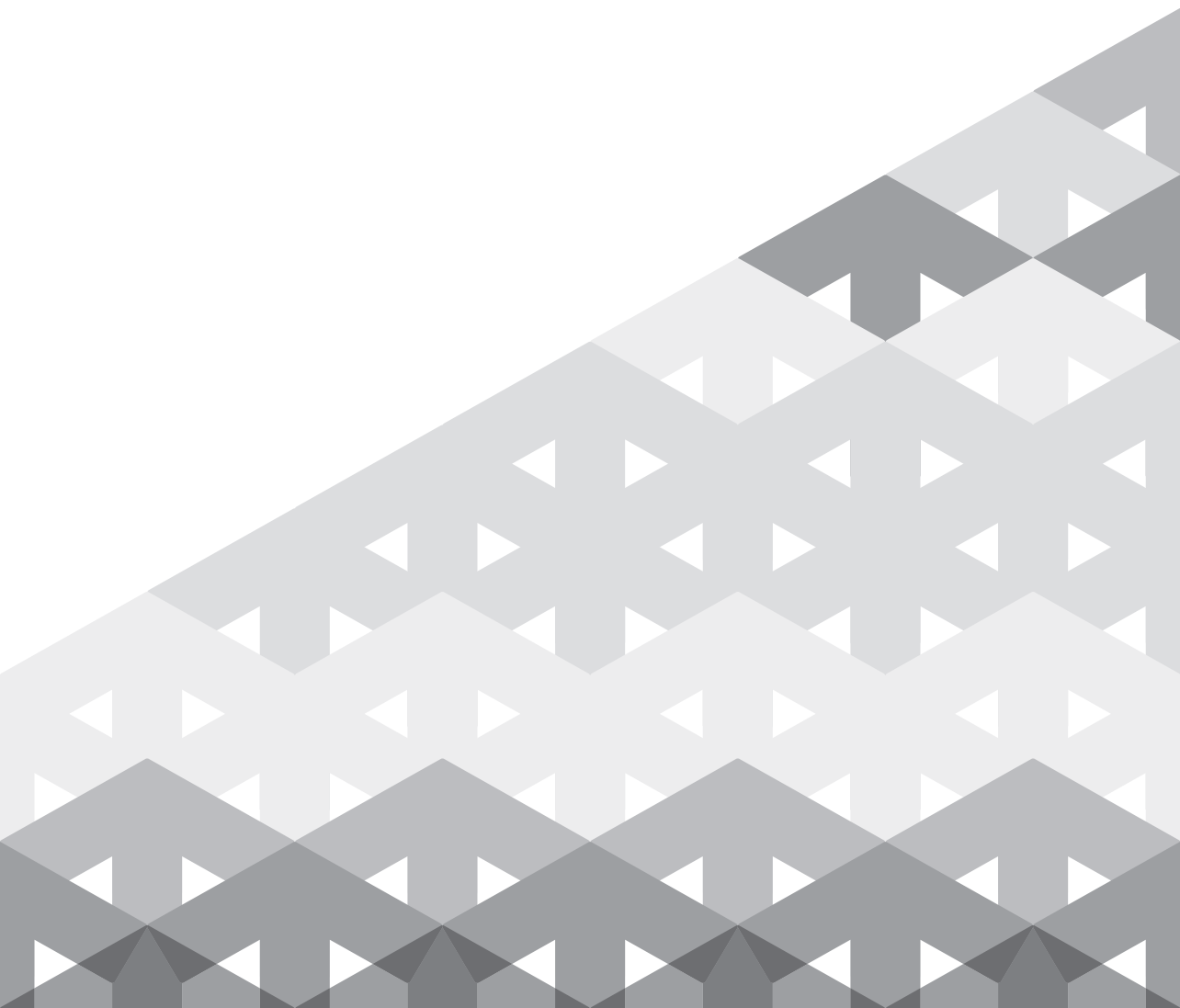
2014



INTER
CHANGING

Future designs for responsive transport environments

GARDNER HAEUSLER MAHAR

CONTENTS

Foreword 8
Associate Professor Marcus Foth

CONTEXT

Introduction: responsive transport environments 13
Dr. M. Hank Haeusler

Interdisciplinary frameworks 19
Nicole Gardner & Briedy Mahar

VISION

Urban infostructures of possibility 27
Nicole Gardner

Reframing public transport: what is and what ifs? 33
Tim Tompson

Future transport services: challenges and opportunities 39
Tom Hordern

PARAMETERS

NSW long term transport master plan 47
Transport for New South Wales

The role of the City of Sydney in bus shelter provision 53
Bonnie Parfitt

Responsive passenger information systems: the next generation 59
Dr. Michelle Zeibots

