

TALKING AND THINKING ABOUT DESIGN AND/OR TECHNOLOGY 2.0

**Edited by Alison Hardy and Eddie Norman, with contributions
from David Spendlove and others**

Published by: Loughborough Design Press Ltd, 12 Church Hill Road, Oxford, OX4 3SE

Copyright for this edition © 2020, Loughborough Design Press

All rights reserved. Extracts from the book may be reproduced for academic purposes, otherwise written permission is required from the publisher. The book is sold subject to the condition that it shall not by way of trade or otherwise be stored in a retrieval system, re-sold, hired out or otherwise circulated except in the publisher's binding.

For information on all Loughborough Design Press publications, please visit our website: www.ldpress.co.uk

Printed by Printondemand-worldwide.com, UK
The paperback is FSC and PEFC certified

ISBN: [paperback] 978-1-909671-

eISBN: [ePub] 978-1-909671-

eISBN: [mobi] 978-1-909671-



PEFC Certified

This product is
from sustainably
managed forests
and controlled
sources

www.pefc.org



Mixed Sources

Product group from well-managed
forests, and other controlled sources
www.fsc.org Cert no. TT-COC-002641
© 1996 Forest Stewardship Council

ACKNOWLEDGEMENTS

Book and cover design: Eddie Norman

CONTENTS

1. INTRODUCTION	5
<i>Alison Hardy</i>	
2. HOW DID WE GET TO THIS POINT?	7
<i>Alison Hardy</i>	
HOW DID WE GET HERE?	11
3. DESIGN AND/OR TECHNOLOGY 2.0: IS THIS THE WAY FORWARD?	15
<i>David Spendlove</i>	
DAVID AND ALISON IN CONVERSATION	19
4. ARE THESE THE QUESTIONS THAT NEED TO BE ADDRESSED?	31
<i>Eddie Norman</i>	
HOW CAN DESIGN NOT BE CONSIDERED AS CENTRAL TO ENGAGING WITH THE FUTURE?	33
DO DESIGNERS KNOW ANYTHING?	39
ARE THERE DIFFERENT WAYS OF KNOWING?	43
INITIAL EXPLORATIONS OF DESIGN EPISTEMOLOGY ... HOW CAN WHAT DESIGNERS KNOW AND HOW THEY KNOW IT BE APPROACHED?	47
EDDIE AND ALISON IN CONVERSATION	51
5. OTHER THOUGHTS, QUESTIONS AND RESPONSES	67
AUTHOR PROFILES	68



CO-AUTHORS

1. INTRODUCTION

Alison Hardy, Senior Lecturer, Nottingham Institute of Education, Nottingham Trent University

This book came about over several lunches and conversations that began back in 2015 when Eddie and I met to talk about an article I had written for *Design and Technology Education: An International Journal* that Eddie was then editor for. What started as a discussion about tidying up my paper led to a conversation about the position, direction and purpose of design and technology (D&T), which we have continued to debate ever since. As time has gone on, we have focussed more on the nature of D&T and its content, with particular interest in design epistemology, something which many seem to talk and write about but don't often agree on or define – me included. And so that leads us to here, sharing our thoughts and conversations in this book *Talking and Thinking about Design and/or Technology 2.0*.

Why 2.0? As David Spendlove explains we are at:

'... the intersection of the rapid demise of design and technology 1.0 and the spectacular rise of design thinking ... [and that] there is therefore a unique, perhaps once in a decade, opportunity for reorientation of the values that were instrumental within the development of design and technology through adopting and capitalising upon the intellectual and reflective aspects of design thinking and re-visioning them within 'Design and/or Technology 2.0'.

We believe this book provides space for us, with you, to talk and think about David's challenge – what are the issues that we need to further explore about design knowledge, design thinking and design epistemology?

The book as you are reading it today is the first iteration with a section from me, David and Eddie:

- How did we get to this point?
- Design and/or technology 2.0: is this the way forward?
- Are these the questions that need to be addressed?

Each section includes some commentary either from the book *Design Epistemology and Curriculum Planning* or some new ideas that have come to us since then, followed by the transcript from some *Talking D&T* podcast episodes.

These include:

TD&T12: How did we get here?

TD&T13: Talking design and/or technology 2.0 with David Spendlove

TD&T15: Do designers actually know anything?

TD&T18: How can design not be considered as central to engaging with the future?

TD&T22: What designers know and how they know it

TD&T28: Eddie and Alison talking about D&T and epistemology

Currently the final section is blank, it is a space waiting for contributions from people such as you to add your thoughts about the issues facing design and technology today. You can send us your contributions via the Loughborough Design Press website [www.ldpress.co.uk, email: books@ldpress.co.uk] or my website (<https://alisonhardy.work/ldp1/>) or by email to alison@alisonhardy.work

This book is part of an ongoing conversation, it is not a book with answers instead a space to question our thoughts and open up debate about what we and you see as the issues facing design and technology today. In the next book we explore how these issues may be addressed.

2. HOW DID WE GET TO THIS POINT?

Alison Hardy

The dramatic decline of D&T as a core component of the English National Curriculum is well documented with some reasons for the decline suggested, including its non-inclusion from school performance measures and its disapplication as a compulsory qualification for all 16 year olds (Bell et al., 2017; Design and Technology Association, 2015; Hardy, 2015). Yet it was the Expert Panel's (Department for Education, 2011) report that focussed the D&T community's mind on the subject's epistemology and knowledge-base, matters that have often not been at the forefront of either D&T research or debate. The report asserted that D&T had insufficient disciplinary coherence to warrant its continued inclusion in the National Curriculum. Rather than discussing whether D&T has disciplinary coherence or not, or whether it should be part of a core or basic curriculum, this chapter explores why the Panel may have come to that conclusion. It begins with the report's political origins and the prevailing ideology of the purpose of education. Once this is understood it becomes easier to understand the Panel's opinion, which is born out from interviews with D&T teachers about D&T's contribution to a general education. Finally, a way forward is suggested.

The Expert Panel report was commissioned early in 2011 by Michael Gove, the then Secretary of State for Education and a Conservative MP in the Coalition government. Conservatives have long extolled the centrality of knowledge to education and equality (see Lord Baker's comments in the 2010 House of Commons report). And when, after the 2010 general election, Michael Gove became Secretary of State and Nick Gibb Schools Minister there was an opportunity to 'slim down' the National Curriculum to one that taught young people the 'best that has been said and thought' (Gibbs, 2016). It needs to be recognized where Gove and Gibb were gaining their ideas from. Gibb and Gove had publicly lauded the work of Hirsch (2006) and Willingham (2009) who focus on the value of learning knowledge and facts, specifically 'general, all-purpose knowledge' (Hirsch 2006:12), knowledge that forms part of a general education (Willingham 2009). In drawing on Hirsch and Willingham they had found 'evidence' to support their views:

'The work of cognitive scientists, most helpfully analysed by the University of Virginia's Daniel T Willingham and buttressed by the research of educationists like E D Hirsch, has shown that the best way to develop critical thinking skills is to ensure all children have a firm grounding in a traditional knowledge-based curriculum.' (Department for Education and Gove, 2014)

By placing thinking skills as a subordinate of knowledge, Gove and Gibb shifted away from the 2007 National Curriculum that some thought had emphasized skills to the detriment of knowledge. Consequently, the Panel was commissioned to:

'Develop a National Curriculum that provides young people with the knowledge they need to move confidently and successfully through their education.'

Underpinned by a belief that the National Curriculum should 'ensure that all children have the opportunity to acquire a core of essential knowledge in the key subject disciplines'. In the Expert Panel report, knowledge is defined as 'subject knowledge' that constitutes the concepts, facts, processes, language, narratives and conventions, and is regarded as 'powerful'. Here the report references Young (2008) as its source for 'powerful'. Therefore, to understand the Expert Panel's stance on knowledge, it is necessary to understand Young's 'powerful knowledge'.

Professor Michael Young has written extensively on knowledge and social justice through education. His opinion is that the purpose of schooling is to 'enable young people to acquire the knowledge that for most of them cannot be acquired at home or in the community' (Young, 2011:150); he defines this knowledge as theoretical not everyday knowledge, and specialised in how it is produced and transmitted (Young, 2013). He argues that powerful knowledge originates in specialist institutions (e.g. universities), which is transmitted in other specialist institutions (i.e. schools). His argument for the importance of powerful knowledge is underpinned by the principle of social justice and entitlement - for young people to gain access to universities they need to learn the powerful knowledge that originates there, which can only be done in schools (Young and Muller, 2013). Furthermore, powerful knowledge 'is embodied in different domains' (Young, 2011:151), and therefore is discipline-based (Young and Muller, 2013). Strong, disciplinary coherent school subjects have a clear form of knowledge, which originates in universities and research centres. Disciplinary coherence is a subject that has a strongly defined boundary between itself and other subjects (Bernstein, 2000).

