

CASE STUDIES IN THE USE OF DESIGN PRACTICE BY PHD RESEARCHERS



DESIGNING ROUTE BUSES: FROM BESPOKE TO MASS CUSTOMISATION

CREATIVE DISCIPLINE: Industrial design

RESEARCH METHODS:

- Literature review
- Focus group
- Case study
- Experimental design development
- Assessment of market implementation

NUMBER OF DESIGN CASE STUDIES UNDERTAKEN BY THE RESEARCHER: 2

LENGTH OF THESIS: 30000 words

EXAMINATION FORMAT: Exhibition and Exegesis

DURATION OF STUDY: 3.5 years full-time

EXPERIENCE OF DESIGN PRACTICE BEFORE START OF PHD:

- Bachelor of Industrial Design (4 years)
- Freelance industrial designer in consumer products sector (1 year)
- Industrial designer in capital goods sector (1 year)

PERSONAL MOTIVATION FOR UNDERTAKING PRACTICE DURING PHD:

- The opportunity to explore a conviction that design and research share methodological bases
- Concern for the quality of research carried out in industry in the product development process and a desire to unite them in own skill set
- Make use of an opportunity to undertake in-depth research as part of a product development programme

AIM OF THE RESEARCH:

The conflicting needs of route bus operators and bodywork manufacturers as evidenced by specification diversity in the market were in need of reconciliation to facilitate quality, cost, manufacturability and service life improvements. The aim of this research was to determine a method for making these improvements in such a way that would benefit both bus operator and manufacturer.

RESEARCH QUESTIONS:

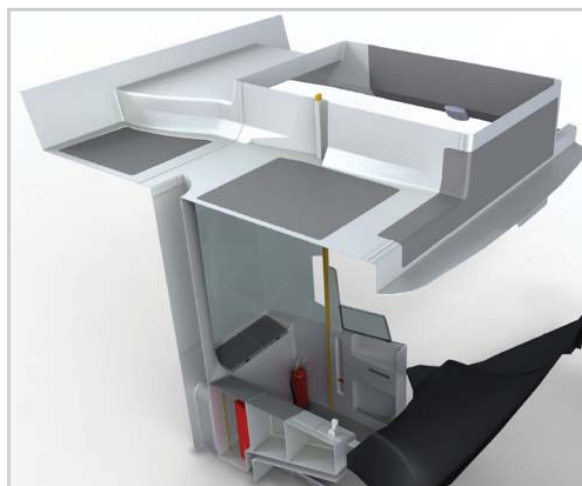
- How can the design of buses in route bus bodywork manufacture reduce the negative effects of specification diversity?
- How can systems of design in route bus bodywork manufacture reduce the negative effects of specification diversity?

OBJECTIVES:

- By means of literature review, understand the intersection of knowledge in three subject areas; design, public transport, and mass customisation
- Discover the root cause(s) of specification diversity in route bus bodywork by means of focus group research
- Through case study, determine an implementation strategy for mass customisation in the field of capital goods
- By means of design practice, determine whether mass customisation is an appropriate means to overcome specification diversity in the field of route bus bodywork manufacture



RESEARCHER: Dr Robbie Napper
INSTITUTION: Monash University, Australia
DATE OF AWARD: 2011
SUPERVISOR(S): Dr Karen Burns
Associate Professor Arthur de Bono
EXAMINER(S): Emeritus Professor Elvino Bonollo
Mr Edward Kayser



Rendered CAD model of design proposal taken to focus group for appraisal



Spatial prototype 1:1 scale, built for ergonomic and instrumentation tests



Modular components used to fit out the interior of a conventional rigid route bus to an existing customer specification – number of seats and layout thereof

SUMMARY:

Operator specifications for the urban route bus exhibit considerable variation across a sample of businesses, cities and Australian state jurisdictions. This specification diversity has a detrimental impact on manufacture; in particular economies of scale, quality, and the cost of designing individual solutions. It is particularly noticeable considering that the purpose of the vehicle remains consistently the provision of public transport. The PhD programme undertook research to understand the root causes of this specification diversity by conducting a statistical study of vehicle specification documents, followed by focus groups investigating the motivation of those who create the specifications. The solution of mass customisation emerged as a possible solution from the literature review, however, implementation of this paradigm was a barrier. The research undertook a case study of mass customisation implementation in consumer (automotive) and capital goods (large commercial aircraft) sectors in order to develop a strategy to use such a paradigm in the particular situation of route bus bodywork manufacture. From there the research shifted into product design and development to test whether and to what extent mass customisation was appropriate and effective as a solution to specification diversity. Subsequent market adoption of the design proved that mass customisation was appropriate.