STUDIO

NEXUS 66
Morgan Carson, Alexander Mendes
Annie Vu, Kevin Lao

GIVETAKEGIVE 70
Belinda Hoang, Lilia Lanegra,
Melody Willis

GROWTH 74
Evan Fan, Mani Hunjan,
Gene Jin

REFUEL 78
Estelle Rehayem, Xiaolu Li,
Clement Yoong

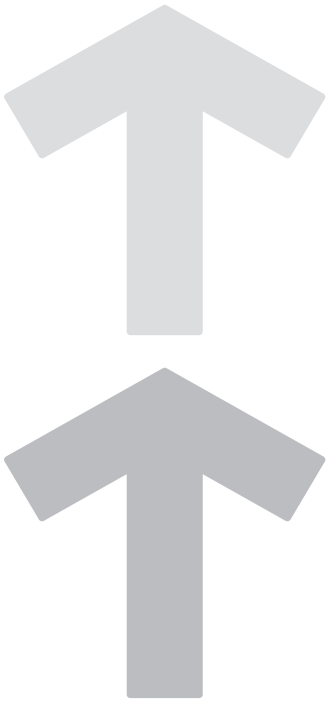
ACTIVE 82
Vivyan Wu, Nailah Masagos,
Alyanna Agda

SYSTEMS

Urban informatics in public transport environments 91
Jimmy Ti

Sense and sensing in public transport environments 97
Dr. Nathan Kirchner

The history and future of interaction design in public transport environments 103
Dr. Martin Tomitsch



COMPONENTS

Designing urban infrastructure 111
Professor Alec Tzannes

Designing public transport environments 117
Mark Gilder

Enabling new revenue models through media architecture 123
Dr. M. Hank Haeusler

SITUATING

Interchange of the future 131
Nicole Gardner
Dr. M. Hank Haeusler
Briedy Mahar

Acknowledgments 137
Encircle ARC linkage grant 139
BEIL initiative 141
Author biographies 143
Students teams 147
Image credits 149
Glossary of terms 149
Imprint 150

This book is significant and timely as it coincides with an historic moment: Cities now house the major infrastructures as well as the majority of the world's population. Increasing pressures from urbanisation and population densification present many complex challenges, one key issue being transportation. Despite upward trends in the use of rail and aviation for more long haul connections to further away places, the majority of personal transport needs remain short and local. City-dwellers may live in West End, work in the CBD, prefer the Italian restaurant in Paddington, the farmers market in Herston, the recently opened state-of-the-art gym in Newmarket, and want to get to and fro quickly.

As a result, when it comes to improving the quality of public transport, the focus of attention has traditionally been on making services more efficient and effective. Journey planners conventionally optimise their routing suggestions only on the basis of speed and distance. Why not offer other search criteria, for example, find me the greenest, the least polluted, the scenic, the most comfortable, or the social route home that increases the likelihood of meeting my friends on the bus. Or – if I've had a bad day – help me find a bus route so I can avoid bumping into them.

Most real-time passenger information systems still consider the logistics of public transport a complex concoction of different vehicle types, stops, stations, and routes, in dire need to be defragmented and optimised. I agree that it would be nice to do away with timetables altogether, and be able to access real-time information that allows me to walk up to the stop right at the moment when the bus arrives. However, there are new opportunities beyond telematics (Camacho et al., 2013a). The transit ecology becomes far more compelling and exciting once passengers themselves feature more prominently in the design space; and not just an abstract notion of 'passengers', but a more nuanced and refined socio-cultural understanding of who they are, where they are going, and what they are doing, across space and time.