Therefore, it could be concluded the Expert Panel decided a coherent National Curriculum should only consist of subjects that teach 'powerful knowledge' whose knowledge originates in universities and research institutions. And it is at this point the argument for including D&T in the National Curriculum unravels. As an educational construct (Bell, et al., 2017), D&T's knowledge is not derived from a single discipline; instead it draws on several disciplines, such as art, anthropology, and physics. Unfortunately, this perception of D&T's incoherence as a discipline is corroborated by my research (for example Hardy 2016).

In 2014, I interviewed D&T teachers and students from two schools, and asked for their perception of the contribution D&T made to an individual's education. Their responses were grouped into three themes:

1. Responses relating to the uniqueness of D&T, which could suggest some coherence about the subject which makes it distinct from other subjects;
2. Responses about competency or skills that are not limited by specialist knowledge curriculum;
3. Responses that relate to other subjects and their content, which would indicate a disciplinary incoherence as the participants would be suggesting that D&T exists because of other subjects.

In the first theme, the predominant view was that children were taught to critique products and their impact on the environment. A lesser view was that D&T's unique contribution was to teach vocational skills, an argument which disqualifies it as an essential subject in the National Curriculum taught to all children. If the perception is that D&T is a subject which prepares children for D&T related professions then all children do not need access to it – only those who have an aptitude or inclination to progress into a D&T-related career. The value of learning how to design and make products was rarely mentioned. In the second theme, participants talked about individuals learning skills to look after themselves that meant they could do DIY, cook and sew; skills that rely on everyday knowledge and do not necessarily require a specialist institution. Other responses mentioned learning generic, transferrable skills such as team working, and problem-solving. Neither learning generic skills or 'domestic' skills are forms of knowledge deemed essential to the National Curriculum by the Expert Panel. The fewest responses were grouped into the final theme; here the teachers and students mentioned learning about materials, using maths and drawing, which would 'help them in art'. This analysis suggests these teachers and students held a narrow perspective of D&T's knowledge, and instead emphasized how students learnt to become competent in skills useful for domestic life and future employment.

Although a small study it does have implications for D&T, how it is understood by those within its community and how it is understood by outsiders. It would be interesting to conduct further research asking D&T teachers what discipline they see as the origins of D&T's knowledge, to determine their understanding of D&T's specialist knowledge. I would suspect many would find it a challenging question, and others would dispute its value as a research question. However, as the current education ideology emphasizes the importance of knowledge it is timely to encourage the D&T community to engage in answering the questions - What powerful knowledge is taught in D&T? And from where does it originate?

References

Bell D, Wooff D, McLain M and Morrison-Love D, (2017) 'Analysing design and technology as an educational construct: an investigation into its curriculum position and pedagogical identity', *The Curriculum Journal*, , 1-20

Bernstein B (2000) *Pedagogy, Symbolic Control and Identity: Theory, research, critique*. Revised Edition, Rowman and Littlefield, Lanham, Maryland

Department for Education (2011) *The Framework for the National Curriculum. A report by the Expert Panel for the National Curriculum review*, Department for Education, London

Department for Education and Gove M (2014) *Michael Gove speaks about the future of education reform (Speech given to Education reform Summit 10/7/2014)* [online]. Department for Education. Available at: <https://www.gov.uk/government/speeches/michael-gove-speaks-about-the-future-of-education-reform> [Accessed 03/04 2017]

Design and Technology Association (2015) *Designed and Made in Britain...?* [online]. DATA. Available at: <http://bit.ly/1n1vm9J> [Accessed 01/14 2016]

Gibbs N (2016) *What is a Good Education in the 21st Century?*, Hild Bede College, Durham University, Department for Education

Hardy A L (2015) *Why has the number of teenagers taking design and technology GCSE dropped?* [online]. The Conversation. Available at: <https://theconversation.com/why-has-the-number-of-teenagers-taking-design-and-technology-gcse-dropped-46361> [Accessed 07/22 2016]

Hardy A L (2016) An assortment box of views: different perceptions of D&T's purpose and structure. In: *PATT2016 - Technology Education for 21st Century Skills Conference, Utrecht, 23-26 August*. Utrecht, Netherlands

Hirsch E D (2006) *The Knowledge Deficit: Closing the shocking education gap for American children*, Houghton Mifflin Company, Boston

Willingham D T (2009) *Why Don't Students Like School?: A cognitive scientist answers questions about how the mind works and what it means for the classroom*, John Wiley & Sons

Young M F D (2013) 'Overcoming the crisis in curriculum theory: a knowledge-based approach', *Journal of Curriculum Studies*, 45 (2), 101-118.

Young M F D (2011) 'What are schools for?', *Educação, Sociedade & Culturas*, 32

Young M F D (2008) *Bringing Knowledge Back In: From social constructivism to social realism in the sociology of education*, Routledge, Abingdon

Young M F D and Muller J (2013) 'On the powers of powerful knowledge', *Review of Education*, 1 (3), 229-250

HOW DID WE GET HERE?

Alison Hardy

Talking D&T podcast, published on 14 January, 2020

The theme of this week's episode is how did we get here? I've got a number of different things around that that I want to unpick that relate to design and technology, this podcast in particular, and also some podcasts that are coming up in the future. Before I go any further, I apologize in advance for my croaky voice, I've had a heavy cold and it's not back to full strength yet. Back to this idea about how did we get here.

In this podcast, I'm going to go be looking back at a chapter I wrote in a book that was edited by Eddie Norman and Ken Baynes in 2017 called *Design Epistemology and Curriculum Planning*. How I got to the point where I'm revisiting that chapter has come about through conversations I've been having with Eddie and previously with Ken, until he passed away late last year, about design and technology and the position it had found in the curriculum. This podcast has come about as a result of those conversations and my ideas moving on from that chapter that I wrote, although the book was published in 2017, I wrote the chapter back in 2016.

So, the 'how did we get here?', is where the we is design and technology and my focus is on how did D&T in England get to this point. First I am going to talk about the contents of the chapter, if you want to read the whole chapter (and its very short) I will put a link in the show notes, and in that chapter I drew my PhD study, which I was doing at that time, some of the literature that I was reading, and the conversations that I was having with people around education and around curriculum design.

The book was a riposte to the National Curriculum review of 2011 that gave the D&T community a bit of a jolt because the proposal was that D&T did not require a national curriculum, only a basic, locally because it had insufficient disciplinary coherence to be stated as discrete and separate National Curriculum 'subjects'. The report went on to state that 'Implicit in this judgement is a view of disciplinary knowledge as a distinct way of investigating, knowing and making sense with particular foci, procedures and theories, reflecting both cumulative understanding and powerful ways of engaging with the future. In this sense, disciplinary knowledge offers core foundations for education, from which the subjects of the curriculum are derived. Some very worthwhile areas of learning apply such knowledge in particular ways or foreground particular areas of skill or competence – but have weaker epistemological roots. Our judgement about possible reclassification is based on the balance of advantage, given

the need to reduce prescription in the National Curriculum.' So basically, the subject was not distinct in how investigation, knowing or making sense took place within the subject's focus. The discipline of science is quite discrete and different from maths and from history for example, and that those boundaries can be seen and articulated. Whereas in design and technology, we have maybe not always made this so clear.

There have been many counter arguments as to why D&T should be part of the National Curriculum, some based on economic reasons, others about skills and others about personal development, and whilst valid, these do not address the report's argument that D&T has insufficient disciplinary coherence.

This report put a marker in the ground for the focus of a knowledge-led curriculum, and many of you may be using that term in schools, in your curriculum design and research. Teachers are being expected to design the curriculum focussing on disciplinary and substantive knowledge of their subject. So if a teacher finds it difficult to articulate how knowledge is defined and known in design and technology then this becomes quite a challenge and what I have seen happening is that teachers are using definitions of knowledge that come from science, history or maths and using the knowledge from these and other subjects to design their D&T curriculum. But by doing this, the argument presented in 2011 for D&T to be removed from the National Curriculum is inadvertently strengthened and it becomes more difficult to argue for D&T to be part of a core curriculum.

Now, in some ways, it is a strength of design and technology that we draw on other subjects, that we make use of knowledge from science or maths or the humanities to inform, to shape whether it's our design thinking or design ideas, our understanding of a context which we might get, from example, from the humanities, but also then when we move through the process of developing and creating and shaping and coming up with new ideas and starting to model them and explore materials, we might start to draw more on the discipline of science or the discipline of maths to help us kind of consolidate those ideas. That is a strength of us because we draw on those different disciplines. But without being able to articulate the uniqueness of our subject in that particular climate, the subject, in my opinion remains vulnerable.

I do not believe that this is the only reason why the subject has got to this point, here I am only presenting a government policy driven reason for its current position. Other external reasons are at national level, such as teacher recruitment, the removal and then reinstatement of teacher education bursaries; at a local school level, budgets, resources, league

tables, local competition all have an effect on the subject's status. Then at department level, budget, staffing, timetabling, league tables also have an effect. And there are others. But my point for this podcast about how we got to this point is defined by the answer to the question – how is knowledge defined and known in design and technology?