RATIONALE FOR THE INCLUSION OF DESIGN PRACTICE UNDERTAKEN BY THE RESEARCHER:

As evidenced in the literature, mass customisation is clearly advantageous in many manufacturing situations however, this lies largely in the consumer goods and services sectors. Hypothesis testing was required to determine whether and to what extent mass customisation could be applied in this particular situation of route bus bodywork manufacture. Product development was a thorough method of conducting such an experiment, provided the documentation adhered to a scientific method. This was the first reason for undertaking design practice in this project. The second rationale for design practice was that the constraints of customer acceptance, manufacturability and real benefit to the manufacturer of such an approach were most effectively negotiated, tested and demonstrated through the development, manufacture and implementation of products.

The inclusion of practice in this research facilitated a re-loop of focus group research, presenting participants with the physical embodiment of their previous responses. Significantly, the physical embodiment led to a change in focus group data and a re-calibration of participants' stated requirements to a more moderate set of vehicle changes. Following the focus groups, the production of a 1:1 scale prototype afforded a fine-grained assessment of the design in light of legislative and contractual vehicle requirements. Finally, the production of this design from 2010 to 2013 and beyond in a revised design had enabled a deeper understanding of the nuances in bus operator requirements, as evidenced in their vehicle purchase specifications.

HOW THE PHD DESIGN PRACTICE DIFFERED FROM THAT OF COMMERCIAL PRACTICE:

Given that the product designed in the PhD was destined for manufacture, sale and field use, there was no difference in the intent of the design. Where the PhD design practice differed from that of commercial practice was largely related to the research training purposes of the design process, and timing thereof, namely:

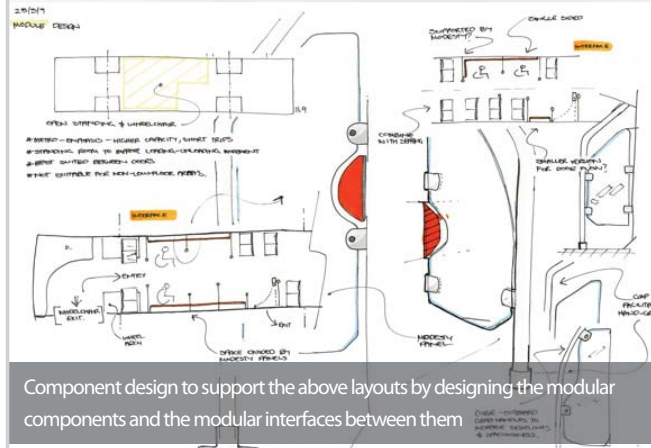
- The time allowed for in-depth research – some 18 months – before the act of design commenced. In the researcher's own professional experience, this time was normally curtailed to a few hours, days or weeks
- That the host organisation / scholarship provider was using the PhD as an agent for organisational change and therefore afforded the process considerable scope in changing engrained practices. One example of this is the strategic involvement of customers in the design phase
- The application of the considerable research resources of a university in commercial design development. For example, the availability of discipline experts at no real cost, peer review of findings as the project progressed and the availability of resources such as libraries

THESIS AVAILABLE AT: <http://arrow.monash.edu.au/hdl/1959.1/475989>

CONTACT DETAILS: Robbie Napper (robbie.napper@monash.edu)



Use of the modular interior components to fit out the interior of an articulated route bus of a future-focussed layout for high-density routes with higher passenger capacity and throughput.



