

# Exploring Designing with Composites Materials

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Presented at the 8<sup>th</sup> International Workshop of Design Theory  
27th January 2015

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## Introduce *“The Dibber”*

What it is

Why it is important

## Exploring Designing with Composites Materials

Problems

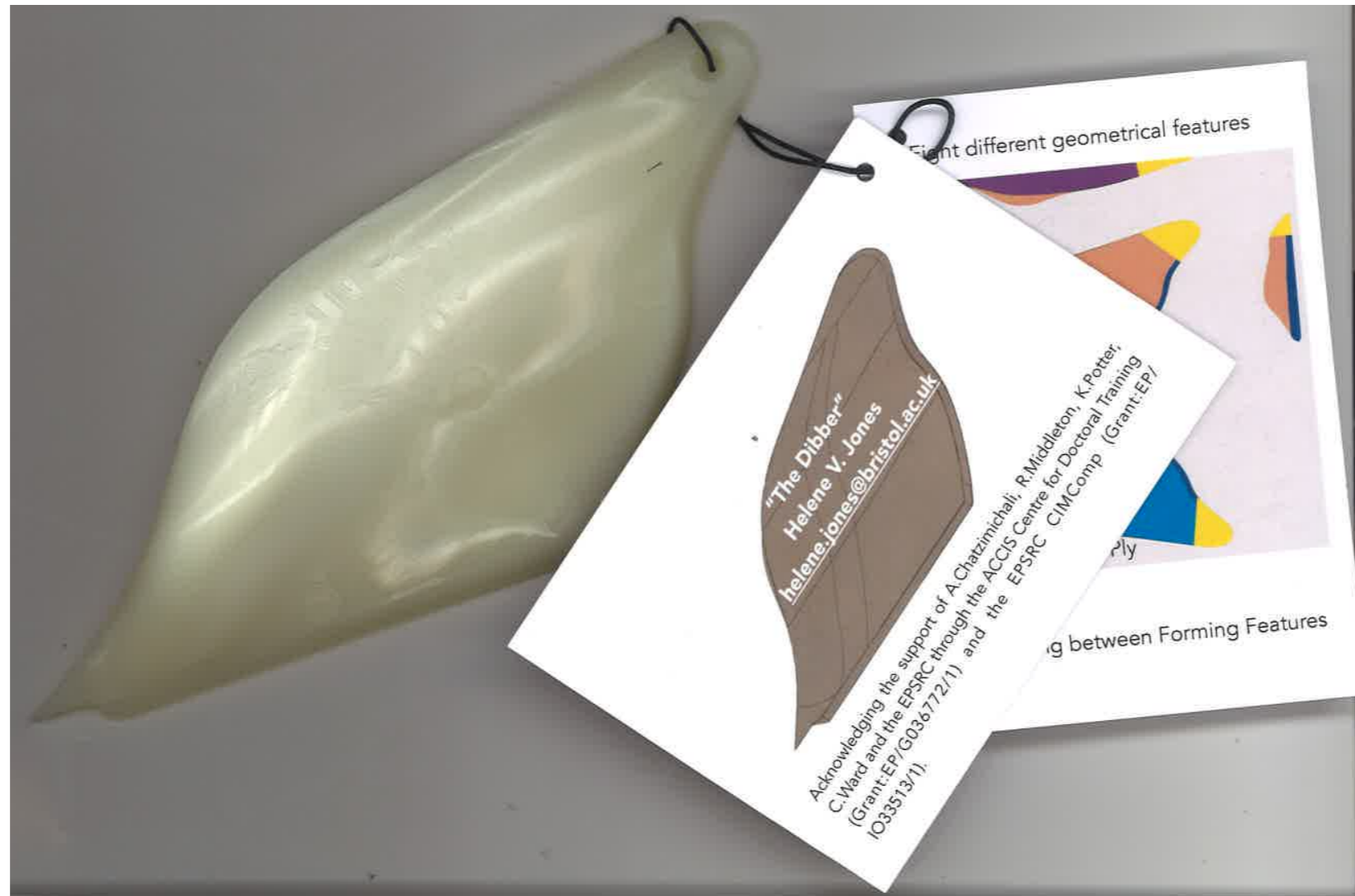
Background theory for integrating new knowledge in new product development (NPD)

Investigating this in the composites industry

## Conclusions and Future Work

# “The Dibber”

- What is it?
- Why is it important?