So that's my next – how did I get here? And by that I mean, how did I get to a point that I am asking the question – how is knowledge defined and known in design and technology?

It started with a conversation with Eddie Norman in 2015, led to the book chapter I've mentioned, then through many more conversations with Eddie, and others about the nature of knowledge, skills and values in D&T.

And this is something I hope will be explored over the next few months in this podcast. I think these are difficult concepts to define and the whole thing is complex, but I believe it is important that we explore and debate the nature of the subject and its content. These podcasts are me and Eddie talking about what we think or where we think design and technology could go from here and its nature. Those are kind of around some of the conversations that Eddie and I have been having about the nature of design and technology and particularly in the current climate that we're faced in very dominantly in England about curriculum, about knowledge and what form does knowledge look like in design and technology and what knowledge do designers need?

Hopefully, you'll engage with those podcasts, because we wanted to share ideas, not just of ours but also others in D&T and to get people chipping in and engaging with those ideas, whether it's through emailing me or Eddie or maybe taking part in a future podcast.

The hope is of the podcasts that are coming out from me and Eddie and conversations with other people that we can start to think about what is the uniqueness of design and technology, what makes us who we are. I began to touch on it a bit in last week's episode where I talk about design and technology capability, which then stimulated some conversation on LinkedIn with Kurt Seemann who's in Australia. Kurt will be on the podcast also in a few weeks time talking about his ideas about holistic technology education and what that might look like and how we can say that that is a coherent subject, mixed into a coherent subject.

There'll be some different ideas coming out. Eddie's going to talk about what designers need to know, what designers see as knowledge and sharing some of his thinking about that. We've also captured a conversation that we've been having about the nature of design and technology education,

so listen out for those coming out in a few weeks. As ever, I am interested to know what you think, what you see as the things that have led us to this point. You can contact me via my website, AlisonHardy.work, or you can find me on Twitter @Hardy_Alison. Thanks for listening.

3. DESIGN AND/OR TECHNOLOGY 2.0: IS THIS THE WAY FORWARD?

David Spendlove, Professor of Education, University of Manchester

This section has been reprinted from *Design Epistemology and Curriculum Planning* and is likely to be updated before this book is published

Recently I was invited to attend the Global Teacher Prize awards in Dubai, which is probably the most lavish event in the education calendar. An indication of just how extravagant the occasion was can be demonstrated by Andrea Bocelli being the warm up act; Bear Grylls skydiving out of an aeroplane to deliver the trophy for which the winner was announced from the International Space Station and then the award was presented by Sheikh Mohammed bin Rashid Al Maktoum.

Preceding the award of the \$1Million teacher prize was a two-day conference where some of the 'who's who' (and interlopers like myself) of the education world shared information and debated whilst ministers of education and dignitaries from around the world negotiated deals in the opulent surrounds of the Atlantis hotel. During the conference Andresa Schleicher, Head and coordinator of the OECD Programme for International Student Assessment (PISA) and considered as one the most influential experts in education, gave a keynote presentation in which he identified 'Design Thinking' as one of the five key areas promoting economic growth and social progress as part of the transformation of education.

Now, if you know a little about PISA and Andreas Schleicher then you will recognize both as being primarily orientated towards traditional educational disciplines and heavily dependent upon data measurements. And this is what made the announcement about design thinking all the more surprising as at present design thinking appears to be entering the everyday vernacular of the education world without there being any real consensus as to what it is, certainly not how it could be measured within an educational context or where it should be located within a curriculum.

Likewise the area of the curriculum in England, Design and Technology, that could be considered as the most closely associated with 'Design Thinking', is far from being regarded as central to transforming education. In fact Design and Technology is suffering an unprecedented and spectacular collapse and contraction to the extent it is in danger of almost being wiped out of the curriculum in some schools. So we have a paradox, in that whilst parts of the world appear to be embracing an emergent dimension of design education; in England a set of intentional and unintentional consequences seem to be perpetuating a rapid stifling of the curriculum area that potentially should offer a significant contribution to design thinking. This is even more ironic when it is recognized that England has been instrumental, for the last fifty years, in the international development of both the practice and research into design education. Yet a traditionalist focussed government schools minister; a narrowing of the curriculum; a marginalization of creative activities; a shortage of teachers and a funding crisis would suggest that the emergence of design thinking through the resuscitation of design and

technology is highly unlikely if the present circumstances are maintained. However this may not all be bad news and here's why.

Design thinking is frequently and increasingly articulated and characterized as a rational, causal and logical approach, reducing the complex processes of design into a condensed, contrived and functional series of steps. In these circumstances I would characterise such activities as the antithesis of design thinking as they are more closely aligned with the dysfunctional and contrived model of 'design process' and assessment method that has contributed significantly to the downfall of Design and Technology in schools. Such reductive 'design processes' which can 'apparently' be applied to 'anything' severely distorts designing as a complex, intellectual activity, and even worse is used to drive assessment systems which have absurdly been adopted and used to define design capability through adherence to an artificial and highly contrived 'McDonaldisation' of designing.

Likewise defining design thinking as a series of 'iterations', another term that is misunderstood, along a linear path merely conceives a potentially complex, intellectual, metacognitive and reflective activity as a formulaic, contrived, quasi-designing process. Such codification of design is unfortunately used to present designerly activities as a package that is transportable to different sectors and inevitably, like fast food can be attractive in its simplicity but lacking in its fulfilment. Despite or perhaps because of the perpetuation of reductive models of design thinking there appears to be a significant gaining of traction for the use of the term 'design thinking' in business, commerce, technology and education. When I do hear the term mentioned I generally ask the person using the term 'what do they mean' when they say 'design thinking' and do they just mean 'design' or do they just mean 'thinking'? The point being that in creating an open compound word from two words a new unit of meaning for design thinking must offer something different and add an alternative value to the individual words.

In considering this further, design thinking is also offering something to Nigel Cross's concept of 'design as a way of knowing'. As such design thinking offers an alternate mode of design enquiry, where enquiry of the mode and the epistemological basis of the enquiry are scrutinized and reflected upon in a cyclical manner (you might just want to read that sentence again). In this mode of thinking, we move away from conventional wisdom, notional common sense and tacit prepositions. We also move away from traditional concepts of product, artefact and aesthetic celebrity orientated design and become more human, earth and sustainability centred. Equally we move beyond form and function as a legitimate reductionist approach to expansive notions of what might be achieved through sustained designerly thinking and reflection.

Central to identifying what design thinking might be is challenging the epistemological basis of this embryonic, overly adopted and heavily distorted term. For this I am drawing upon my previous writing where I have explored how our emotions and sub-conscious processing plays a central part in our decision-making and how concepts of narcissism and altruism also influence our thinking.

In previous writing I have also acknowledged that underlying assumptions relating to social, political, theological, psychological, philosophical and cultural values all interact with the decisions we each make. As such the overcoming of potentially restrictive heuristic flaws and the debiasing of such potential cognitive limitations through metacognitive and reflective approaches should be considered as central to design thinking.

Don Norman has suggested that new forms of design draw upon 'applied social and behavioural sciences and require understanding of human cognition and emotion, sensory and motor systems.' In such circumstances we draw upon multiple sources to better understand who and what we are designing for and seek a more sophisticated understanding of what design can offer. As such my view of design thinking is that it is more purposeful, sophisticated and complex than the traditional, broad definitions of design, using higher forms of thinking.

However, whilst I am trying to locate what design thinking might be I am also considering if and where it may exist within the school curriculum. One potentially obvious place is within design and technology but design and technology doesn't have a right to claim the design thinking territory, albeit it could be claimed that it does have a head start on other areas of the curriculum. Therefore in signalling that there are grounds to be optimistic about the future of a design and technology then this is on the basis of design thinking existing within a future model of design and technology rather than the current version of the subject. As such if we consider the current prevailing model of design and technology in schools to be conceived of as design and technology version 1.0 we can then recognise version 1.0 may be coming to the end of its lifespan. Whilst we could also go into the nuances in that we might be currently operating on version 1.5 or 1.6, for now we can say that 1.0 characterizes a model of delivery that enjoyed incredible success, at times, but that given some of the circumstances outlined, is now coming to the end of its lifecycle. Therefore there is a need to conceive of a new form of design and technology, which I would posit, should be 'Design and/or Technology 2.0'.

In positing the emergence of 'Design and/or Technology 2.0' there is now an opportunity to consider the contribution of design thinking in an education context. More specifically there is an opportunity to consider design thinking as the catalyst for the next version of 'Design and/or Technology 2.0'. Adoption of design thinking into a new model of design and technology will not however be straightforward given the existence of the difficulties that traditional notions of design have had in becoming established in practice in the 1.0 version. This is why design thinking has to be situated in a new model of design and technology. Nevertheless the emergence of design thinking could be, and in fact already is, gaining a foothold in other parts of the curriculum, such as humanities or science and it will be up to the design and technology community to show the same tenacity as was apparent in the emergence of design and technology 1.0 in order to capitalise on a window of opportunity for embracing design thinking.

