Engaging students in experiential learning

Design-driven entrepreneurship in industrial design

Professor Blair Kuys

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Connectivist learning theory used to benefit industrial design

A methodology for understanding learning in a digital age
INNOVATING MANUFACTURING SMEs

--> Profit from successful industry-university engagement reinvested into new product opportunities

SALES/DISTRIBUTION

--> Marketing
--> Buying groups
--> Investors

DIRECT AVENUE TO MANUFACTURING

--> Evaluation
--> Manufacture

PRODUCTION/RAMP UP

--> Testing/Refinement

ORGANISATIONAL CAPABILITIES

--> WILLING TO INVEST

TACIT INDUSTRY KNOWLEDGE

--> MANUFACTURER LOOKING TO DIVERSIFY

INDUSTRY UNIVERSITY ENGAGEMENT

--> ADVANCED DESIGN AND ENGINEERING SKILLS

NEW IDEAS

--> DESIGNATED PROJECT MANAGER

ACCURATE AND HONEST PROJECT PLAN SHOWING PROJECT DELIVERABLES. FORTNIGHTLY UPDATES SENT TO CLIENT

FUNDAMENTAL RESEARCH

--> Generative Research
--> Foundational Research
--> Qualitative and Quantitative analysis

CONCEPT DEVELOPMENT

--> System Level Design

--> Idea generation
--> Concept selection
--> Low fidelity prototyping

Research & Development

ENGINEERING ANALYSIS

--> CAD
--> Computer modeling

--> Detail design

--> Specialised product development expertise

SPECIALISED PROJECT DEVELOPMENT TEAM

--> Iterative process

TACIT INDUSTRY KNOWLEDGE

--> RE-INVEST

Manufactured products

--> Detailed project proposal MUST be developed between the manufacturer and the university. This will include the following:
1. Project challenge [WHY is the research needed?]
2. Project methodology [HOW will it be executed?]
3. Project outcome[s] [WHAT are the deliverables?]
4. Project budget [Activity – Time – Deliverables – Costs]

--> The specialised product development team MUST be knowledgeable in engineering analysis, product refinement, prototyping and design for manufacture. These stages are critical to translate research findings into commercial products.
World GDP
Contribution to growth, percentage points

- Rich countries
- BRICs
- Other emerging markets

Total* % increase on a year earlier

Sources: IMF; The Economist
*Estimates based on 58 economies representing 89% of world GDP. Weighted GDP at purchasing-power parity.
Employment by Industry

Share of total*

%

Services

% 70
60
50
40
30
20
10
0

61/62 71/72 81/82 91/92 01/02 11/12

Agriculture  Construction  Manufacturing  Mining

* Estimate for 2011/12
Sources: ABS; RBA; Withers, Endres and Perry (1985)
Machines just make things
Industry 2.0
Once they are connected it will change the way we design and manufacture products.
If a physical product that industrial designers create undergoes a large revolution in 10-years, education must also follow.
20-years ago…
• Strong sustainability focus
• Eco-friendly solutions
• ‘Green design’
• Traditional methods of mass manufacture
Article

The Priority Given to Sustainability by Industrial Designers within an Industry 4.0 Paradigm

Blake Kays *, Christoph Koch and Gianluca Renda

Centre for Design Innovation, School of Design and Architecture, Swinburne University of Technology, Melbourne 3122, Australia; christoph.koch@swin.edu.au (C.K.); giannicor@gmail.co.uk (G.R.)

* Correspondence: blake.kays@swin.edu.au

Abstract: Industrial design is traditionally linked to manufacturing, however, what is required of industrial design to adopt new changes brought on by Industry 4.0 is currently unknown. Current literature gives little insight into how industrial designers need to evolve to the current developments in manufacturing to remain valuable drivers in an Industry 4.0 paradigm. To address this, a mixed-method research methodology was used. A qualitative survey of 190 respondents and a multiple-case study were conducted to establish current industrial designers practice globally and to better understand the priority of sustainability given by practicing industrial designers. Qualitative data allowed a deeper, more profound sustainability process, however, quantitative data concluded this, showing “sustainability” as one of the foremost issues of importance in design practice for industrial designers. While sustainability—especially in manufacturing—demands more prominent change as industrial design adapts to an Industry 4.0 manufacturing paradigm, it seems that junior industrial designers do not currently see this as a priority.