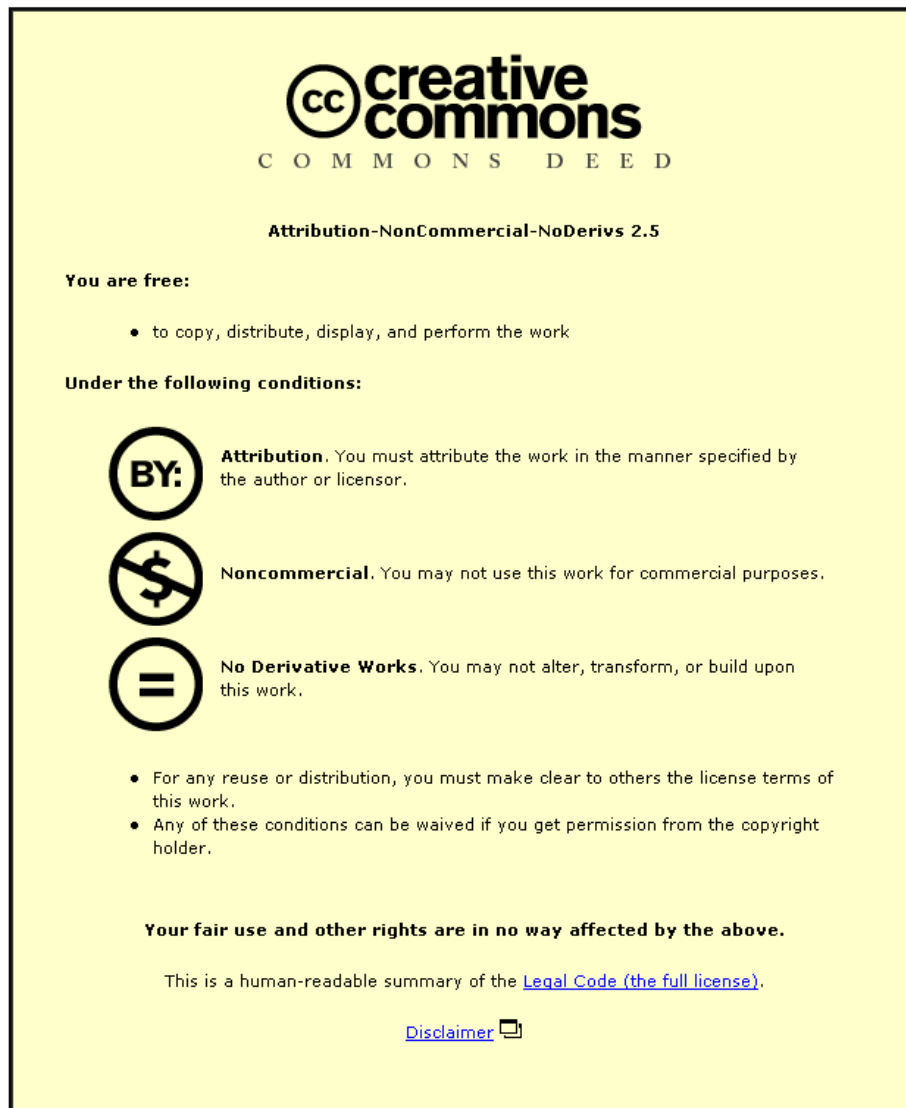
Component design to support the above layouts by designing the modular components and the modular interfaces between them



View of production driver's area taken looking in the front door of the bus

Design Practice Research Case Studies have been compiled by the Design Practice Research Group at Loughborough Design School. If you would like to work with us or contribute a case study, please contact the Design Practice Research Group Leader, Dr Mark Evans (M.A.Evans@lboro.ac.uk).

This item was submitted to Loughborough's Institutional Repository (<https://dspace.lboro.ac.uk/>) by the editor and is made available under the following Creative Commons Licence conditions.



cc creative commons
COMMONS DEED

Attribution-NonCommercial-NoDerivs 2.5

You are free:

- to copy, distribute, display, and perform the work

Under the following conditions:

BY: **Attribution.** You must attribute the work in the manner specified by the author or licensor.


Noncommercial. You may not use this work for commercial purposes.

No Derivative Works. You may not alter, transform, or build upon this work.

- For any reuse or distribution, you must make clear to others the license terms of this work.
- Any of these conditions can be waived if you get permission from the copyright holder.

Your fair use and other rights are in no way affected by the above.

This is a human-readable summary of the [Legal Code \(the full license\)](#).

[Disclaimer](#) 

For the full text of this licence, please go to:
<http://creativecommons.org/licenses/by-nc-nd/2.5/>