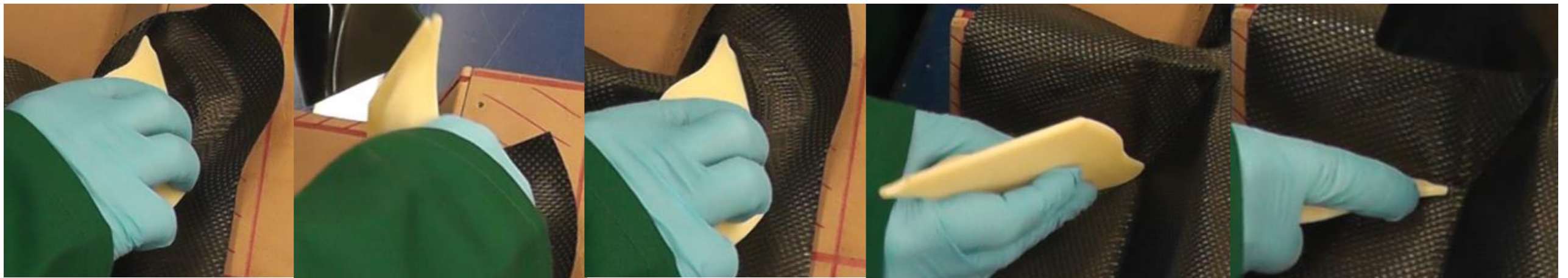
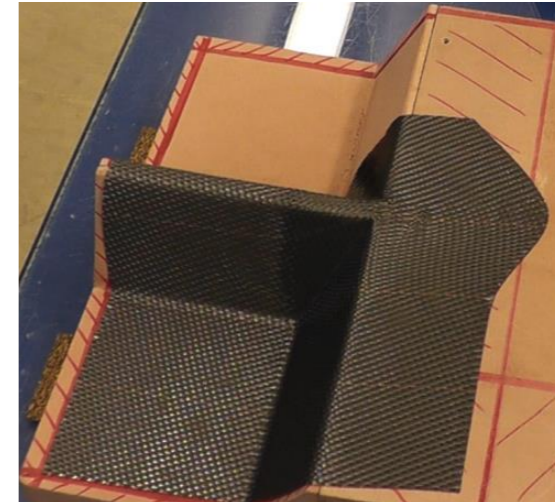
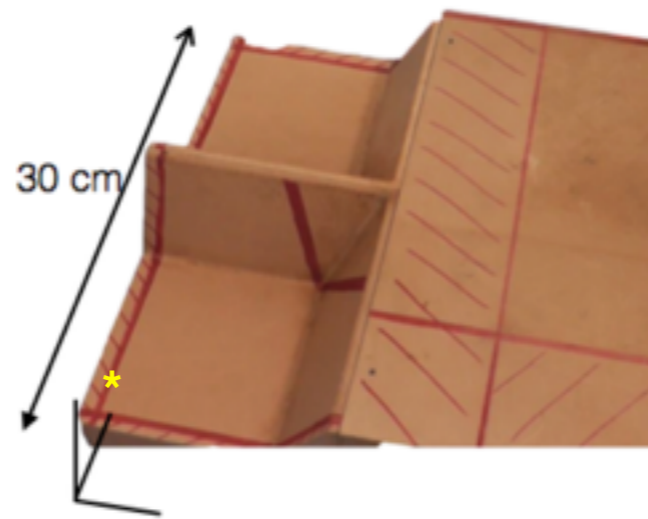
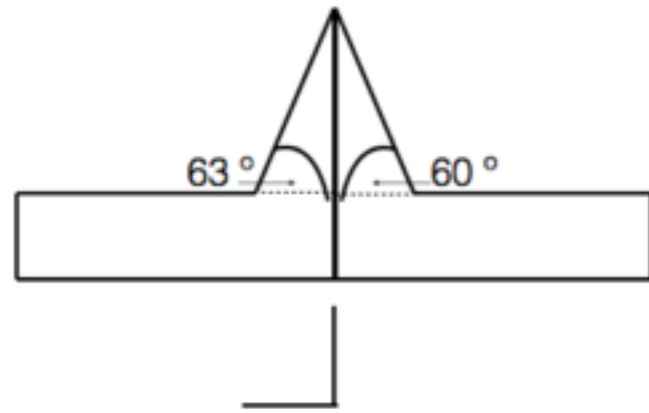


# “The Dibber”

- What is it?