Ultimately we have the intersection of the rapid demise of design and technology 1.0 and the spectacular rise of design thinking, albeit in its ill-defined and unadopted form. There is therefore a unique, perhaps once in a decade, opportunity for reorientation of the values that were instrumental within the development of design and technology through adopting and capitalising upon the intellectual and reflective aspects of design thinking and re-visioning them within 'Design and/or Technology 2.0'. If the design and technology community are insufficiently proactive then we risk losing a generation of learners who will be bereft of an informed design literacy and the further demise of an underutilized and misunderstood subject that potentially still has huge amounts to offer in the broad education of all children.

DAVID AND ALISON IN CONVERSATION

David Spendlove and Alison Hardy

Talking D&T podcast, published on 21 January, 2020

Alison 0:03

Okay, so today I'm chatting with David Spendlove, who's up in Manchester. And this is part of our follow on from the book that Eddie Norman edited about design epistemology. The book's been out for a while now, but David wrote a chapter about design thinking, what is it and where it might reside, which kind of continues to be a topical conversation and then provokes us to start thinking about what 'Design and/or Technology 2.0' might be. So, David, can you say a little bit of context for the chapter where you were thinking if you can think that far back?

David 0:41

Yeah, so I think one of the things about it was, Eddie asked me to write a chapter. And there was certainly some freedom with the chapter as far as I was concerned, and it's something I've been thinking about for awhile. So this was a chapter I'd probably describe as me freestyling. It's not kind of anything too sophisticated. It's a bit of a polemic of me just, you know, thinking out loud about tying various things together, which seemed appropriate in the context of the book called design epistemology and linking it to curriculum development. The other side of it was there was an ongoing conversation taking place on a PhD design forum which has been going on for many years about design thinking, of which there was no consensus. There was absolutely no consensus. However, what was appearing was, people were suddenly saying 'this is what it is'. And it's like many things in education, someone capitalises on something, they take it forward, they present it as their own and the whole basis of it is distorted. Actually, one of the fundamental questions that anyone should ask as soon as anyone mentions, design thinking is ... but what's the difference between design thinking and just design by itself? And that's one of the real key issues, because often I hear people talking about design thinking, or talk about design thinking, and really, they're talking about design. So one of the things that we've seen, and I mentioned it in the chapter, is that the emergence of design thinking, has started to appear in general education, in the curriculum, in the humanities, and so on. And from my perspective, they're not talking about design thinking. They're talking about design, and a form of design. So we've got to kind of ask the fundamental question, what is design thinking? And essentially, what is the thinking element of design, and actually design without thinking cannot be design, so you can see that it's quite convoluted.

Alison 2:58

Yes. Okay, so you started with a really nice light gentle easing us in there from that. So okay ... so I suppose the next logical question is, so what do you see as design thinking? How would you explore that?

David Spendlove 3:14

So, yeah, so again, because there was no consensus and equally, you know, it's very easy because I don't if you are aware of the PhD design forum, it's

been going for many, many years. And it's, it's always been an interesting forum which actually has quietened down over the last few years. But people like Don Norman who you know, famous design theorist, someone I actually very much kind of admired in terms of his thinking, Actually, I got the opportunity to present an actual paper on design thinking to him in Shanghai, which was fascinating because basically, I mean, just to expand on that anecdote a little bit further, Shanghai Tongji University, I think it was, pulled in Don Norman and Ken Friedman, two big thinkers on design to kind of develop the design aspect of the university. And for many years, there's been this kind of theory of the West owns design, and England is the home of design, and you know, that's our place and we own that right. And there was always this concept of the group thinking of the East, and actually design would never kind of emerge from the East. But whilst manufacturing was very strong in the East, and actually when I went to that conference, which was a really interesting conference, every aspect of that was just blown out of the water and the investment that China was making in design was phenomenal. And was characterized by the fact that they'd bought in Don Norman, Ken Friedman to kind of spearhead aspects of the development of the work.

David Spendlove 5:13

So I can't remember what the original question was ...

Alison 5:16

What is design thinking? What's your thoughts about what design thinking is?

David Spendlove 5:19

Yeah, so going back to the lack of consensus in the forum, you know, people kept putting ideas forward and then getting shot down. So I kind of theorised it from multiple perspectives, and I've actually done some work with PGCE students on this and trying to develop it and it's probably one of the most exciting times that I've had with a small group of students where we were working on developing this area and actually then translating it with students. It was very much a kind of action research in practice, resulting in some kind of third space activity. It was also lesson study activity, it was everything thrown in ... flying by the seat of our pants, trying something out. It was all about understanding, essentially the heuristics of designing and understanding the mental processes, so my emphasis on design thinking is understanding the cognition associated with designing.

That to me is the only aspect that I can draw upon, the thinking elements. Otherwise, it's just design. So it's kind of a higher level approach to the thinking side, which has often being bereft in designing as an activity anyway. Because often in designing, we rely upon tacit assumptions, and we rely upon people's kind of innate response to activities, and again, just going back to my other work, this was tying in to the previous work that I've done on emotion, which emerged, you know, 15 years ago, something like that. So there was a thread emerging and it seemed to me to be an opportunity to pull it together by looking at the whole area of cognition, and try to better understand how that works in a design context. The

irony is with this is ... that you'll be familiar with in the social media world, the way cognition has been kind of hijacked and capitalized upon, and, you know, people kind of almost suggesting that it was invented in the last 10 years, and they were the key mechanism for it and, you know, Ofsted having an interest in it and the reality is, it's always been central to designing. But equally it's always been part of the broader educational culture anyway. And just going back to that, one of the things I always remember from the early days when I was teaching design, was asking children about design and the cognitive processes that they were going through, so you know, the whole conversation about cognitive load. Well I remember having that conversation 25 years ago with kids and schools about how they designed because actually designing, that concept of an iterative process, isn't just an iterative process on a piece of paper, it's an iterative process between the kind of hand and eye and if you go back to Richard Kimbell's models of, you know, the kind of Christmas tree model, where there's that iteration, and also, you know, the balancing of cognitive load the conversation about extrinsic load and how you balance that out of what it should be, actually, a pencil is in the essence, the solution to that because actually, you are recording information as you're going along, which is feeding information back into the system. And actually, that's where you get this kind of iterative process of designing it's a feedback mechanism taking place. So, I was just trying to tie in the kind of the cognition elements in the thinking aspects of design, and, in essence trying to hold that open to scrutiny because of the flaws that exists in cognition, which now, you know, increasingly we're seeing people talk about bias. But again, if you go back to Design and Technology's national curriculum, statements of importance, you know ...

Alison 5:52
2007 yeah ...

David Spendlove 8:23
... yeah whichever one it was ...It said about improving the world, children improve the world, designing to improve the world. And I was always kind of caught on that one, by, you know, on what basis does a child make a decision about improving the world for others? How on earth can they do that? ... without it being, you know, kind of artificial and kind of naive. How could we even do that when they don't fully understand themselves or they, they're not necessarily put in a position to understand their own influences and biases and so on. So that's where I think it's on one of the pages where, you know, we need to understand the kind of social, political, theological, psychological, philosophical and cultural values that all interact with decisions. And recognising that at the end of the day, anyone can make a decision. And designers are making decisions all the time. But asking children to design isn't just putting a mark on a piece of paper. It's asking them to understand their values and actually just, you know, in the current climate where Dominic Cummings is being mentioned, and so on, and I was involved in an interaction a few years ago, probably more than a few years ago, where I said something about values overriding evidence. And actually because sometimes you're looking for evidence, but values are what needs to be established in that and I got kind of this kickback ... can't remember if it was from him or from

other people in this forum that we were engaging with, because they were very much interested in the scientific method, you know, and, as if that is the proof, but unless you have your values and actually as we're seeing over the last week, and so on, so Brexit dare I mention it, which that whole notion of values is the thing that's probably missing. Because what you're ultimately trying to do is question the whole basis of the decision making process that you're making. And to me, that has always been what designing is for in a education context, which again, you know, I would completely recognise that it's often been very different to what other people would hold. But then the thing that I've always been quite comfortable about in that kind of discourse is that because the design community was generally so small, it always needed people to be going off on different tangents and you know, that's what we can each offer and it wasn't about establishing grouping. So I think the thing about this piece, and I'd say the other stuff that I've written, it's slightly provocative, slightly to make people think, to challenge people because they're not right and they're not wrong. They're just there to kind of posit a position.

Alison 12:17

So when you talked to these children that you were teaching about asking them to explain what they were thinking about, what did they say? What was there? How did they explain what was going on in their cognition?