For example the Brisbane River is criss-crossed by 'CityCats,' the local river ferries. Tourists frequently hop onto a CityCat, not necessarily because they want to go from A to B, but because they enjoy the journey on a ferry, to take in the views, take photos, and enjoy the breeze. It is not uncommon that they return and disembark at the same stop from which they first departed. It is not getting to a destination, but the experience of the journey itself, that is their primary goal.

Digital information, ubiquitous computing, mobile devices, social media, and urban informatics offer new possibilities to bridge the digital and physical layers not just of cities, but of public transport as well – before, during, and after a journey (Foth & Schroeter, 2010). Location-based services not only allow passengers to access more accurate information from the transport provider, but also engage in a dialogue to report maintenance issues and provide feedback. This dialogue has also been extended to consider passenger-to-passenger communication and interaction. For example, the *TrainYarn* application was inspired by the popular *ChatRoulette* web service and allows commuters to anonymously chat with each other (Camacho et al., 2013b). The *Cart-load-o-fun* study by Toprak et al. (2013) re-conceptualises public transport vehicles as game spaces in order to bring about a more playful, enjoyable, and engaging passenger experience.

What does the future hold? In the short term, many interaction design applications seek to enhance and improve the experience of using public transport, so to make the journey a little bit more convenient, personal, and comfortable – just like being driven in your private vehicle. At the same time, single-occupant vehicles continue to contribute to major traffic congestions and parking problems in urban environments, and as a result, ride sharing and car pooling applications have been developed that make private transport a little bit more public (Brereton et al, 2009).

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Perhaps we won't see a convergence of public and private transport straight away, but this perfect storm has already given rise to emerging new forms of hybrid public/private transport. Similarly how apps such as *Airbnb* allow ordinary people to compete in the short-term letting market (Ikkala & Lampinen, 2014), smart phone apps such as Uber, GoCatch, and *WunderCar* introduce share economy principles to the public transport market by reducing the barrier between drivers and passengers, challenging existing pricing structures and business models, and designing new innovative value-add services. Following Gandhi's famous quote, "*first they ignore you, then they laugh at you, then they fight you, then you win,*" it seems this trend has now (June 2014) advanced to the fighting stage as "*angry cab drivers gridlock Europe in protest at 'unregulated' taxi app*."[1]

People may still want to own personal vehicles for a while, but the advent of more sophisticated car-pooling and car sharing schemes, and 'DIY public transport' services such as *Uber* will increasingly make these alternatives more attractive. At the same time, as they compete with the conventional public transport space, they are blurring the boundaries between public and private transport. Once the proponents and engineers of autonomous cars hurry to sort out their ethical dilemmas and arrive at ready-to-market solutions, the driver may soon be obsolete, as the driver-less robot car picks you up when and where you need it and drops you off wherever you want. Running after the bus may soon be a relic of the past, as public transport will follow the people.

1. http://www.theguardian.com/uk-news/2014/jun/11/cab-drivers-europe-protest-taxi-app-uber-london-madrid

Brereton, M., Roe, P., Foth, M., Bunker, J.M. & Buys, L. 2009. "Designing participation in agile ridesharing with mobile social software", in *Proceedings of the 21st Annual Conference of the Australian Computer-Human Interaction Special Interest Group: Design*: Open 24/7 (OZCHI '09). ACM, New York, NY, USA, 257-260. DOI=10.1145/1738826.1738868

Camacho, T., Foth, M. & Rakotonirainy, A. 2013a, "Pervasive Technology and Public Transport: Opportunities Beyond Telematics", *IEEE Pervasive Computing* vol. 12, no. 1, pp.18-25. DOI=10.1109/MPRV.2012.61 <http://dx.doi.org/10.1109/MPRV.2012.61>

Camacho, T., Foth, M. & Rakotonirainy, A. 2013b, "TrainRoulette: promoting situated in-train social interaction between passengers", in *Proceedings of the 2013 ACM conference on Pervasive and ubiquitous computing adjunct publication* (UbiComp '13 Adjunct). ACM, New York, NY, USA, 1385-1388. DOI=10.1145/2494091.2497360

Foth, M. & Schroeter, R. 2010, "Enhancing the experience of public transport users with urban screens and mobile applications", in *Proceedings of the 14th International Academic MindTrek Conference: Envisioning Future Media Environments* (MindTrek '10). ACM, New York, NY, USA, 33-40. DOI=10.1145/1930488.1930496