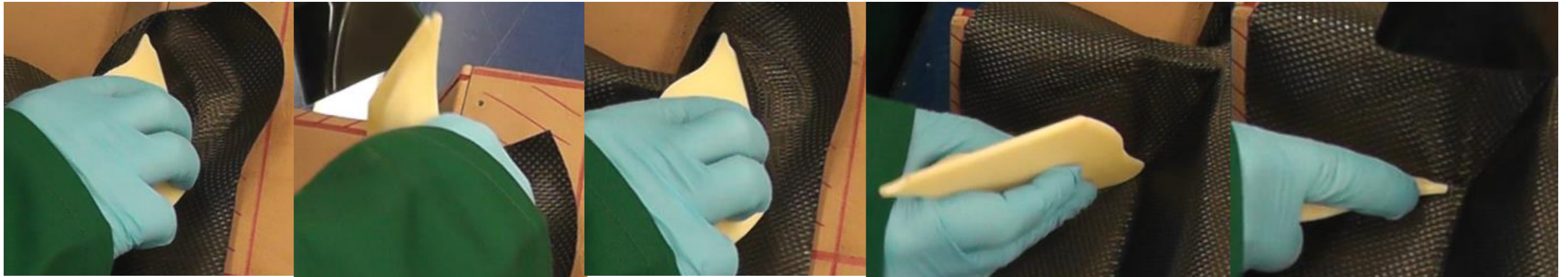
Composites manufacturing route

- Predominantly hand lay up
- Ingrained are handmade and personally owned tools.



# ***“The Dibber”***

- What is it?



Why is hand lay up difficult?

- Unusual: different manufacturing route to metals
- Material variabilities
- Stickiness

# ***“The Dibber”***

- What does it help make?

## Components for high performance sectors

- Autosport
- Aerospace
- Defense

## The industry is looking to grow

- Automotive
- Mass transport
- Oil and Gas

# **“The Dibber”**

- Why is it a problem that laminators make their own tools?
- How is it linked to the problems faced by the industry?
  - Unstandardised process that is poorly understood
    - Heavily reliant on tacit knowledge
    - Lack of knowledge base
  - Low production rates and capabilities
  - Ability to develop the supply chain
  - Training workforce with composites skills
  - Manufacturability issues
  - Defects, high scrap rates and increased costs

# **“The Dibber”**

- How is it linked to the problems faced by the industry?

What is the significance of materials knowledge to design and production?

Could its integration help the industry overcome the challenges that it is facing as it is looking to grow?

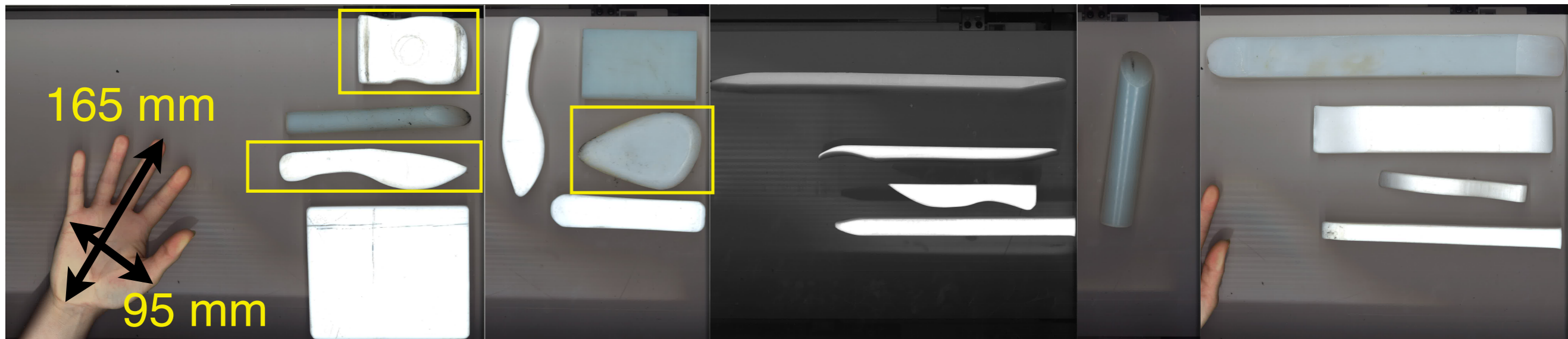
Chatzimichali, A.P., Potter, K.D. (2014) ‘Building material capabilities: A sociotechnical analysis of composite product development and manufacturing strategy’, *Int. J. Sustainable Manufacturing*, in press

