

Impact case study (REF3)

Institution: University of Wales Trinity Saint David		
Unit of Assessment: 32		
Title of case study: Assistive seating devices for children with neurodevelopmental conditions		
Period when the underpinning research was undertaken: 2010-2015		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s): Dr Ross Head	Role(s) (e.g. job title): Cerebra Innovation Centre Design Manager	Period(s) employed by submitting HEI: Oct 2005 - current
Period when the claimed impact occurred: 2014 - 2020		
Is this case study continued from a case study submitted in 2014? N		
1. Summary of the impact		
<p>The Goto portable, postural support seat and Scoot seat are unique seating devices for children with neurodevelopmental (brain) conditions, developed by a collaborative research initiative between national charity Cerebra and UWTSD's Cerebra Innovation Centre. Research and iterative design processes involving parents of disabled children led to a further collaboration including commercial partner Leckey. The subsequent products formed the flagship products for Leckey's subsidiary brand, Firefly. The Goto Seat and Scoot Seat have international sales of 13,000 and 5,500 units respectively in over 50 countries. Following a highly ambitious marketing campaign the Goto Shop was launched and 3,500 units have been adopted into 12 supermarket chains internationally. The 22,000 seats have significantly improved the lives of children with neurodevelopmental conditions and their parents and carers, increasing inclusion, integration and interaction with people, with attendant benefits for physical, cognitive, and sensory abilities.</p>		
2. Underpinning research		
Creative, inclusive and innovative design solutions		
<p>Cerebra Innovation Centre (CIC), set up in 2005, is a collaboration between UWTSD and national charity Cerebra. Now in its 16th year, Dr Ross Head (Associate Professor and Design Manager) has led the centre since its inception. Aligned to Cerebra's national research strategy, CIC's discovery research encompasses user-experience evaluation and user-centred development of assistive devices and products to help children with neurodevelopmental conditions discover the world around them. The creative, inclusive and innovative design solutions serve to improve the quality of life for these children and their families. Neurodevelopmental (brain) conditions describe any disorder or disability that affects the brain, including those caused by illness, genetics or traumatic injury. These include (but are not limited to) autism, ADHD, Down's syndrome, learning disabilities, cerebral palsy, epilepsy and developmental delay.</p>		
Methodology (i,ii)		
<p>The CIC team responds to requests for assistance from families to investigate and develop potential interventions to support independent living and to improve relative quality of life. Cerebra's mission is to research and develop solutions which help children whilst concentrating on increasing social inclusion by intelligent user-centred design. The methods deployed by CIC incorporates the methodological and data triangulation between objective behavioural, physiological and bio-mechanical data with subjective self-reported measures. The team respond to around 150 requests from parents each year, with requests falling fairly equally into three areas: brand new designs; repeat designs; and advice jobs. When CIC receive a request from a parent its first job is to research the market to see if there is a product out there that will meet the needs identified. If so CIC advise the parent of this. Where CIC fail to identify a suitable product and the design is within its capabilities CIC will design a bespoke product for the individual child. This is a one off design and the research team ask families to feed back to us on its suitability. For some one-off designs CIC make a small batch of repeat designs for other children. Each repeat design is made to measure for a particular child and again families are asked for feedback. When CIC get overwhelmingly positive feedback it approaches third party</p>		

companies to work with it to scale up production. CIC is a research and innovation team and it does not make and sell our products to the general public. Rather, CIC aims to make the best products available to the general public by getting established manufactures to adopt its designs. Within this research context, two designs developed in 2014 and 2015 underpin the reported impact.