Ikkala, T. & Lampinen, A. 2014, "Defining the price of hospitality: networked hospitality exchange via Airbnb",in *Proceedings of the companion publication of the 17th ACM conference on Computer supported cooperative work & social computing* (CSCW Companion '14). ACM, New York, NY, USA, 173-176. DOI=10.1145/2556420.2556506

Toprak, C., Platt, J., Ho, H. Y., & Mueller, F. 2013, "Cart-load-o-fun: designing digital games for trams", in CHI '13 *Extended Abstracts on Human Factors in Computing Systems* (CHI EA '13). ACM, New York, NY, USA, 2877-2878. DOI=10.1145/2468356.2479557

CONTEXT

Introduction: responsive transport environments 13
Dr. M. Hank Haeusler

Interdisciplinary frameworks 19
Nicole Gardner & Briedy Mahar

...a public transport environment for the 21st century can, and should, be more than just a place to catch a bus or tram; it can play a positive and active role in a wider range of cultural, social, and economic matters...

figure 01
ACTIVE studio interchange of future design concept

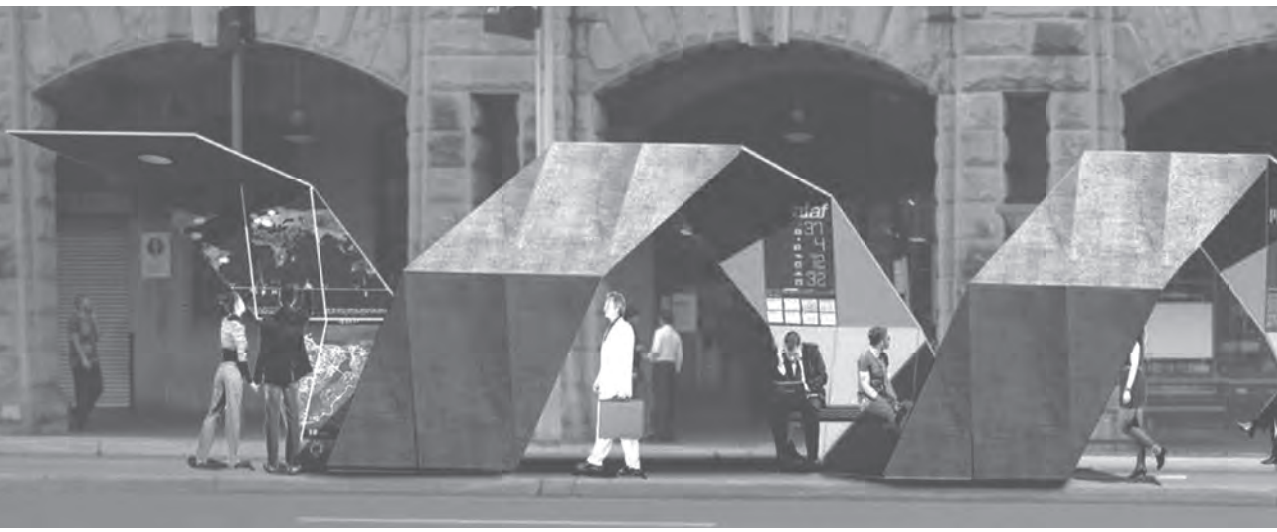
INTRODUCTION: RESPONSIVE TRANSPORT ENVIRONMENTS

DR. M. HANK HAEUSLER

Digital technologies have, in recent years, permeated many aspects of everyday life. Communication and interaction between humans and things has been augmented and reconfigured through the use of Internet-accessible digital devices, such as smart phones, and embedded forms of computing in the built environment, such as sensors and cameras, that can gather and transmit data and information. These developments have clearly impacted urban life and the way we use cities. This includes new ways to access and generate information, social interaction and activity, and urban navigation and exploration, to name a few. At the same time cities around the globe are also experiencing rapid population growth. Consequently an increasing number of people want to get from home to work, school or university, travel to see their friends to socialize with them, or participate in other activities in different parts of the city. Collectively, these journeys increase the pressure on transport networks such as roads, and public transport systems including, trains and buses.

