Institution: Ravensbourne University London		
Unit of Assessment: 32. Art and Design: History, Practice and Theory		
Title of case study: Caskia: Growing a MarsBoot		
Period when the underpinning research was undertaken: 2017- 2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s): Liz Ciokajlo	**Role(s) (e.g. job title):** Associate Senior Lecturer	**Period(s) employed by submitting HEI:** January 2014
Period when the claimed impact occurred: 2017- 2020		
Is this case study continued from a case study submitted in 2014? N		

1. Summary of the impact (indicative maximum 100 words)

Caskia:Growing a MarsBoot (2016-20) is an art and design research project positioned in the fashion product sectors. The work focuses on strategies for more sustainable material and fabrication design by proposing systems of manufacture in the enclosed ecosystem, space.

It impacted industrial collaborators (MOGU, Italy) to advance material development and strategies.

It also impacted public/industry attitudes/awareness at MoMA (Museum of Modern Art, New York) Items: Is Fashion Modern? commission, exhibition, book, curator Paola Antonelli, 588K international visitors September 2017–February 2018

- Nominated for Beazley Design of the Year, Design Museum London 2018, September 2018 – February 2019

- Moving to Mars Design Museum, London, 80K visitors rated 4-5star, (plus touring) Tekniska Museet, Stockholm 2020-21

- Coursera - Fashion as Design - business/design online course for students/industry 230K rated 4.8 of 5star (2,393 reviews) since 2017

2. Underpinning research (indicative maximum 500 words)

Underpinning research ran 2013-20, is by Liz Ciokajlo and collaborators, and gathered research insights into:

1. Deeper understanding in novel materials and design-led applications to advance material and design innovation for everyday products (footwear).

2. Deeper understanding in relation to cultural values/ perspectives towards novel materials (bio/renewable/3D Print) and processes (grown/circular economies/additive) to raise public/industry attitudes/awareness of challenges and opportunities by utilising design narratives to reimage our relationship to everyday fashion footwear products.

OurOwnsKIN project (2015-17) Innovate UK and Arts Council England funded, Bloomsbury Academia published, utilised human skin performative properties to inspire the design 3D printed footwear structures.

Collaborators, Ciokajlo, Ravensbourne University London (lead concept/footwear designer), Papastaverou (computational specialist/designer) and Solomon (artist/researcher-skin), put human over machines as design directives for 3D print lattice by design of:

- a parametric framework, inspired by skin's tension lines
- responsive, 'springy', auxetic cells inside parametric framework
- a one-unit structure to seamlessly cover the top of the foot and project lattice depth for sole

The computation was finely 3D printed into a holistic part with a responsive structure allowing the 3D printed material to behave more flexibly than conventionally expected. The design approach capitalised on the fineness of 3D print SLS (selective laser sintering) process taking the approach design structures can impact material behaviour. Outputs were iterative footwear prototype, sample tests, film and publication, evidenced in…

- **Bloomsbury Academia** published (02-2020) collaborator team co-authored chapter 'OurOwnsKIN: The development of 3D-Printed Footwear Inspired by Human Skin' in book *Crafting Anatomies: Archives Dialogues, Fabrications*
- **Exhibitions and talks** Wild at Somerset House, London (2016), Material Anatomies at Digit2Wigets, London as part of The Design Festival (2017)
- **Industry interest/engagement** included Clarks, Puma, Nike and the collaborative team was hired on a Kings College London Research scoping project Reboot to design footwear for people with EB/Epidermolysis Bullosa (2016-17).
- **Funding -** Innovate UK, MVWorks Makerversity London (PO Arts Council England, Innovate UK, w/support KTN Knowledge Transfer Network), Ravensbourne Research.

  "Of the projects we funded, this one stood out originally because it is novel and the direction it was seeking to travel…it went well and is the standout project… it was a very good project from an InnovateUK point of view". (Fiddian, Head of Artificial Intelligence and Data Enterprise, InnovateUK)

Computation directly informed MarsBoot sole and narrative approaches.

The BioCouture Shoe: to grow a shoe (2013) collaborative project, Ciokajlo and Lee (BioCouture, BioFabricate) where Ciokajlo grew bacterial cellulose material using Lee's recipe/fermentation process and explored footwear design and construction application methods unique to the novel material. The project radically rethought what constitutes sustainable consumer products, proposing alternative perspectives and design systems for grown biomaterials/fabrications for design fashion/products items. Outputs were material samples, shoe prototype and film communicating proposed manufacturing system narrative. Exhibited at *Alive: The New Frontiers* (2013), Espace Foundation EDF, Paris in the New Artisans section showcasing designers who worked with bees, fungi, bacteria, algae or plants to develop new techniques to grow and craft consumer goods.