David Spendlove 12:31

... so there's two elements on that. One is when I was first doing it, when I first started teaching, I was asking children the kind of the basis by which they were making those marks on their piece of paper and those ideas and those designs for other people when I didn't understand them myself. But it was a sense that ... How are you doing that? How are you making those decisions? ... because I always knew that there was something there and I had an interest in psychology anyway. So, you know, I'd done a degree. I'd kind of, not specialised, but I'd been interested in the psychology elements. And I'd always kind of followed that through into areas. But then as my work developed on creativity, and then we went into, so myself and a colleague, were looking at the whole area of risk or uncertainty, and I started work on that area of emotion and how emotions influence our kind of state of mind and influence our ability to design and then how we also build in emotion and how it influences learning. So it was this triadic schema that I came up with which, which emphasised how teachers could comprehend emotion in different phases. So then feed that forward and then taking this concept of designing into a classroom, it was very much about, we put together and as I say it was it was kind of a lesson study type activity with the trainee teachers where they're exposing biases in children. And actually, again, this goes back to previous work we've done around 2000. You know, so one of the things we used to do was asking children to design something for a disabled person, to design something for a newly married couple. And they would always do the stereotypical things, you know, so for the disabled person, they would come up with kind of a poor idea of toy, or something like that, revealing their kind of stereotype of that. For the newly married couple, you know, they would kind of just do the typical gifts, and then we'd show them a picture of kind of either an elderly couple, you know, who are in their 80s getting

married, or a gay couple. So it was challenging the stereotypes. So that implicit bias that exists in their thinking was all about revealing to them that their position. So that was again ... that was around 2000 and John Moores University where I was working at the time were doing some really interesting stuff at the time. And in fact, I was having a conversation with the person I used to work with the other day, saying, you know, that is a million miles from where we are now, you know, at the time, it was fascinating. But how often do we hear this kind of conversation now, you know, without being pushed, and that was also the concept of creativity. Then feeding forward, as I say, into the concept of actually design thinking, we did stuff around a concept of illusions, you know, cognitive illusions, on decision making, the emotions, the whole concept of anchoring and the bias that builds in, that is built into your decision making, basically revealing almost a straitjacket that people start off with ... to make decisions. It was very interesting because this was a few years ago, and not long ago, I was speaking to the teacher about ... I just happened to bump into them and we were having a conversation, and he was saying that they were still using those ideas, that they were using that as a reference point to their future designing, you know, a couple of years on, which is fascinating, you know, the idea. And it was something that really was an activity, it was done around a kind of acronym of IDEAS, which stood for illusions, decision making, emotions ... I can't remember what the others were and it was just a way of kind of characterising those cognitive flaws that we have when designing so to me that offered an opportunity to justify a thinking element to design thinking,

Alison 16:58

... right? Okay, so if I've got this right, so the, the idea was that you would use this for want of a better word strategy ... the IDEAS ... to kind of help in a classroom to help the children sort of expose their sort of inbuilt bias that they weren't aware of as they approached a design task. Is that it? Have I captured that right?

David Spendlove 17:19

... yeah, yeah, I mean, we did it through kind of discrete exercises., and one of the things that's, that's really important, though, is the whole classroom environment that you're trying to create. Because again, that goes back to the whole concept of emotion. I mean, you know, the difference between that working and not working is quite a fine line, but actually, it needs a level of nuance and sophistication and thinking about it because this isn't to reveal people as being, kind of having a weakness, it's about authentically revealing that we all are kind of caricatures and we adopt certain behaviours without fully understanding what those behaviours may be. And by the way that can be applied to any aspect of any process of thinking. It's just about always central to the designing, the concept of designing is you generally start out trying to improve something without necessarily knowing how you going to improve it. And the other side of this is that it is my general belief that the whole area of design has been constrained for design education. And I'm using design education typically rather than Design and Technology education, I think it distorts it too

much. But the whole area of design education has been ... kind of always adopted a kind of a simplistic aesthetic kind of prioritisation, which, which was understandable, again, because you know, there suddenly comes a point when you realise you've been around for a long time in design education. And, you know, I've got a brother who was a teacher of Design and Technology and I've also got a sister, my twin sister, who was, who still is a textiles teacher. So there's kind of a continuum that I know of and, you know, the whole craft concept that existed in the 60s and the 70s. You know, that was a generation of people who were never exposed to designing and had to increase their kind of understanding of design. And I just remember them as teachers struggling to understand design. And then children struggling to understand the concept of design. And even me struggling to understand when I was a teacher of design. And it wasn't until later on. And in fact, you know, earlier we were talking about Eddie Norman. I remember going to Loughborough University in about 1994 and meeting Eddie, for the first time ... Eddie won't remember ever this ... because Eddie had written his A-level book on ...

Alison 20:05

... the classic, the classic book ...

David Spendlove 20:07

... yeah ... Norman and Urry ... and, in fact, as soon as I came back ... it was a residential with engineering students I was there with from the school ... as soon as I came back, I signed up for a Masters. And it was only there that I started to be exposed to kind of broader concepts of designing. So people like Phil Roberts, who was at Loughborough was kind of quite influential in provoking our thinking, because he was talking at the time, and his work was around cognitive modelling. Again, you know, people were talking about cognition, a long time before social media, realised that they created it! And that whole concept of cognitive modelling was fascinating and so on, so it was just tying in lots of different things. But you know, one of the problems that design or design and technology as a subject had was that it didn't have a strong pedigree of design. There were patches, but it certainly wasn't strong. And adopting a kind of embellishment, product orientated activity was certainly very popular in the 80s and the 90s, and absolutely understandable. But the difficulty is, it became so constraining in so many different ways, and you still see it today, and it's completely understandable why that still pervades. And in many ways, that's why I've said about 'Design and/or Technology 2.0' is because something needs to happen to break the mould. And something needs to happen to distinguish between what existed in the past and what exists in the future. Now again, it's being slightly provocative and I've had this conversation with quite a few people because there are so many vested interests in the current iteration of Design and Technology 1.0, that, you know, why would you break it? But the other side of it is mentioned in the chapter, we're seeing the most rapid implosion of a subject in the history of the curriculum in schools. And no one seems to be doing anything about it, or anyone of influence seems to be doing anything about it, or capable of doing anything about it. Those of us, you and I, who were involved some years ago in teacher training for Design and Technology, you know, we remember it being bouyant., but actually,

we've seen it just simply collapse for a whole variety of reasons. Some are deliberate, some are accidental, some are just bad timing. So the fact is, either the subject was simply vulnerable because of a whole range of, you know, perhaps it grew too quickly and so. So, again, I'm just tying various things in and saying the 2.0 is just a way of reconceiving it. And it's the the challenge for other people to go ... well, 3.0 should be this and 4.0 should be that.

Alison Hardy 23:12

And so my work has looked at, about what people say is the value of the subject. And, you know, that's what my PhD research was. And I'm continuing to sort of explore that. And in my work, you could really clearly see the history, that generational stuff continuing to be played out in the classroom. And it's very difficult to get away from our history of craft, and some of the stuff around technological developments that was happening also around in the 60s that Geoffrey Harrison was sort of part of all of that, and some of the gender issues and you know, you talked earlier about that stereotyping that kind of continues to come through. So I can see really clearly where you're coming from around this idea that there needs to be a disruption because trying to change things gradually, in the way, if you look at the seven iterations of the national curriculum that we've gone through, they've just been a minute shift. You know, you could say, the 1.0, that came around with the Working Party was an attempt to disrupt, you know, and to some extent succeeded, but as you said, was constrained by our histories, our own cultures of what we came from, but also finance, pragmatism, you know, that you have to take forward into the classroom. And so, yeah, that that whole embellishment movement, and you can still see that being played out in the classroom today. So and I can completely get your call for a disruption of a 2.0 with a greater focus on design thinking, which in some ways from my perspective, and what what I've read around some of this is links back to some of the stuff that David Layton talks about, right back in the early days, but has got lost. This whole idea about values and the impact that our values and our perceptions and our biases and our judgments that we don't necessarily articulate and aren't even aware of, have an impact on the way we think when we are designing, whether it's the physical activity of designing or the, the cognition activity.

David Spendlove 25:14

Yeah. I mean, so one of the things about this, I think, particularly in the context of curriculum is Design and Technology doesn't have a right to exist. And that sounds a bit harsh, but it doesn't, but equally, I don't think any subject has a right to exist, you know, and but again, in the context of the current Ofsted framework, you know, one of the things that we will have done as teacher educators, was develop a very strong understanding of the purpose of the curriculum and your role in the curriculum and so on. And a justification more so than anyone or any other curriculum area in many respects because we always had to do that and we always had to kind of fight for a place. Us, as teachers, we had to fight for places in the curriculum. And actually, we ... I don't know, when when you entered teaching, but as a teacher when I started off Design and Technology certainly wasn't a compulsory subject, and you are always fighting for the

subject, and you're always having to fight for your the place in the option lines and the curriculum.