As Gardner et al. argued in 2010 in our first book on the topic of responsive environments *'Infostructure – A Transport Research Project'* (Gardner, Haeusler & Tomitsch 2010) for public transport systems, the problem of pressure can be addressed in several key ways, by improving: the proximate access to transport service (physical and contextual), access to service frequency (operational and demand led), and access to information (commuter interface). In an Australian Research Council Linkage Grant (ARC) application (LP 1102000708) put together in 2010 it was proposed that the last of these aforementioned three points – 'access to information', offered a resilient, cost-effective, and efficient means of implementing both interim, and future solutions, to address the stress on public transport systems in Sydney, Australia.

figure 02
GROWTH studio interchange of future design concept



Subsequently, the ARC research project has aimed to investigate the development of a 'digital information layer' to improve the delivery of information in, and around, public transport environments and infrastructures, such as stations and bus stops. The research argues that through using existing data, the digital information layer has the potential to provide personalized real-time information across different transport modes, that can improve wayfinding, and enhance information about ticketing and service options. By applying a customer-centred approach to the design and presentation of information, that addresses the delivery of information through smart phones and on-site/situated media screens, this can lead to a significant improvement in the overall customer experience.

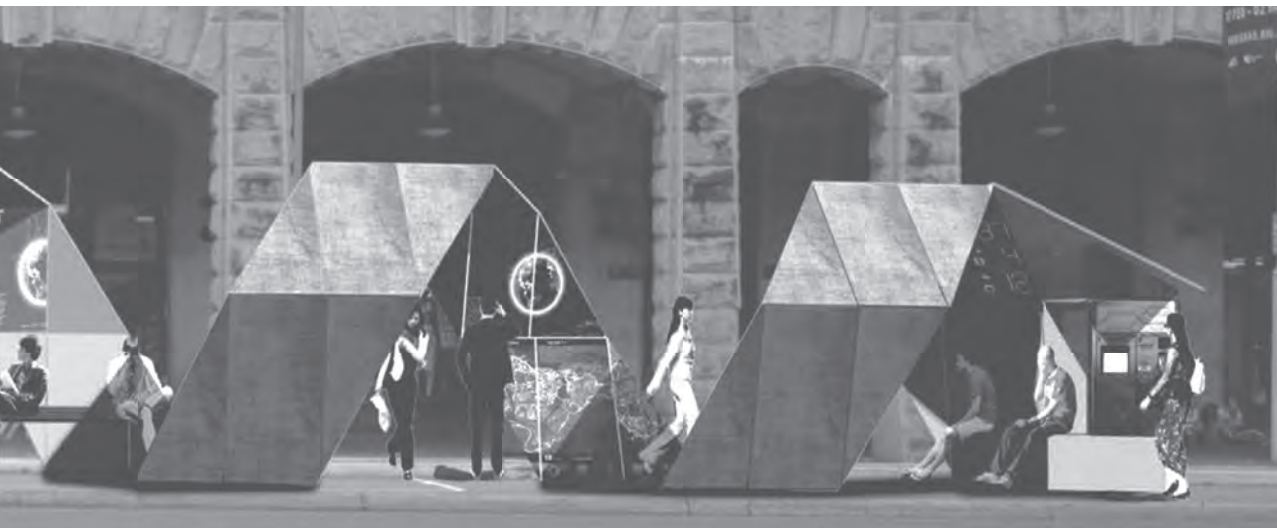
In order to further investigate the topic, *Encircle*, an academic and industry innovation alliance, was founded in 2012. Led by the University of New South Wales (UNSW), together with the University of Sydney, and the University of Technology Sydney (UTS), the alliance is supported by ARC funding, and industry partners Transport for NSW, Railcorp, City of Sydney, Arup and Grimshaw Architects. *Encircle* is dedicated to the research and development of digital information technologies in public transport environments. It is focused on creating benefits for customers by using low-cost technology to improve the delivery and quality of information.

The research project aims to use a range of innovative new technologies, in order to provide forms of information that are currently not available to public transport customers. This aims to make it easier for people to move around public transport environments more efficiently, to board and alight from public transport services and move to where they want to go as quickly as possible. These technologies include robotic sensing and cognition programs that can, for example, track and analyse customer movement around public transport environments, assess seat availability on public transport services and overall assist in optimising service delivery.