Insights directly informed MarsBoot craft methods/narratives.

Ciokajlo's **HempShoes** (2013) design prototype from Natural Selection shoe collection project reappropriated low value natural non-wovens to higher value footwear designs. For footwear performance requirements, natural (non-synthetic) binders were added in key areas to create variable densities over one continuous surface. Material was moulded with 3D prints and provoked debate on material value perceptions. Exhibited internationally including…

- **Utopian Bodies: Fashion Looks Forward**, Stockholm at Liljevalchs Konsthall (2015-16) curators Martynov and Hedman '…aimed to present the great power and possibilities of fashion, and inspire visitors to search for their vision of the future' (Henman, 2015).

- **Plant Fever: Towards a Photo-centred Design** (2020-22) curator studio d-o-t-s, produced by the Belgian museum CID au Grand-Hornu showcasing designers, scientist and engineers looking at the future of design from this new vegetal perspective.

Insights informed MarsBoot material boundaries and perceptions.

Ciokajlo's **Arts Council England**: Artist International Development Fund Partnership with **Art Group Tumar** (2015) project, knowledge transferred traditional Kyrgyz renewable wool felting, gaining an understanding of Central Asian historic nomadic manufacturing methods and circular systems by Ciokajlo traveling to Bishkek and surrounding villages. Dissemination included workshops with University of the Arts London students.

Insights informed MarsBoot circular design and material fabrications.

3. References to the research (indicative maximum of six references)

Key outputs and related research council awards are listed below:

1. Papastavrou M., Ciokajlo L., Solomon R. (2020), 'OurOwnsKIN: The development of 3D-Printed Footwear Inspired by Human Skin' in Townsend K, Solomon R, Briggs-Goode A, *Crafting Anatomies: Archives Dialogues, Fabrications* London: Bloomsbury Academia, pages 191-210.

2. Ciokajlo L., Papastavrou M, Solomon R, (2015-17) *OurOwnsKIN.* [Design project]. Ravensbourne University London on request.

3. Ciokajlo, L., & Lee, S. (2013) *BioCouture Shoe.* [Design project]. Ravensbourne University London on request.

4 Ciokajlo, L., (2013) *HempShoes* [Design item from Natural Selection design project]. Ravensbourne University London on request.

5. Ciokajlo, L., (2015) *Partnership with Art Group Tumar* (2015) [Design project]. Ravensbourne University London on request.

• Ravensbourne University London, PI Ciokajlo,L., Papastavrou M., Solomon R. *OurOwnsKIN* (01/2016-06/2016) £10,000. MVWorks Makerversity London (with support from Innovate UK, Arts Council and KTN Knowledge Transfer Network).

• Ravensbourne University London, PI Ciokajlo,L. & Solomon R. *OurOwnsKIN* (10/2016-06/2017) £24,666 Innovate UK grant number 132416.

• Ravensbourne University London, PI Ciokajlo,L. & Solomon R. *OurOwnsKIN* (10/2016-06/2017) £4000. Ravensbourne Research

• Ravensbourne University London, PI Ciokajlo,L., *Partnership with Art Group Tumar* (09/2015-06/2017) £5000 British Council Arts Council England

4. Details of the impact (indicative maximum 750 words)

Caskia: Growing a MarsBoot has helped position the UK as a leader in the field of 'Sustainable Fashion Product Design' via its nomination for the internationally-renowned ***Beazley Design of the Year 2018, which recognises innovative and thought-provoking designs from around the world,*** and through being commissioned/exhibited/published at world-leading museums/galleries, including MoMA (Museum of Modern Art, New York) and the Design Museum (London), and associated exhibition books. The project was a vehicle for innovation, awareness, and debate, created by Ciokajlo (lead concept/footwear designer), collaborator Montalti (designer/mycelium specialist) and collaborators Papastavrou (designer/computational specialist) and Solomon (artist/researcher).