Bolton, A. & Koda, H., (2011). Alexander McQueen: Savage Beauty (Metropolitan Museum of Art), Yale University Press



# “The Dibber”

- Why is it important?
- Laminators’ in-process knowledge
- Unstandardised process



*“Dibbers are made for jobs” (1)*

(1), Semi structured interview with an experienced laminator

# ***“The Dibber”***

- Media and Discussion

- Demonstrate the acceptance of changing

*“Don’t you think that a production process that is used to make some of the world’s most exotic structures might **just benefit from getting away from individually hand-whittled tools that are entirely dependent on the individual technician?**”*

- Demonstrate the reluctance to change

*“But I like my dibber it works just fine, but thanks.”*

*“What a load of hogwash, I have been laminating for 6 years, and as a laminator you make your own dibbers for various jobs and uses in prepreg laminating.”*

Quotes taken from here on 21/01/2015: [https://disqus.com/home/discussion/netcomposites/phd\\_student\\_designs\\_and\\_develops\\_revolutionary\\_new\\_tool\\_the\\_dibber\\_30/](https://disqus.com/home/discussion/netcomposites/phd_student_designs_and_develops_revolutionary_new_tool_the_dibber_30/)

# Exploring Designing with Composites

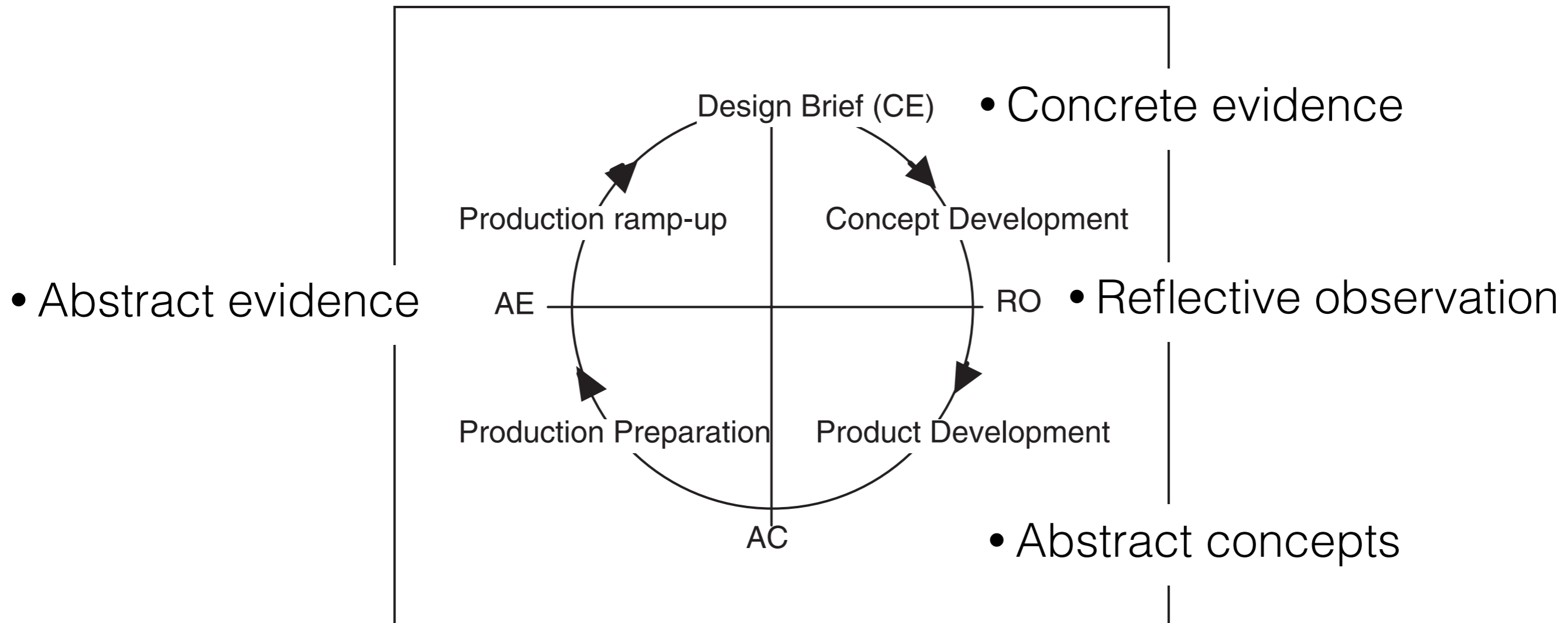
- Where do the problems start?
- Why do we have them?
  