The research team sees the public transport environment and its associated stakeholders (people, provider, policy, precinct), as a system, where various conditions (internal and external) can influence the system to underperform. This understanding of conditions that influence a system offers parallels to treatment approaches that are designed to heal and enhance the performance of the human body. In medicine, syndromes are a collection of signs and symptoms that are observed in, and characteristics of, a single condition. In our research these conditions (syndromes) are noticed through subjective experiences between stakeholders (symptoms), and objective observation (signs), through in vitro examinations (studies).

INTRODUCTION: RESPONSIVE TRANSPORT ENVIRONMENTS

DR. M. HANK HAEUSLER



In vivo (Latin for "within the living", thus within the public transport environment) studies are conducted through observations in situ, while ex vivo (Latin for "out of the living, thus outside the public transport environment) studies are conducted to test isolated elements. Based on the in vivo and ex vivo studies depth and systemic nature of the syndromes can be treated through digital design interventions.

Over the course of the research project to date, the vision of developing a *Interchange of the Future* as a test scenario for a digital design interventions has found support as the ideal method for testing, developing, prototyping, and evaluating key research aims and objectives.

Through an iterative design process the ARC project partners developed a framework that was picked up in January 2014 by the UNSW Built Environment Interdisciplinary Learning (BEIL) program as a design studio for 3rd and 4th Bachelor students from Architecture, Interior Architecture, Landscape Architecture, Industrial Design and Construction Management.

Here the students were given the task of designing an *Interchange of the Future*. The *Encircle* team, as well as visiting academics, industry members and local government representatives, provided the studio with solid and extensive foundational knowledge relating to public transport issues and digital technology innovation.

The interdisciplinary student teams addressed two main objectives: firstly, the pervasiveness of digital technologies in everyday life, and secondly, how these shifts in the day-to-day engagement with digital technology can, and could better influence how we commute and travel. The design outcomes of the five student teams are represented here in this publication, and the lectures presented during the studio form the basis of the featured essays. The essays broadly reflect the conceptualisation processes of the first two years of the ARC Linkage grant and speak to the policy, planning and design issues that need to be addressed in the shift towards a responsive transport system that enables sensing, cognition, and interaction. The *Interchange of the Future* studio projects have addressed, translated and integrated these aims in various ways.

figure 03
NEXUS studio interchange of future design concept

figure 04
REFUEL studio interchange of future design concept

figure 05
GIVETAKEGIVE studio interchange of future design concept

The ideas and imagination of the students towards integrating state-of-the-art solutions for the design challenge surprised the participating academics and industry partners. Concepts ranged from investigating and inventing new revenue models to finance and maintain bus stops. This included ways to collect 'Big Data', through to data from environmental and behavior sensors to generate revenue in a business model as Facebook or Google. Another revenue model explored the idea of integrating recycling collection points, that would collect certain products – a business model successfully used by the US company TerraCycle.

Significantly, while commercial considerations were taken into account and played a role in the design development of the studio team concepts, issues such as strengthening local communities, local identity, and place-making were also addressed. Ideas here considered how embedded screens could function as dynamic digital community boards where citizens could exchange interests, news, and information, creating a localised social network. Other concepts addressed local identity issues by incorporating purchasable items aligned to specific contexts, such as sunscreen at bus stops closer to the beach, or package storage facilities near inner-city apartments to collect online shopping goods on the way from or to work.

All concepts had one thing in common, they understood that a public transport environment for the 21st century can, and should, be more than just a place to catch a bus or tram; it can play a positive and active role in a wider range of cultural, social, and economic matters, to address the needs and requirements of the 21st century urban digital citizen.

… in interdisciplinarity individuals operate between and at the edge of their discipline/s and in so doing question the ways in which they usually work.