Goto Seat (iii)

Initiated by a request from the single parent of a partially sighted child with severe cerebral palsy and low trunk muscle tone, a novel assistive device was required to facilitate i) safe handling, ii) enhanced access, and iii) inclusive participation for the children during essential shopping trips in supermarket settings. This was especially important in the case of single parent families where use of multiple mobility devices is not practicable. The product design specification required: postural support, specifically, lateral trunk support and head control; flexibility in use and ease of use and installation by single adult; and portability and ability to fit multiple trolley/mobility devices. The collaborative team from CIC, led by Head, established an iterative design process focused on a) ergonomic data, medical condition and supportive needs of specific child; b) preliminary sketch solutions and 3D CAD concepts of form; c) generation of full scale prototypes to test fit, function and support in response to PDS; and d) material consideration for comfort, lateral stress and postural support in response to the PDS. The research process set in motion a series of design iterations culminating in a successful supportive seat for disabled children which allows significantly higher social inclusion and opportunities for interaction, play and exercise. The research project established a design protocol by which human centred, iterative design stages and functional trials enabled the successful development of a product suitable for one child. Subsequently reported in a magazine distribution of 15,000 homes, a revised design was made available to over 60 more children. Further, the commercialisation of the product via a IPR licensing agreement with a third party company, Firefly, enabled income for reinvestment and set a precedent for the future commercialisation of the Scoot Seat (as detailed below and in Part 4).



Figure 1.



Figure 2.



Figure 3.

Figure 1. Goto seat concept 3 from CIC being tested. 2 of 60 units produced. Machine cut, hand assembled in ABS plastic, evozote foam and sewn webbing straps.

Figure 2. Fixed supermarket trolley. The first Firefly "Goto Shop" units produced for Firefly

Figure 3. Firefly Goto Seat Mark 2. Includes floor seating support.

Scoot Seat (iv)

Children with Cerebral Palsy often present with reduced muscle tone in lower body and lower limbs resulting in functional impairment. The inability to weight-bare and significantly impairs independent mobility and associated developmental pathways. A typical NHS provider-solution is a standard sized wheel chair which, in many cases the child is unable to self-propel. 'Bottom shuffling' becomes the standard mode of mobility for many children which can lead to severe skin injuries from friction burns and trapped fingers. In response to Cerebra initiated requests, research investigated assistive solutions for mobilisation in the domestic and school environment for children with cerebral palsy. Device parameters were designed for children ranging from 2-6 years old (maximum weight 22kg) and Gross Motor Function Classification System (GMFCS) levels II - IV. The original conception and prototype device was designed and validated in user settings by Head at the Cerebra Innovation Centre (to TRL 1-6) using behavioural, physiological, bio-mechanical data and subjective self-reported measures. Following user demand from Cerebra clients, the commercial product was developed and taken to market under licence (TRL 7-9) by industrial partners Leckey / Firefly, as detailed in Part 4.



Figure 4.



Figure 5.

Figure 4. Second iteration to the CIC design. Shows seat back included, safety hand holds to reduce chance of trapping hands against furniture and child-friendly wheels. 40 units produced and used by Cerebra referred families.

Figure 5. Scoot promotional images for the final product, launched 2015 (courtesy Firefly by Leckey)

3. References to the research

- i. Head. R. Bespoke product design and manufacture for disabled children. A case study of products and their perceived effectiveness on user wellbeing. Making Futures, Volume 5, ISSN 2042-1664, 2018
- ii. Head. R. et al. The Cerebra Innovation Centre- Product design to improve the quality of life for brain-injured children. Proceedings of the 7th International conference: QRM 2010. Coxmoore. ISBN 978-1-901892-34-5. Pp 87-97
- iii. Goto Seat: <https://www.fireflyfriends.com/uk/goto-seat>
- iv. Scoot Seat (REF2: 32-RH1): <https://www.fireflyfriends.com/uk/scoot>

Grants & Royalties:

- v. Charitable sources (Cerebra) £283,000
- vi. IPR. £226,000

Awards:

- vii. Welsh Government. Saint David's Award for Innovation, Science and Technology, 2019. <https://gov.wales/st-david-awards/cerebra-innovation-centre>

