Enhancing industrial capability to innovate in vehicle and transport design, nationally and internationally

1. Summary of the impact

Vehicle and mobility design research carried out at the Royal College of Art (RCA) since 1993 has resulted in industrial innovation in vehicles and transport, both nationally and internationally, enhancing industry's ability to provide commercial, societal and environmental benefits between 2008 and 2013. The areas in which we are claiming impact include accessible, user-centred transport (Impact 1); future visions of public service vehicles and systems (Impact 2); and innovation in vehicle design for changing technologies (Impact 3). These impacts are produced through design and consultancy. Corroboration of impact takes the form of public records of achievements, and authentication by manufacturers.

2. Underpinning research

The RCA developed the first Master's programme in Vehicle Design in the world in 1969; its graduates are in leadership positions in automotive and transport organisations internationally. Staff are practising researchers, designers and consultants. Vehicle Design collaborates with the Helen Hamlyn Centre for Design (HHCD), whose expertise on 'design for all' began with DesignAge (1991), investigating the transportation needs of an ageing population.

The research team, led by Professor Dale Harrow (1989–present; currently Dean, Design) includes Professor Roger Coleman (1991–2009; currently Professor Emeritus); Professor Peter Stevens (1973–85 Founder Lecturer Vehicle Design; 1999–date Visiting Professor Vehicle Design); Merih Kunur (2003–present; currently Senior Research Associate); Rama Gheerawo (1999–present; currently Deputy Director HHCD); Owen Evans (2002–3, Research Associate) and Serge Porcher (2005–6, Research Associate).

Research leading to Impact 1, accessible, user-centred transport: in 1997, Coleman and Harrow presented a paper which addressed population ageing and environmental concerns as important factors in designing future transport [s3.1]. They proposed a shift from 'a car for all' to 'mobility for all'. These ideas informed the practice-based research for Harrow's contribution to the re-design of the London taxicab with Pentagram (1999). Harrow incorporated the concept of inclusive mobility, using observation and interviews with a range of disability cases and groups, and cultural perceptions of the London cab tradition. The TX1 was awarded Millennium Product status by the Design Council (1999). Gheerawo, Kunur and Harrow subsequently argued for increasing adoption of user-centred design approaches to vehicles (2006) [s3.2].

Research leading to Impact 2, future visions of public service vehicles and systems: Coleman and Harrow (2000) [s3.3], argued for a shift from the dominance of privately-owned vehicles to a service view of transport, based on enhanced mobility for all. Kunur confronted the tension between private demands for transport and public systems (2006) [s3.4]. He undertook research for Capoco, which has designed two-thirds of UK buses, on sustainable bus systems [s3.5] and with Intel (co-author Gheerawo) on the relationship between mobility and digital systems (2007). These investigations foregrounded user research as an integral part of the process of design for transport and vehicles. Evans's practice-based research for Optare developed a mixed-use vehicle that brought local services to people in isolated rural communities [s3.6].

Research leading to Impact 3, innovation in vehicle design for changing technologies*:* a special contribution of RCA research is to combine advanced technical expertise with innovative design thinking, to integrate aesthetic considerations with functional innovation. Engineering solutions alone risk failing to appeal to the users' needs and desires. This integrated approach helps manufacturers to create products that are commercially successful, as well as safe,

accessible and efficient. Porcher researched a radical modernisation of the vehicle control surface for Visteon, re-conceived as software-based and customisable (2004–5). He developed a hierarchical system of in-car information, displayed by means of rear-projection within the area normally occupied by a conventional dashboard [s3.7]. Stevens's practice-based research, from the 1990s to date, focuses on combining efficiency with aesthetic appeal. He is the designer of iconic cars such as the McLaren F1 and models for Lotus and BMW. Four research outputs submitted to RAE 2001 [s3.8] were: (1) Subaru Impreza World Rally Car, 1997, Type: Design, Client: Prodrive; (2) Le Mans Racing Car, 1999, Type: Design, Client: BMW Motorsport; (3) GT One Road and Race Car Interior, 1998, Type: Design, Client: Toyota Team Europe; (4) F1 Supercar Derivatives, 1994, Type: Design, Client: McLaren Cars. With weight a key factor in vehicle efficiency, the Stevens-designed MG SV (2002) used composite panels developed by him in association with Gurit (a global leader in advanced composite materials). He worked with Ecotricity on new methods of airflow management, reducing aerodynamic drag, and on specific cooling requirements of an ultra-high performance electric vehicle (2010) [s3.9].