Professor Jane Rendell 2013, p. 129

figure 01

interchange of the future studio: final presentation to industry guests

CONTEXT
INTERDISCIPLINARY FRAMEWORKS

NICOLE GARDNER
BRIEDY MAHAR

What does it mean, and what are the implications, when a design brief, project team, context, and outcomes are framed as *inter*disciplinary? This is a necessary question as the various pre-fixes for 'disciplinary', that include *trans, multi, cross,* and *inter*, are often understood to be interchangeable. For Professor Jane Rendell distinguishing between these terms is significant to understanding different ways of working, and structuring alternate design approaches. She argues that:

> "… multidisciplinarity describes a way of working where a number of disciplines are present but maintain their own distinct identities and ways of doing things, whereas in interdisciplinarity individuals operate between and at the edge of their discipline/s and in so doing question the ways in which they usually work"
> (Rendell 2013, p. 129).

With reference to Julia Kristeva's (1998) notion of the "diagonal access", Rendell further suggests that interdisciplinarity is a mode of working that can productively cut across disciplinary boundaries, and in doing so, can provide the context to call into question "the [extant] way we do things" (2013, p. 130). Given this, and the broad range of issues, disciplines, skills, and stakeholders, involved in public transport environment and infrastructure design, an interdisciplinary framework – that encourages modes of 'thinking between' – provided a suitable model for the *Interchange of the Future* design studio competition, run in the 2014 summer session as part of the UNSW Faculty of Built Environment Interdisciplinary Learning program (BEIL).

Director of BEIL, Dr. Kate Bishop, describes the overarching objectives of the program and competition as being committed to:

> "… building a collaborative teaching and research environment in order to provide an interdisciplinary setting for our students and future leaders of our disciplines. The BE Design Competition courses are intense, demanding a high degree of cooperation and innovation in a very short time frame. They are an excellent vehicle for interdisciplinary collaboration. The BE Annual Design Competition is envisioned as an opportunity for students to work on complex 'real life' projects … with leading design and industry professionals and community partners" (Bishop 2014).

More specifically the 2014 BEIL design studio competition brief – *Interchange of the Future* – centered on urban public transport issues as defined by the industry partners of the *Encircle: ARC Responsive Transport Environments* project. Further, the brief called for design concepts that would not only consider 21st century digital technologies, but also their relationship to modes of 21st urban living such as, social networking, online shopping, multi modal travel, recycling, active lifestyles, and sustainability. While the context, and therefore the site, to test design concepts, was notionally the proposed Light Rail site in front of UNSW on Anzac Parade, the brief required a modular design approach that would allow adaptation to suit varying functional requirements, scales, and contexts across Sydney.

figure 02
Dr. Michelle Zeibots workshop session on transport planning

figure 03
ACTIVE studio interim presentation

Structured as a two-week intensive studio that included a public lecture series, the *Interchange of the Future* design studio brought together Faculty of Built Environment (BE) students from the schools of Industrial Design, Interior Architecture, Landscape Architecture, Architecture, and Construction Management. The students formed interdisciplinary teams (table 01) and were required to design and consult on behalf of their discipline, and also with the visiting professional and academic lecturers. The public lecture series included academics and professionals from the fields of transport planning, architecture, urban planning, policy, industrial design, and interaction design (table 02). Studio requirements began with conceptual exercises as directed by Tim Tompson and described in his essay "Reframing transport: What is and what ifs?", including rich picture, stakeholder chain analysis, and user scenarios, followed by design visioning and development, and culminated in the production of reports including design visualisations, urban layouts, plans, sections, elevations, details, physical models, and finally professional presentations to a range of industry partners and transport design professionals (table 03).

The projects presented throughout this publication represent the outcomes of the *Interchange of the Future* studio competition. In sum, *inter*disciplinarity is addressed here in several key ways including: 'structure' – the project teams comprised of students from different design and construction based disciplines, 'intent' – the competition brief required teams to think in ways beyond normative understandings of 'transport design' and their own individual disciplinary frameworks, and 'content' – the lectures featured a wide range of disciplinary and professional knowledge, and diverse perspectives, from those experienced in transport environment and infrastructure design.

figure 04

ACTIVE studio presenting concept design to Bonnie Parfitt, City of Sydney

table 01

transport interchange of the future interdisciplinary design teams

NEXUS
Morgan Carson, Alexander Mendes **Architecture**
Annie Vu **Interior Architecture**
Kevin Lao **Construction Management**

GIVETAKEGIVE
Belinda Hoang **Interior Architecture**
Lilia Lanegra **Architecture**
Melody Willis **Landscape Architecture**