Keywords: industrial design, Industry 4.0, sustainability, manufacturing, priority, value, sustainable

1. Introduction

Establishing close relationships or close partnerships with manufacturers is one way that industrial designers can stay ahead of manufacturing change. It is also an excellent value to designers in influencing manufacturers to be more innovative, more sustainable, and more flexible when working with designers. In the eyes of industrial designers, the aspect of sustainability is not only concerned with ecological issues but also with economic sustainability. However, industrial designers are not the belief that the barrier to be more “sustainable” seems to test with profitable manufacturers. There are existing frameworks showing how to integrate Industry 4.0 alongside sustainability practices into a company [1–6]; however, the role of the industrial designer in the process of integration is largely neglected. Although the designers in previous literature on this topic, the designers themselves are not included. The survey conducted for this study took the perspectives of practicing industrial designers rather than company managers, and a knowledge gap was apparent when a number of industrial design respondents were unfamiliar with existing frameworks. This study is exploratory and shows that industrial designers need to better understand existing frameworks for Industry 4.0 and sustainable integration to be a driving force in this manufacturing paradigm. This research reveals that it is the systems that surround the manufacturing processes that are crucial both ecological and economic sustainability, not only the methods of production themselves and it is the designer who needs to evolve to design for an Industry 4.0 manufacturing environment. Industrial designers support future manufacturing to be more sustainable; however, current practice suggests this is not the highest priority when designing.
Method

We conducted an extensive survey of 190 respondents from 53 countries to establish the present state of industrial design practice globally and to better understand the priority sustainability is given by practicing industrial designers.
Demographics

Years of experience

Per cent

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33

Years of experience
European industrial designers made up the biggest part of the sample with 44.7 per cent (n = 85); North America with 18.9 per cent (n = 36); Asia with 13.7 per cent (n = 26); Australia and Oceania with 11.1 per cent (n = 21); South America with 9.5 per cent (n = 18); Africa with 2.1 per cent (n = 4);
Findings

Where do you rank the importance of the following in regard to your design practice? (in %).
Findings

Where do you rank the importance of the following in regard to your design practice?

Sustainability by country of residence or work (by continent)
Discussion

Data shows a clear disconnect between issues of environmental and social responsibility between industrial designers and their opinion of manufacturers.

Manufacturers—in the eyes of the industrial design respondents—were mainly profit and efficiency driven, taking on an introspective approach, compared to the holistic stance of the industrial designers.

With the emergence of Industry 4.0 we see a trend for industrial designers to work much more closely with their manufacturing counterparts for mutually beneficial, and importantly, sustainable product outcomes.
Discussion

Junior industrial designers do not currently see sustainability as a priority, establishing a foundation for future research to understand why this is the case.

As Industry 4.0 begins to become the dominant manufacturing paradigm, education and engagement with ethical and sustainable practices need to be expanded.
Now…

MAKERS
THE NEW INDUSTRIAL REVOLUTION
CHRIS ANDERSON
Author of the bestseller The Long Tail
Autonomous Transport Robots
ELECTRIC CONVERSION

STANDARD CAR
3,300 lbs.

+600 lbs.

CARBON FIBER + INNOVATION

-750 lbs.

-450 lbs.
2,700 lbs.
Will this mean jobs will be lost?
This is water fountain
Not a bin
For rubbish
An example of distributed learning: 3D Prosthetic Foot

- Little ‘formal’ knowledge on the machine & material
- Blogs, YouTube, tacit knowledge of lecturers
- Portable file format
- Provides a low cost (approx. AUD$15.00) prosthetic
An example of distributed learning: 3D Prosthetic Foot

• Students to become more entrepreneurial; creating their own brands
• No longer tethered to traditional manufacturers
• Can be more agile and respond to market influences, new technology and processes
• Are more engaged with the discipline
Give students REAL projects

A case study of Hong Kong ‘nano-apartments’
CONCEPT 1
Simple & classic

CONCEPT 2
Configurable & versatile

CONCEPT 3
Customisable & playful

CONCEPT 4
Convenient & comfortable
Prototype 1 – 1:1 scale evaluation
02/07/2021
ERGONOMIC EVALUATION

1. Overall height to increase. This allows users to sit on the bed without the top crossbar obstructing their head.

2. Upper support beam to reduce in width. This provides more head room when sitting on the bed and reduces material.

3. Privacy screens to extend to 1/3 the length of the bed. This allows greater privacy and a larger bedside table when folded out.

4. Base of bed to move down to allow greater storage and increase the height between the mattress and the upper support beam.

5. Lower storage to be divided into 3 sections instead of 4. This provides more practical storage solutions and maximises usability.
CONCEPT ONE

1. Perforated profile for back face removal

2. Perforated pull tab Pull up

3. Remove back face card profile

4. Remove plastic film with NFC using pull tab