3. References to the research

The originality of the research is evident from the importance attached to it by the research users, who are leaders in their fields; the rigour by the quality of the solutions; its significance by the prestige of the users, its ambition and longevity. As is characteristic for this industry, some research is disseminated through peer-reviewed outputs but most is undertaken confidentially for clients and is not therefore validated by third parties until the resulting design solutions are in use.

3.1) Coleman, R. and Harrow, D. (1997) 'A car for all – or mobility for all?', a lecture given at the conference 'Car Design for All', Institute of Mechanical Engineers (03/12/97) Text: <http://hhc.rca.ac.uk/resources/publications/CarforAll/carforall1.html>, accessed 02/11/13.

3.2) Gheerawo, R., Kunur, M. and Harrow, D., 'Beyond product design – user centred design methods for vehicle designers', in Clarkson et al. (eds.) Designing Accessible Technology, Proc. 3rd Cambridge Workshop on Universal Access and Assistive Technology (CWUAAT), University of Cambridge, 10–12/04/06 (Springer, 2006).

3.3) Coleman, R. and Harrow, D. (2000) 'Moving on – the future of city transport', 'Moving On' seminar held at the Royal Geographical Society, London, 21–22/03/2000 <http://www.hhc.rca.ac.uk/CMS/files/MovingOn.pdf >, accessed 02/11/13.

3.4) Kunur, M., 'Local needs in urban transport', in Nieuwenhuis et al. (eds.) The Business of Sustainable Mobility: from Vision to Reality (Greenleaf, 2006), 187–95.

3.5) Ponsford, A. (Capoco Design) and Kunur, M. (2007) 'The mobility PPT automated urban mobility system "See the future today"', World Electric Vehicle Association Journal (2007), 1.

3.6) Evans, O., 'Optare Alero CSV: A service delivery vehicle for excluded rural communities', in <http://hhc.rca.ac.uk/resources/publications/RA/ra_cat2003.pdf> (Helen Hamlyn Centre for Design, 2003) 22–3, accessed 02/11/13.

3.7) Helen Hamlyn Centre for Design, The Helen Hamlyn RAs 2005 (Royal College of Art, 2005), 34–5, <http://www.hhc.rca.ac.uk/CMS/files/ra_cat2005.pdf>, accessed 02/11/13.

3.8) Stevens, P., Four research outputs submitted to RAE 2001, <http://goo.gl/kah52k>,

accessed 02/11/13.

3.9) From the MG SV derived the record breaking MG ZT-T. Bonneville Speed Trial certificate http://www.mgtf.be/images/MD_Zeds_ZT_EX15_01.jpg>, accessed 02/11/13.

4. Details of the impact

Impact 1: Accessible, user-centred transport. The impact of the taxi design is represented by the longevity and adaptation of Harrow's original concept and by the recent award of a research contract by a major international taxi manufacturer. The TX1 model London Taxi (Harrow working for Pentagram) was the first to address accessibility, setting the agenda for all future models. It continues in use in London and many other cities, alongside its evolutions, the TXII and TX4. Cumulative production total for the three models was over 31,300 at 2012 [s5.1]. The company was acquired by Geely of China; the London Mayor has highlighted the key features of the design as a 'world famous, fully accessible and instantly recognisable vehicle synonymous with London' [s5.2]. Geely will invest £150m in the Coventry factory and develop a TX5 model. Following this work, Harrow was approached by Hexagon, a Turkish automotive manufacturer (£216m turnover in 2010), for research towards a highly accessible and iconic new taxi. Two of five work packages (value £58,000 each) have already been agreed and begun (total value £290,605) [s5.3]. The benefits identified by the client include (1) understanding of the specific cultural dimensions of the London and UK taxi markets, with an influence extending beyond the UK; (2) expertise in comprehensive inclusive design, including, but not limited to, functional accessibility.