- Start in design but manifest themselves in production
  
- Training designers
  - Sectors have history built from metal design
  - Not trained in designing components with composite materials
- How new knowledge is integrated
  - Lack of integration results in no standardised codes of practice
  - Developing craftsman in production

Chatzimichali, A.P., Potter, K.D and Smulders, F. (2013) Understanding the NPD-production interface: advanced industrialisation and growth in the composites industry, In Business Development and Co-creation; 14th International Continuous Innovation Network (CINet) Conference, Nijmegen, Netherlands, 8th-11th Sept. 2013.

Bolton, A. & Koda, H., (2011). Alexander McQueen: Savage Beauty (Metropolitan Museum of Art), Yale University Press

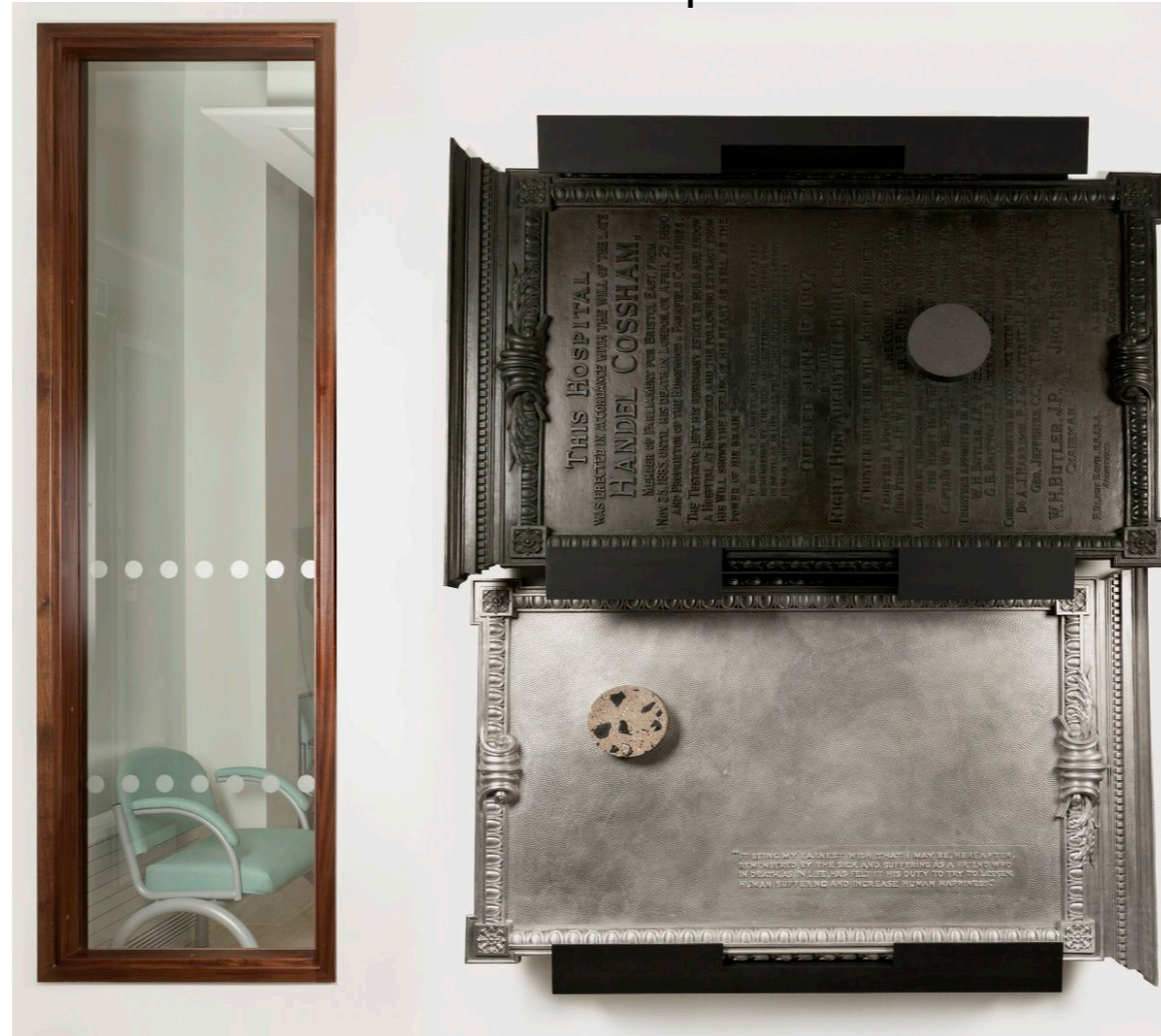
# Background Theory

- Integrating new knowledge into the Kolb learning cycle



# How New Knowledge is Integrated and Generated

- Interviews
  - Laminators: Typical production process for a high performance product
  - Art Fabricators: Handle artistic concepts and material explorations

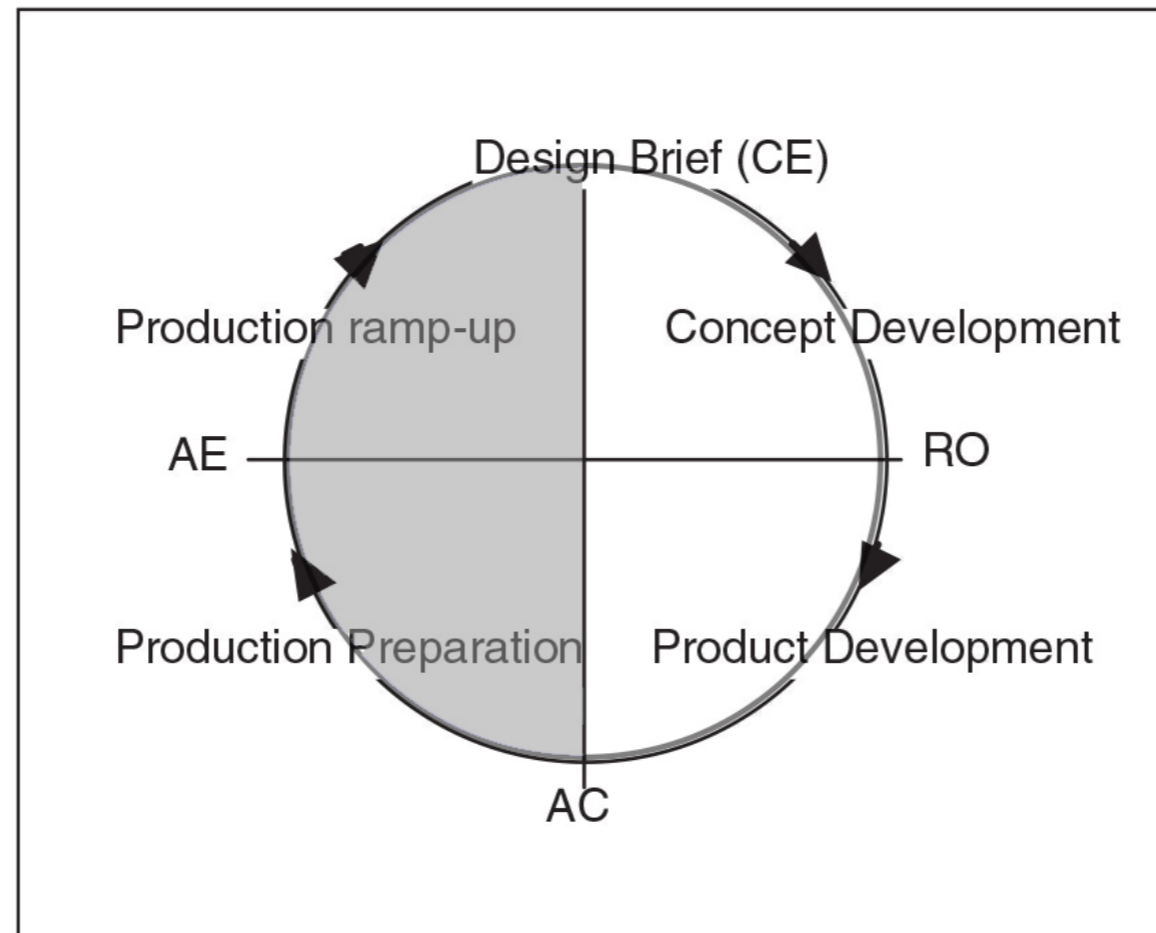


Themes of interest were

- How tacit knowledge from production moves into design
- Impact of having material knowledge at the concept development phase on design and production