David Spendlove 26:21

And I think, in many respects, potentially, we got a little bit lazy in that period when the subject became compulsory and didn't do enough. And then, effectively, people were almost deskilled in articulating that curriculum position. But it was always certainly part of my mantra in terms of training teachers that you had to understand the justification. And actually, the justifications that were often positive, were not sustainable. And if you look at Bill Nichols work that he did around ... it was kind of on the values, kind of the benefits of Design and Technology, the kind of parental view or the concept of the children have to take something home, and so on, which were just strong anecdotes, but the reality is, did you want children to take home a box of something or whatever? Or did you really want them to change their way of thinking? Well, the reality is you would want them to be changing intellectually, that is partly the purpose of school. I never actually bought in entirely to many of the arguments about Design and Technology, but again, I just put myself, something I was quite happy to do, position myself in a slightly different position. Because the whole artefact thing, I think, was kind of an illusion in many respects. It worked for some, but it didn't work for many. And it became artificial in many respects. And ... but it was like an anchor wasn't it? It was weighing us down and weighed us down for many, many years. And it used to be astonishing to me, the way you would fire the trainees up to go out into school, and then they would immediately be pulled back into this kind of 1960s model of designing or Design and Technology. And actually, the technology was very rare anyway ...

David Spendlove 28:20

So, again, I think, you know, there is an irony to all the kind of conversations that we're having at the moment, because actually, you know, Ofsted looking at curriculum, yeah, that's what we've always talked about, but actually, the integrated curriculum, the kind of the way Design and Technology has always been typically interdisciplinary, or should be interdisciplinary. And you know, the whole David Hargreaves thing, when he was at QCA and he said, if he was starting ... it was something like if he was starting the curriculum again, he'd put Design and Technology at the centre, because it's the one subject that draws upon the other subjects. That's what it does. And yet, we've probably gone back 25 years where we now have very discrete subjects, you know, how often do people talk about interdisciplinarity? How often do we talk with people about integrated curriculums, which are difficult. So I understand why.

David Spendlove 29:21

You know, we we've kind of reverted back, but it seems, in many respects, going back to the conversation about kind of creativity earlier, you know, we've lost so much ... it is a fascinating time. It's not all bad, but I don't see the kind of signs of you know, forward looking, we think, I mean, that was one of the ironies with the opening line, because you had Andrew Schneider, you can take or leave, but Andrew Schneider's

talking about design thinking being one of the most important things and I was thinking, does he really know what it is? And actually, irony in the fact that at the same time in England, it's the most rapidly imploding subject on the curriculum. The other side of this, which I still think is an interesting phenomenon where it [design] is good. I don't think it can be beaten as an activity because it is complex, it is intellectual, it is demanding, it is interdisciplinary, it is creative. But when it's poor, in my opinion, it doesn't justify a place on the curriculum. But you can almost say that for any subject.

Alison 30:31

Yes, I think you're absolutely right ... I think you're absolutely right. So I'm going conscious of time and sort of thinking, well, thinking about how we can bring this to a point of leaving people with something to think about. And because it's been, it's been a huge amount in that ... in what you've talked about, and that I think, hopefully will provoke teachers to be uncomfortable, some of it will resonate, some of it people will disagree with, which is absolutely fine, that's what this is all about. It's the same thing. You say that there's a PhD form, and they can't agree about design thinking. I interviewed the 23 interviews, something like that, about what people thought was the purpose or value of Design and Technology, at least 32 different reasons, and nobody agreed on any one of them. And these things are ambiguous, which just highlights the, to me the kind of the challenges that we're facing. And for me acknowledging that we're never going to reach reach a consensus, but by having these sorts of conversations people can be provoked to think about what what do they mean by that? How does that come out in their classrooms?

David Spendlove 31:40

But the optimism I mean, so you know, in talking about try to be optimistic, the optimism absolutely should be there. It is always why I've maintained is that the optimism comes from knowing that actually fundamentally, there is something of significant value here. We know through the evolution of, you know, drawing on design theory, we know, through the evolution of products, it's not about the best product winning, it's about the right product at the right time. And, you know, perhaps Design and Technology was the wrong product at the wrong time. But equally, it was the right product at the right time in a previous iteration, but one of the things that we need are teachers to be activists in that sphere of understanding how curriculum links to the kind of politics of the time and so on, because this isn't just happening, this is happening for a variety of reasons.

David Spendlove 32:42

And, you know, whilst teachers can plan curriculums, they have to understand the political context that they are operating in. The second thing is, they need to employ the very skills, and processes and kind of capabilities that they tried to engender in their pupils. And that is about trying to be creative and consider this as a design problem, as what is the next problem? That's effectively why I drew up on the 2.0. In that, what is the next model? What is the next iteration that's going to be sustainable? That actually fits in with the current political situation?

School and context? I mean, one of the things that's always been absolutely challenging is the kind of list of demands from teachers, you know, and this won't be popular, but the list of demands that Design and Technology teachers used to make ... of I need X amount of money, I need a smaller group than everyone else, I need this amount of time. Fine, but you've got to deliver on that.

David Spendlove 33:53

And actually, you know, that was where one of the problems was. And in a climate of you know, restricted budgets, asking can you have or telling people that you need a 3D printer? But actually, you're not going to actually expand a child's design thinking because of that, actually, in many respects, the evidence has shown that it constrains it, if you're not careful. My view is how can we design something that is fit for purpose in the next iteration, which draws upon many of those things? I absolutely believe that fundamentally, there are huge opportunities for those key ingredients. But equally, and it's the points that I am making there, if designing, Design and Technology isn't careful, someone else will pick up that design thinking activity, and probably do it, you know, significantly worse and adopt it and recreate it in the humanities or in the sciences, and so on which happened with the national strategies, you know, when people were talking about the foundation subjects and telling people in Design and Technology how to teach their subject and, you know, it goes back a long time.

David Spendlove 35:12

So I would be optimistic because there is something there that I still have never seen anywhere else in that particular way.

Alison 35:24

Well, that's a very positive note. And I think that you think you're absolutely right, and that idea of Design and Technology teachers or design teachers, using the very skills and activities that we are trying to infuse in the children we teach, to develop and create a new curriculum and view an understanding of Design and/or Technology is absolutely the heart of it. So thank you very much. I've really enjoyed the conversation.

David Spendlove 35:59

It's nice to revisit the chapter because I'd forgotten completely about it, but you know it, it has to be there for winning. People have to be out there. And, you know, one of the things ... I'm just extending this a little bit, but it's waiting, When does Design Technology hit the lowest point because you keep thinking, where does it go to. We've seen the numbers fall and fall and fall. And I saw on a table this morning minus 230% in terms of recruitment for Design Technology teachers. I think Business Studies was slightly lower, and that's after 10 years and we know those discussions that we've been having over a decade of you know, when's it going to stop? when's it going to stop? There comes a rock bottom and at that rock bottom there's got to be a bounce back. That will be for a new generation of people, as was the generation that initiated Design and Technology all those years ago. Nottingham Trent University was at the forefront, Loughborough University, Brunel University, all those

universities that were at the start of it, but it may have to exist in a Multi-academy Trust. It may have to exist in another format. But there will be people out there, you know, and hopefully one of them might just accidentally listen to this or come across the chapter. But they might be provoked into thinking, this is the challenge because the people who led it then some of the names that you mentioned, and people like Mike Ive, you know, Richard Kimbell and Andy Breckon, who were kind of key people, John Eggleston, who were the key people when, when I was starting off, you know, they were driving you forward. I think we've lost some of the capacity, which is an issue, but equally there will be good people out there who can drive it forward. I'll stop now.

Alison 37:47

... and as you say, hopefully listening to this podcast, and picking it up from there, and kind of coming back to us and arguing and saying, Well, I don't agree or do agree or wanting to be involved in the what's next and that's the hope and the ambition of this series of podcasts is that people will be challenged and want to kind of take part in those sorts of conversations. So yeah, so thanks ever so much. It's been brilliant.

David Spendlove 38:12

Thank you.

4. ARE THESE THE QUESTIONS THAT NEED TO BE ADDRESSED?

Eddie Norman, Emeritus Professor of Design Education, Loughborough University

HOW CAN DESIGN NOT BE CONSIDERED AS CENTRAL TO ENGAGING WITH THE FUTURE?

- Need to reflect on how the Expert Panel could have reached the conclusion they did in order to begin to understand what has gone wrong with D&T 1.0
- Need to reset thinking away from current conceptualizations of D&T and towards more generalised concepts such as modelling
- Need to consider where design knowledge might reside within the school curriculum ... perhaps relating to numeracy, literacy, articlacy and graphicacy

DO DESIGNERS ACTUALLY KNOW ANYTHING?

- Why is the nature of design knowledge hard to articulate? eg scientific/ articulate and intuitive/tacit forms of design knowledge
- Can understanding the roles of engineering drawings provide a clear illustration of the nature of design knowledge?
- Does the concept of 'enhancing the perceptual span' enable the significance of mastering 2D and 3D modelling techniques to be understood?