GROWTH
Evan Fan **Architecture**
Mani Hunjan **Construction Management**
Gene Jin **Industrial Design**

ACTIVE
Vivyan Wu **Interior Architecture**
Nailah Masagos **Architecture**
Alyanna Agda **Industrial Design**

REFUEL
Estelle Rehayem **Architecture**
Xiaolu Li **Construction Management**
Clement Yoong **Industrial Design**

table 02

transport interchange of the future public lecture series:

LECTURE I Encircle: Bus Stop of the Future, Tim Tompson, UNSW

LECTURE II Public Transport / Interchange Design, Mark Gilder, Grimshaw Architects

LECTURE III Bus of the Future, Tom Hordern, Volvo

LECTURE IV Transport Planning, Dr. Michelle Zeibots, ISF, UTS

LECTURE V Interaction Design in Public Transport, Nicole Gardner, UTS

LECTURE VI Street Furniture Design, Professor Alec Tzannes, UNSW, Tzannes Associates Architecture & Urban Design

LECTURE VII Public Transport Interchange Design, Dean Boston, TfNSW

LECTURE VIII Urban Infomatics, Jimmy Ti QUT

LECTURE IX Rollout and Implementation of Opal Card System, Gerald Pelle, Cubic

LECTURE X Material Finishes Policy, Bonnie Parfitt, City of Sydney

figure 05

NEXUS studio presenting concept design to Dr. M. Hank Haeulser

table 03

transport interchange of the future outline of brief requirements:

- Rich picture (RP) presentation.
- Case studies / reference design that matches "What if" concept.
- User scenario.
- A day in the life of the interchange.
- 1:1 scale foam board models of electronic components. Based on the report from the UTS / MD3 Engineering students.
- Three design concepts (form studies) models, sketches, plans.
- Case studies that outline aesthetics, qualities, materiality, technologies.
- Analysis of each form study reflected back on user scenario.
- Further development of selected design concept redefined (models, sketches, plans, etc.).
- Materiality detailing of final concept.
- Integration of electronic components.
- Plans, section, elevations (scale 1:20).
- Detailed vertical section (scale 1:10).
- Interim Model of Design (scale 1:10) .
- Details at crucial points of the design (scale 1:5).
- Final presentation Model 1:10.

Bishop, K. 2014, BEIL Program Brochure, Faculty of Built Environment, UNSW, Australia.

Kristeva, J. 1998, "Institutional Interdisciplinarity in Theory and Practice: An Interview", in A.Coles & A. Defert (eds.) *The Anxiety of Interdisciplinarity, De-, Dis-, Ex-*, vol. 2, Black Dog Publishing, London.

Rendell, J. 2013, "Working between and Across: Some Psychic Dimensions of Architecture's Inter – and Transdisciplinarity", *Architecture and Culture*, Vol. 1, no.1 and 2, pp.129-142.

INTER*CHANGING* brings together a collection of design projects and interdisciplinary perspectives on policy, planning, design, and management issues, that currently, and are set to, shape and influence our expectations and experiences of urban public transport environments. This comprises a unique range of contributions from academics, industry and practice, including the Australian Research Council Linkage Grant project and research team Encircle: Dr. M. Hank Haeusler (University of New South Wales/ UNSW), Briedy Mahar (UNSW), Tim Tompson (UNSW), Dr. Martin Tomitsch (University of Sydney), Dr. Nathan Kirchner (University of Technology Sydney/UTS) and Dr. Michelle Zeibots (UTS), together with Nicole Gardner (UTS), Tom Hordern (Volvo Group), Transport for New South Wales, Bonnie Parfitt (City of Sydney), Jimmy Ti (Queensland University of Technology/QUT), Professor Alec Tzannes (Tzannes Associates/UNSW), and Mark Gilder (Grimshaw Architects), and with a foreword by Associate Professor Marcus Foth, Director of the Urban Informatics Research Lab at QUT.

With consideration of a range of social trends, but also emerging responsive and sustainable technologies, the essays and design projects presented here reimagine, in various ways, a public transport *Interchange of the Future* better suited to address the complexities and conditions of 21st century urban digital life.

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