# Mapping Data onto the Learning Cycle

- Production Environment
  - Incomplete learning cycle for production of a composite artefact
  - Laminators' knowledge remains tacit



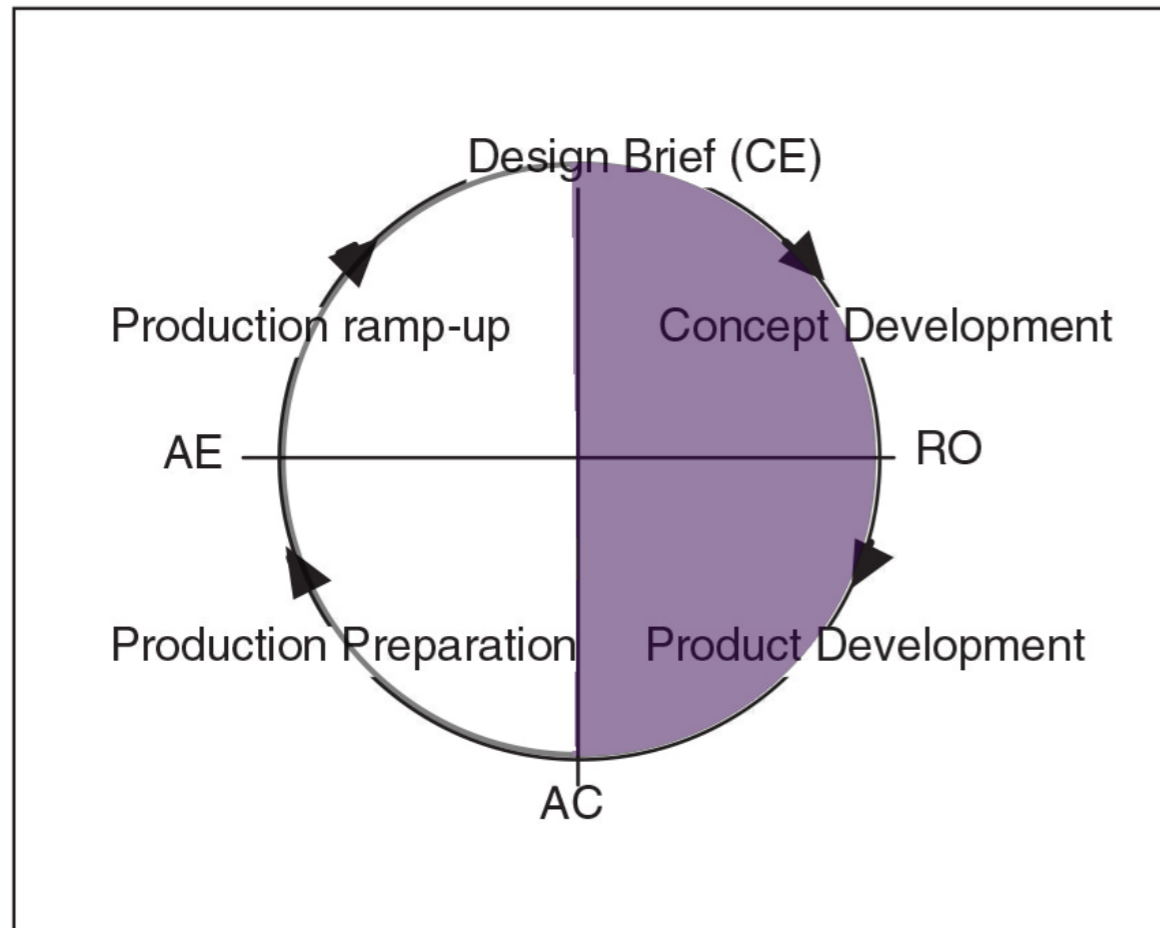
■ Manufacturing Tools

- Using “*The Dibber*” a craft can be explored as a standardised industrial setup process