Impact of the research can be seen in a commerce and economic context, and on creativity, culture and society. This is demonstrated through:

1. **Contribution to innovation activity through the design of new products:** Through collaboration with Italian industrial SME MOGU, the research resulted in advanced material development. With each MarsBoot iterative prototype, MOGU supplied myceluim variant

material for the research, responding to application opportunities and challenges communicated by Ciokajlo for directive development. *"Responding to Liz's requirements in the iterative prototypes working with the mycelium material, we supplied her with the first version of our flexible mycelium (pure white "fabric"), plus other mycelium materials too."*

The collaborative working relationship also impacted upon business practices and strategies at MOGU, influencing priority shifts in expenditure:

"*The concept of the MarsBoot, deriving from the utilisation of human sweat as culturing terrain, was well displayed and contributed to attracting interest from leading fashion houses and brands, supporting the possible creation or further expansion of commercial opportunities."* As a result, *"Mogu continued to decisively invest and expend on research and development efforts targeting the Fashion sector... and it is driving strategic business" (Camera, Head of Products MOGU)*

2. **Impact on creativity, culture and society:** Public/industry attitudes/awareness via museum exhibitions/publications of design-led opportunities and challenges moving from a plastic throwaway society towards biomaterials/renewable circular economies and associated cultural/ethical values in material/design narratives.

   Through collaboration with world-leading public arts venues, the creative outputs of the research have resulted in **raised awareness of issues and opportunities, provoking debate** with regard to **fashion products and material sustainability,** *"reimagining our relationship to clothing" (Arguedas Ortiz, BBC Futures).* The MarsBoot project was exhibited/published in multiple international museums/events, including MoMA. Senior Curator of the Department of Architecture and Design at MoMa, Paola Antonelli, commissioned Ciokajlo, commenting, *"In Stockholm, Liz was exhibiting a hemp shoe. [..] I liked Liz's approach to sustainability and the use of materials. As a result, I got directly in touch with Liz and the relationship has developed and matured".*

   Representing a change of practice for the Museum, The exhibition at MoMA that featured the MarsBoot, 'Items: Is Fashion Modern?', was the first fashion exhibition at MoMA since the 1940s. For the duration of the exhibition, MoMA estimated that 588,000 people visited the exhibition, a daily average of 4,985 people during its 118 day run, including visitors from France, Italy, UK, Germany and Canada. *"It has also featured on social media and engaged with a range of publics. People's responses to the MarsBoot were very positive. The designer of the Tecnica Moon Boot and his family came and saw Liz's MarsBoot at the exhibition. They really understood it and loved it…What appealed to me about the MarsBoot was it's view of the future from today's viewpoint as opposed to 1969's. [..] MarsBoot portrays a more feminine concept of going to space…. I also included Liz's MarsBoot also in the 2019 exhibition, Broken Nature. There are certain projects I take with me. The MarsBoot was one of them."*

   The project received further public exposure and engagement with the Design Museum London, being exhibited twice, which is unusual for the Museum, first as part of ***Beazley Design of the Year 2018,*** Design Museum London's internationally-renowned exhibition, for which it was **shortlisted for the Product Design category Award**. *"BDOTY is an annual exhibition and awards programme that showcases the best design projects from around the world." (Horton, CEO Beazley). "It is the fast-track to what's coming, the world summit of design, designers do not come looking for us we go looking for them – (designs are) nominated by a team of people from all over the world (Adamson, Curator 2017).*
   The MarsBoot was nominated for inclusion in the exhibition by the leading international art curator and critic, Jan Boelen.

   In its second exhibition, '*Moving to Mars'*, the MarsBoot was *"…exhibited in the 'Survival' chapter in a subsection about closed-loop systems…. work once again proved to be a popular exhibit, being at once a recognisable everyday object but also futuristic and provocative. We presented the final product alongside a petri dish filled with mycelium so that visitors could see the living organism that went into the boot's production. Visitors were*

both repulsed and fascinated by the exhibit, and it provided a great entry point through which to discuss broader issues of sustainability, self-sustenance, environmental collapse and the dangers of space." (Watson, Curator Design Museum London). The exhibition received 80,000 visitors and garnered a number of four and five star reviews from the national press, being featured on television programmes such as Sky News and Saturday Brunch. In further evidence of international reach, the MarsBoot has been taken on loan by Sweden's national science museum, the Tekniska Museet, touring *Moving to Mars*.

5. Sources to corroborate the impact (indicative maximum of 10 references)

Evidence of impact on industry

1. Statement from MOGU Serena Carmera Head of Products

Evidence of public funding body and Awards

2. Statement from Innovate UK funding body Tom Fiddian, Head of Artificial Intelligence and Data Enterprise, Innovate UK OurOwnsKIN Ravensbourne University London on request.

3. Statement from The Design Museum Curator Eleanor Watson MarsBoot. Ravensbourne University London on request.

Evidence of impact on raising awareness of issues with regard to fashion and textiles sustainability and perspectives on materials and clothing

4. Statement from Director of Design and Research at MoMA and curator of Broken Nature, Paolo Antonelli MarsBoot. Ravensbourne University London on request.

5. Statement from BBC Futures journalist Diego Arguedas Ortiz MarsBoot. Ravensbourne University London on request.