ARE THERE DIFFERENT WAYS OF KNOWING?

- Can examples be provided that illustrate different ways of knowing?
- Are the risks of undervaluing the importance of design knowledge, skills and values understood when offering students a variety of design contexts?
- Is a patchwork of supported experiences in different design areas the approach to be preferred for design in general education?

INITIAL EXPLORATIONS OF DESIGN EPISTEMOLOGY ... HOW CAN WHAT DESIGNERS KNOW AND HOW THEY KNOW IT BE APPROACHED?

- Do D&T teachers already have considerable understanding of design epistemology - articulated or tacitly?
- Must design epistemology embrace the making of meaning through visual images?
- Need to appreciate that design epistemology is a moving target changing with time and culture. Can understanding the development of graphicacy across the curriculum give initial insights concerning design epistemology? And design thinking?

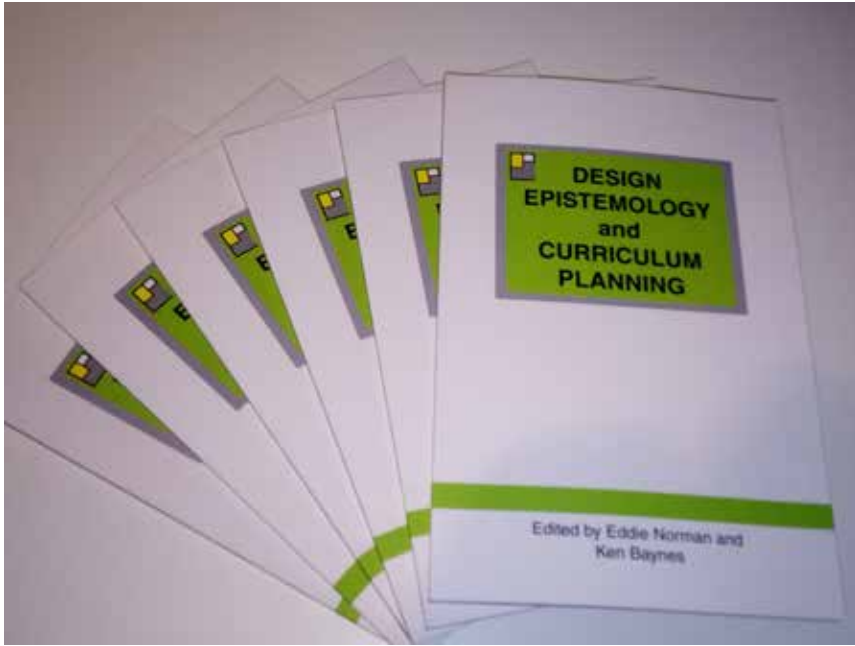


Fig 4.1

HOW CAN DESIGN NOT BE CONSIDERED AS CENTRAL TO ENGAGING WITH THE FUTURE?

Eddie Norman

Talking D&T podcast, published on 10 March, 2020

When I retired, I uploaded as many of my publications as I could to ResearchGate so they might be available to future researchers. So far there have been over 3000 reads, and well over 700 of them are for the editorial I wrote in June 2013 entitled Design Epistemology and Curriculum Planning. So it's clearly an important topic for many researchers.

The editorial had been written for *Design and Technology Education: an International Journal* and in response to a report prepared by an Expert Panel concerning the National Curriculum in England and Wales. The major concern was that the Expert Panel concluded that Design and Technology did not provide a powerful way of engaging with the future. How could this be when that is in essence its reason for existing? Design concerns the modelling of future possibilities and the implementation of those possibilities considered worth pursuing. And so in 2017, Loughborough Design Press published an exploratory book with the same title. Colleagues were invited to give their views in relation to the 2013 editorial and the Expert Panel's report. Stephanie Atkinson, Alison Hardy, Steve Kierl, Graham Newman, Tristram Shepherd and David Spendlove all made important contributions. In his contribution, David Spendlove called for a new vision for Design and Technology Education based on design thinking, to which he gave the title 'Design and/or Technology 2'. This has been reprinted here (see page 15). He wrote as follows:

'There is therefore a unique, perhaps once in a decade, opportunity for reorientation of the values that were instrumental within the development of design and technology through adopting and capitalising upon the intellectual and reflective aspects of design thinking and revisionism within a Design and/or Technology 2.'

Tony Ryan, the chief executive of the Design and Technology Association, in his recent editorial for *D&T Practice*, seemed to be suggesting that this task has largely been completed when he stated that:

'What I will say is this new GCSE is the award that should have been in place years ago. It's academically demanding, challenges students to develop their subject knowledge while at the same time working on a set of skills and attributes that once learned and mastered, will stay with them and serve them throughout their lives and accurately mirrors the design thinking that takes place in business industry, and indeed in life.'

Well, I hope that is true, but it could be that it's more of an aspirational statement than a reflection of current realities. In October 2018, the Design and Technology

Association, in conjunction with the All-Party Parliamentary Design & Innovation Group and the Design Business Association launched their report entitled *Design Skills: a UK's Industrial Strategy*. As reported in *D&T Practice* the following quotation hinted at some of the complications that accurately reflecting design thinking entails.

'Design is a way of looking at problems and finding solutions; the government should incorporate it into all other subjects - ranging from programming to ethics.'

There's an acknowledgment here that design thinking is cross-curricular. Clearly Design and Technology embodies aspects of design thinking, but so do other subjects. And there is some tricky teasing out to be done before there can be any certainty that design thinking is being accurately reflected by the educational provision across the curriculum. And all this rather assumes that an audit of design thinking is actually a current possibility. I retired in 2012, and in that year, a book was published called *Articulating Design Thinking*, edited by Paul Rogers, that reported on a then recent conference. My reading was a little sketchy as you might expect towards the end of my career, but I don't believe that the problem of articulating design thinking had been resolved at that point. My last task at Loughborough Design School was to co-supervise a PhD by Arthur Chan, which set out to establish the meaning of design thinking as expressed by academics and practitioners. There were many interesting outcomes, but that did not resolve the matter either. One of the targets of that PhD programme was the development of appropriate audit tools in relation to design thinking, but as I remember the situation, there was some way to go. Perhaps satisfactory audit tools have now been developed for design thinking and they would certainly be needed for curriculum planning and review.

The reasons for these appeals to design thinking as underpinning future curriculum development relating to design education are in a sense self-evident. But can anyone actually explain clearly what they mean? Design and Technology is so often presented as a process driven subject that draws on the knowledge base developed in other curriculum areas that it has come to be seen as of secondary importance almost by definition. It's hard to complain about the conclusion that the Expert Panel reached that Design and Technology should not be part of the core curriculum if its major epistemological focus is repeatedly claimed to be applying what is learned in other subjects.

This all gets a little easier to grapple with if modelling is chosen as the point of departure for analysis rather than referencing 'a or the design process or processes'. The fundamental role of modelling and its relationships to designing and graphicacy need to be understood. The human capability to create and use mental models to act on the world and imagine future possibilities to design was at the heart of Ken Baynes' seminal book, *Design Models of Change: The Impact of Design Thinking on People's Lives and the Environment*. Ensuring its publication was a key reason for the establishment of Loughborough Design Press. The seminars

Fig 4.2



that led to the publication of Ken's book provided the backdrop to the work of the PhD research students who were members of the Design Education Research Group towards the end of my full time academic career. Xenia Danos and Cheng-siew Beh were both working on research related to graphicacy, although in very different areas. Xenia's research concerned the development of graphicacy within the school curriculum, and Siew's research concerned the visual communication of technology.