Impact 2: Future visions of public service vehicles and systems. The impacts lie in the capability of two companies to design for the future. Kunur and Evans's research benefited Capoco, which has maintained a 60–65% share of the UK city bus market over the last 15 years. The company's city bus products have outsold the combined imports from Mercedes, Volvo, Scania, DAF, MAN, Iveco and Renault by a factor of 2:1 over the past decade. Capoco also carries out design projects for the leading manufacturers in North America, Asia (India and China) and Africa. The research helped position it as a company with a future vision focused on systemic approaches. The benefits identified by Capoco include: (1) dealing with issues beyond the normal remit of its in-house team, helping the firm to envision strategy for the next 25 years; (2) enabling it to demonstrate the future potential of existing technologies when combined through innovative design; (3) creating exposure and esteem for Capoco internationally, for example, the selection of Mobilicity for the Michelin Design Challenge, where the project won the Outstanding Design Award; the work was included in an exhibition at the Science Museum in 2006 <http://goo.gl/Fg2Nme>; publications and broadcasts outlining the project's concept to a receptive public; (4) it strengthened Capoco's commercial ties with Optare; (5) Capoco describes the RCA work as 'a perfect calling card to our global clients around the world', augmenting the reputation of its past products by using Mobilicity to assure new clients of Capoco's innovative edge [s5.4]. Kunur and Gheerawo also contributed to a highly praised handbook used by the Norwegian Design Council as part of its training courses for business (see s5.5 for testimonials with affiliations). Evans's research led to a new vehicle by Optare that enhanced the firm's capabilities and led to new projects. In 2010, Optare became part of Ashok Leyland, one of the top five global bus manufacturers. India's largest commercial vehicle conglomerate, the Hinduja Group, bought a 26% stake, increased to 75.1% in 2012. Using the existing Optare Alero as a basis, Evans developed a purpose-designed community-service vehicle (CSV) which the company deemed 'an interesting and viable vehicle solution to provide essential services to the community [...] a replacement to the rather archaic mobile libraries and health clinics that were operating at the time'. As a result of the project, Optare has subsequently developed its share of the CSV market and successfully produced several other

community (non-bus) vehicles. Optare was also able to introduce a new model in 2012: the Bonito minibus designed for local communities and offering full wheelchair accessibility [s5.6].

Impact 3: Innovation in vehicle design for changing technologies. Porcher's research with Visteon has had long-term benefits for the research group and the company. Visteon, a leading global automotive corporation, supplies vehicle manufacturers through a family of businesses. Generating sales of more than $12 billion in 2012, including unconsolidated operations, Visteon has facilities in 28 countries and employs approximately 55,000 people. Porcher, through his user-centred rethinking of the instrument panel, enabled the company to explore and demonstrate in-car information and controls of the future, both to inform internal research and to demonstrate its forward-thinking to customers. This has had long-term benefits for the company, providing a basis for the driver information reorganisation in subsequent concepts (X-Wave, C-Beyond, e-Bee). The company confirms that Porcher's input was integral to building a clear vision of the context of use, now and in the future [s5.7 and s5.8]. Ecotricity acknowledges the special contribution of Stevens to high-performance electric vehicles. The outcome was a vehicle that took the UK electric land speed record in 2012 [s5.9]. The company's understanding of the harsh environmental conditions under which very high-output electrical systems operate was considerably advanced by this project [s5.9]. Stevens contributed to 'master classes by eight British celebrity innovators' in a tour of China at the invitation of the British Council (2009) [s5.10].

5. Sources to corroborate the impact

Copies of all sources to corroborate the impact are available from the HEI upon request. Note: In relation to Stevens's research, the impacts evidenced in this case study represent only a fraction of his achievements: some manufacturers were reluctant to divulge his contribution, even confidentially.

5.1) Source data from <https://www.gov.uk/government/collections/vehicle-licensing-statistics>, accessed 02/11/13.
5.2) China Auto Web, 'Geely bought Manganese Bronze, maker of London taxis' (01/02/13) <http://chinaautoweb.com/2013/02/geely-bought-manganese-bronze-maker-of-london-taxis/>, accessed 09/02/13.
5.3) Letter from Managing Director, Hexagon Studio (dated 25/11/13).
5.4) Letter from Design Director, Capoco Design Limited (dated 03/07/13).
5.5) Norwegian Design Council (2013) 'Innovating with people: `the business of inclusive design', <http://innovatingwithpeople.net/en/> accessed 09/02/13.
5.6) Letter from Deputy CEO, Optare Group Limited (dated October 2013).
5.7) Letter from Visteon Corporation (dated 12/11/13).
5.8) Helen Walters, 'Art and business: A royal combination', Bloomberg Business Week, 19/03/07 <http://www.businessweek.com/stories/2007-03-19/art-and-business-a-royal-combinationbusinessweek-business-news-stock-market-and-financial-advice>, accessed 02/11/13.
5.9) Ecotricity, 'The 'Nemesis' smashes UK electric car land-speed record' (27/09/12) <http://www.ecotricity.co.uk/news/news-archive/2012/the-nemesis-smashes-uk-electric-car-land-speed-record>, accessed 02/11/13); and letter from Founder of Ecotricity (dated 12/09/13).
5.10) British Embassy China, news release, 07/05/09 <http://www.britishcouncil.org/200905_experience__overall_press_release_eng_.pdf>, accessed 02/11/13.