4. Details of the impact

The national charity Cerebra reports that in the UK there are around half a million children and young people who are disabled, and while the range of impairments and conditions that are associated with childhood disability is wide, those with neurodevelopmental conditions form the largest group. Many of these children experience a number of impairments and co-morbidities, which result in complex medical, educational and social support needs. These needs are exacerbated as children with brain conditions often encounter barriers to taking part in activities that their typically developing peers take for granted, impacting not only on their quality of life, but also that of their parents and siblings. Regarding the Goto and Scoot devices, there are an estimated 30,000 children in the UK with Cerebral Palsy with around 99% living at home and supported by their families. Up to 45% of those are likely to have at least one serious physical impairment. The cost of bringing up a disabled child is around three times that of a non-disabled child, yet the average family income is likely to be over 20% lower than the national average (9). In this context, through its research, the Cerebra Innovation Centre has developed, evaluated and shared new inclusive approaches to design problems and provided creative, inclusive and innovative design solutions to enable participation and tackle issues families raised with us. The success of this design process have seen both Goto and Scoot launched on a commercial basis through licencing arrangements with Firefly by Lecky.

Commercial development

The Goto seat was originally designed in response to a parent request for help taking a child to the supermarket. The child was unable to sit up un-aided, but the parent was unable to push a specialist wheelchair and supermarket trolley at the same time. Initial design and prototypes were made and tested with the child in a supermarket to test suitability, support, adjustability and fit. Following an iterative range of prototypes and trials mother and child were able to shop at leisure. The story was reported in Cerebra's quarterly magazine and sent to 15,000 homes.

Many requests were made for a similar unit, so the team developed the concept and redesigned for larger scale manufacture. Three batches of 20 units were made by machine and hand and shipped to parents in UK for testing. The feedback was overwhelmingly positive with families using the seat, not only in shopping trolleys, but in park swings, ride-on toys, kayaks, aeroplane seats, cafes and beaches. The support offered by the thin format, fold-flat seat enabled children with complex seating needs to participate in family and peer activities which had been unachievable before. Given the positive experiences and continued demand, the IPR was licenced to the company Lecky (NI), who collaborated with CIC to further refine the design and launch the products in December 2014 with a new brand, Firefly. The Firefly Goto seat Mark 1 consists of a largely handmade unit based very closely on the CIC design constructed from ABS sheet, CNC machine cut and hand assembled with stitched covers and straps. Given this commercial success and positive user responses Firefly subsequently reinvested £120,000 of the profit from Goto Seat Mark 1 to develop Goto Seat Mark 2, for which mass production manufacturing techniques were employed in order to produce more product at a competitive price point (see Figures 1,2,3, and Part 3, ref. iii).

Overwhelmingly positive feedback was received from the disability community, the Goto seat was enabling families to access activities they had never thought possible. The immediate success of the launch of Lecky's subsidiary brand, Firefly, was pivotal upon the take up and success of the Goto seat with sales exceeding 13,000 units on an international basis. The Goto seat has contributed £3.5 million to the company turnover during the last five years and since the first product launch, Firefly has subsequently increased their range of therapeutic products to eight (of which the Goto remains the flagship product). Following the success of Goto, CIC and Firefly entered into a second licensing arrangement for the Scoot device (figures 4 and 5), which has been trialled and used by 40 children referred to CIC by Cerebra. Scoot was launched by Firefly commercially in 2015 and has sold 5,500 units, generating £1.6M revenue. Lecky and Firefly now employ 184 people with a turnover of £17 million, reinvesting almost £1m per year in research and development. IRP licencing arrangements with Cerebra and UWTSD continue for both products.