# Mapping Data onto the Learning Cycle

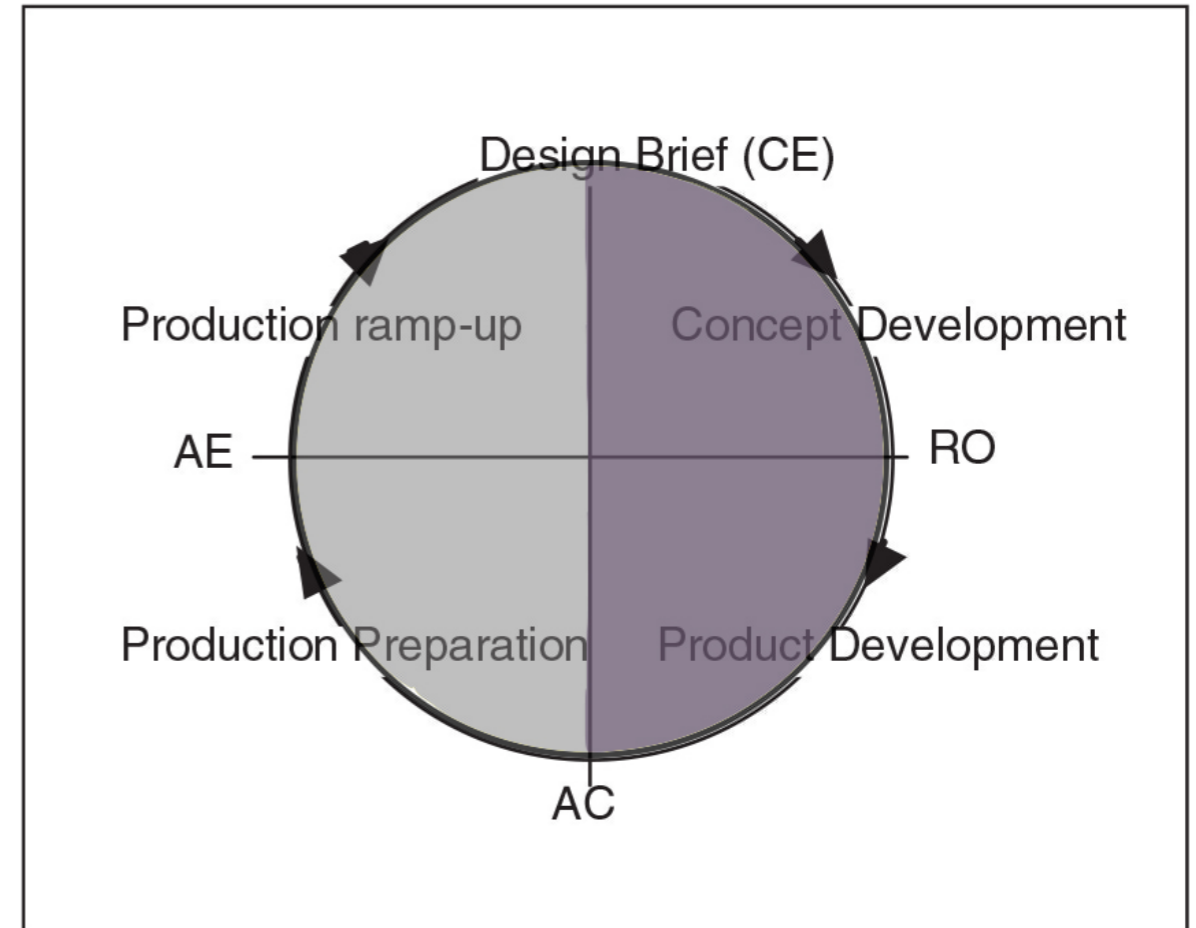
- Art Fabricators

- Material experiments developing knowledge base



Material Experiments

- Complete learning cycle for production of an artefact



Material Experiments' Knowledge Base

Figure edited from: Smulders, F. (2004) Co-operation in NPD: Coping with different learning styles. Creativity and Innovation Management, Vol. 13, No. 4, pp. 263-273.

# Conclusions

- Composites production industry has an incomplete learning cycle
  - **Gaps in design**  
Design education problems
  - **Gaps in translation into production**  
Allow laminators to work out what is possible  
Lack of knowledge base for formal training
- Suggesting prototyping within a production environment
  - Ignoring what is possible if generate new concepts away from knowledge about how to handle the material



## Next Steps

- Identify knowledge gaps
- Use interviews to understand composites' industry development needs
- Suggest mechanisms to bridge knowledge gaps and integrate knowledge

# Acknowledgements

Acknowledging support from Richard Middleton and the EPSRC through the ACCIS Centre for Doctoral Training (Grant: EP/G036772/1) and the EPSRC CIMComp (Grant: EP/IO33513/1).