Benefits for Children

The Goto Seat and Scoot Seat have international sales of 13,000 and 5,500 units respectively in over 50 countries. The 13,000 Goto seats have sold primarily through private sales to families to use in supermarkets or anywhere else they needed supportive seating, although sales are also recorded with groups, therapy centres, schools and children's hospitals, increasing further the number of children who have benefited. Additionally, it was evidenced that supermarkets were falling short of obligations to provide suitable seating for families with disabled children and a national campaign was launched by Firefly, with Cerebra's support, to persuade supermarkets to use the Goto Shop, comprising of a fixed Goto seat which has developed with trolley manufacturer Wanzle. The Goto Shop is required as when a child with a disability outgrows the infant seat of a traditional shopping trolley, the portable Goto is not suitable for use. There is currently



Figure 6. Goto Shop (courtesy of Firefly)

no safe or suitable alternative. The Goto Shop is an adapted shopping trolley suitable for younger children who require extra postural and head support. To date, Tesco, Asda, Sainsbury's, Waitrose, Marks and Spenser, Aldi, Dunnes Stores and Morrisons have supplied 3,500 units for their customers in UK. A companion Goto Finder application enables families to find a supermarket close to them with a Goto Shop. Goto shop has also been adopted by supermarkets in France and Germany and Wegmans in USA.

A significant increase in wellbeing is demonstrated within those families by being able to discover and explore the world together, with fewer boundaries and greater integration, something most people take for granted. Many of the children within this demographic have

additional complex needs such as sensory and physical deficiencies; as such, an activity as benign as shopping, offers a huge range of sensory input, as well as inclusion, integration and interaction with people and society. Their level of wellbeing is increased in such activities. User feedback from families' records that they have been empowered to undertake activities, attend events and even long-haul holidays with minimal additional equipment to support their child. Activities such as shopping, kayaking, ride-on toys, park swings, car journeys, sitting in a sand pit with a sibling and having a haircut have been made possible by the addition of the Goto seat to the family. Almost any situation where sitting is required can be adapted using the Goto seat to give a safe and supported seating solution. Typical feedback is characterised by the following statements:

- "We finally have a supermarket with a GoTo Shop trolley, Maggie loved it! Well done Tesco, thanks for the inclusion. No more struggling to get Maggie's splinted legs in and out of the normal trolley holes! Check out that smile!"
- "For the first time ever, he was able to have his own seat at the kitchen table. Today he sat and ate so well, and was then able to sit with the other kids watching Frozen II. We are beyond grateful for these moments and the adventures to come!"
- "I've waited two and a half years to put the boys in their little red wagon together. This Firefly Goto chair makes so many things possible for Zane. And for us as a family."
- "KJ got to enjoy the park on this gorgeous day thanks to his GoTo"
- "Today we went to watch Milkshake Live with Cooper using his Goto Seat! These 2 just made each other laugh the entire time."

Likewise, the Scoot seat provides an experience of independence for many children with mobility problems. Scoot facilitates play, a key factor in the early years of development in a child's life. It also complements therapy programmes in numerous ways by serving as a practical and fun device for home and therapy environments. It gives children the freedom to explore their home, play with friends and undertake activities that children without brain conditions routinely undertake without any help. In doing so they will have opportunities for developing physical, cognitive, and sensory abilities.

5. Sources to corroborate the impact

Contacts:

- 1) Leckey, Product Management Director
- 2) Leckey, Head of Sales & Business Development
- 3) Cerebra, Head of Research & Information

Documents:

- 4) Cerebra Goto seat information
<https://cerebra.org.uk/cerebra-innovation-centre-portfolio/goto-seat/>
- 5) Cerebra Scoot information
<https://cerebra.org.uk/cerebra-innovation-centre-portfolio/scoot/>
- 6) Firefly Friends sales and product information:
<https://www.fireflyfriends.com/uk/>
- 7) Detailed activity programme developed with health specialists:
https://www.fireflyfriends.com/media/catalog/product/g/o/goto_activity_programme_new_19.pdf
- 8) The Goto Shop supermarket campaign:
<https://www.fireflyfriends.com/uk/campaigns/goto-shop>
- 9) Cerebra Research Strategy
<https://cerebra.org.uk/download/research-strategy/>