Although they are directly related, modelling is a more general and substantial human capability than designing. Models can find expression in a variety of ways, for example, through numeracy, literacy, graphicacy and articulatory. And they exist in the human mind in forms that researchers are still in the process of understanding. Developing understanding of these matters is key to exploring how design thinking will map onto most, if not all, areas of the curriculum, and not exclusively on to Design and Technology. They also shed light on ways in which

Fig 4.3

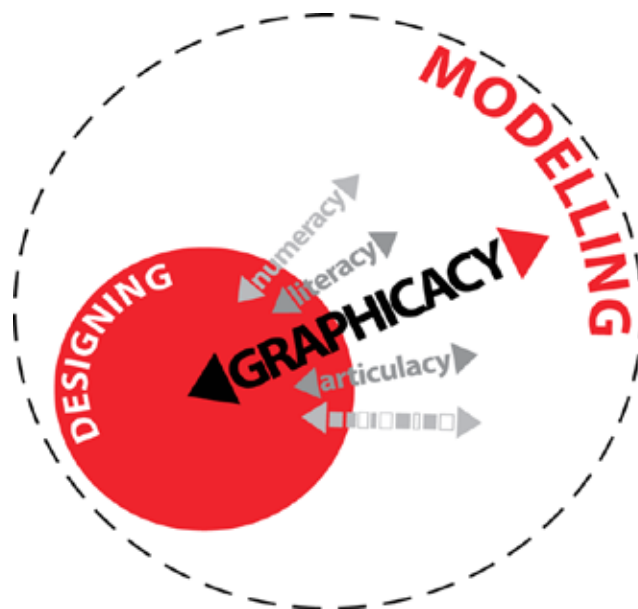
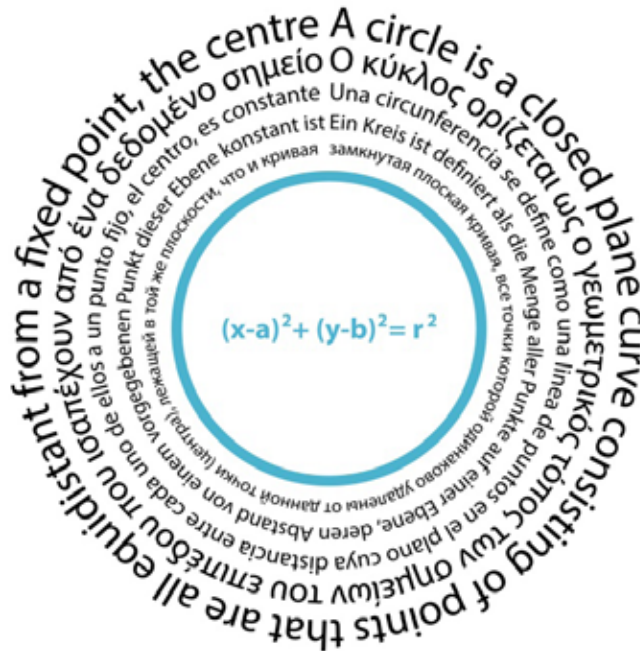


Fig 4.4 Ceci n'est pas un cercle



technology can be viewed and represented. Scientists may well view technology as applied science and seek to represent aspects of technology in particular mathematically-based symbol systems, but it may not be viewed in the same way by designers.

René Magritte's painting from the late 1920s, *Ceci n'est pas une pipe*, made the point that a representation is not the real thing, but from the modelling perspective, it is what that representation enables that is significant. Visual representation facilitates the imagination and the interaction with visual languages as Ken Baynes has described. Ken identified three visual languages. Firstly, visual or spatial qualities such as colour, texture and proportion. Secondly, physical places, things and communications, such as landscapes, clothes and graphic images. And thirdly, human values and meanings such as beautiful, fashionable and green. Visual representation also facilitates analysis with the creation of diagrams that can help understanding and establish order. Technical drawings can also help with quantitative analysis and it is apparent why visual representations are a key aspect of modelling in the context of designing. In fact, the power of visual representations has grown ever greater with the increasing sophistication of data representation that modern information technology has made possible.

Such data representations are already blurring the boundaries between visual and mathematical representations of models. The computer, of course, holds the data numerically. Traditionally, mathematical modelling might have represented a model as a series of equations that enable calculations and forecasts to be performed. I first came across complex mathematical models when I was introduced to the Club of Rome's 1970 report *The Limits of Growth* when studying engineering and economics at university. This report was founded on a world model incorporating such factors as resources, pollution, industrial output and

population and enabled predictions to be made. These are well known to have been alarming, but have not had the impacts on behaviours that the report's authors might have hoped for. Nevertheless, the key point here is that the model enabled the predictions to be made and considered.

It's not always understood that a product design specification, or PDS, is a model for a design. However it is useful to think about a PDS in this way. Within a PDS it's possible to express both the aspirations for design and the constraints on it. Through language they can be expressed in a way that allows considerable interpretation, or indeed very little, but a numerical value is likely to provide a much more precise requirement. Even if a mood board was included in the specification in order to capture aspects that are difficult to express in words or numbers, for example, colours or styles, I would suggest that the visual representation provides tighter limits on the design than a verbal statement might. So a model of design in written language can capture user or market requirements without unduly limiting the designer. This is almost certainly why the creation of a PDS and the use of freehand sketching are common early modelling activities when designing because they allow the ambiguity that is necessary in order to explore a design task.

If this discussion is extended to embrace the concept of technology, then from a design perspective, the form in which technology is presented enables different kinds of exploration through modelling. Hence, in this context it is important to consider the ways in which technological understanding can be expressed in order to facilitate modelling.

I was honoured to be invited to give the John Eggleston Memorial Lecture in 2006, and I included reference to the survey conducted for the Assessment of Performance Unit, or APU, in 1983 concerning the contributions made by UK school subjects to technological understanding. In this survey, technological understanding was analysed within three areas: knowledge, skills and values, and several categories were identified under each of these headings. I remember one delegate saying that she thought "it was rubbish the first time she saw it" (or something very similar. It was a long time ago). I'm not sure of the methodology that the APU adopted, and I must look back and find out, but crucially, the survey recognised that technological understanding was not confined within a particular subject boundary.

The knowledge skills and values framework was used by the APU in their key document published in 1982 concerning Understanding Design and Technology, which reported the work of the APU Technology Sub-Group chaired by George Hicks. It remains a very interesting read and its appendix begins to explore the knowledge and skills embodied in an aerial photography project. I joined Loughborough University in 1984 and this was part of my background reading as I was reflecting on the nature of technology for design or more fully technology for the purposes of those engaged in designing. This conceptualisation of technology for design was always part of my thinking and I eventually published a paper in

1998 considering whether it might provide a route towards more generalised positions concerning technology for design. The intention was not to consider technology in general as trying to generalize too far seemed likely to defeat any hope of reaching a consensus, but it was a model that had gained some traction both in my own research and in framing theoretical discussions with my research students.

The APU survey outcomes were important because they indicated a model of the contributions the different subjects were found to have made to understanding technology. Something similar is going to be needed to audit the contributions different subjects make to developing design thinking, and maybe there are some useful starting points here towards that cause as well.

DO DESIGNERS ACTUALLY KNOW ANYTHING?

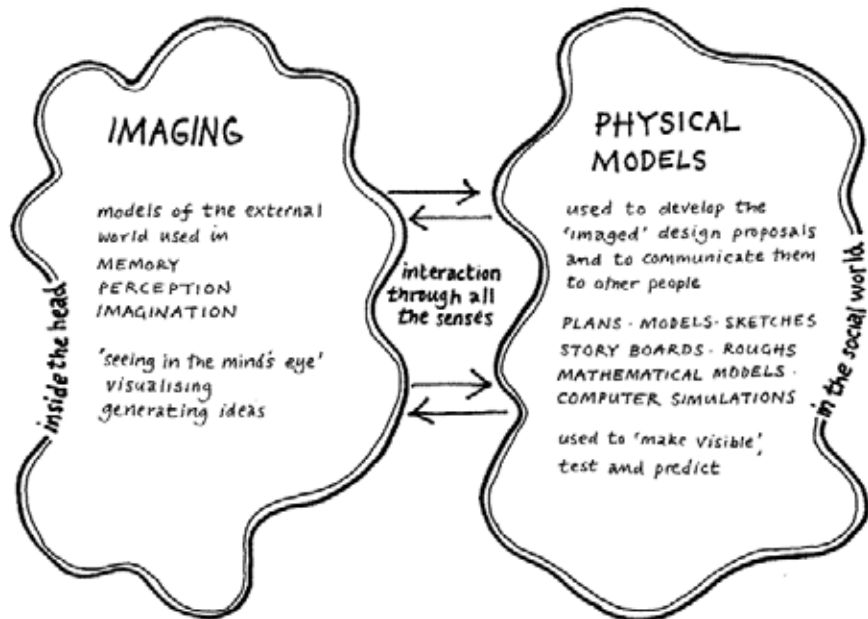
Eddie Norman

Talking D&T podcast, published on 11 February, 2020

I was privileged to work in what is now Loughborough Design School for 28 years and I could watch the students learning as they moved through the degree programmes. It seems an odd thing to say, and it should be self-evident, but the second year students were better designers than the first year students and still looked up to the Finalists ... wondering whether they would ever be able to reach those standards. Of course they did, every year, but it wasn't either through gaining a better understanding of 'a or the design process or processes' or improving their ability to apply what they had learnt from other disciplines. Again this should be self-evident, but seems to need saying – the design students knew more about design and designing as they progressed through the teaching and learning programmes.

Loughborough Design School did not teach 'a or the design process or processes' at any point as far as I know. Students were taught modelling techniques in different areas and when these might prove useful – modelling through drawing, prototyping, investigating the user experience etc both through design practice and dedicated modules such as 'Drawing for Design'. It was always interesting to note the difficulties that many students had in articulating what it was that they had learnt, but you only had to look at their portfolios, or attend the Degree Show, to see it. Employers recognized the value of the Design School graduates and they were amongst the most employable on the campus. So why is it so difficult to articulate what designers know and how they know it ... ie to explain design epistemology?

Fig 4.5



There are many reasons and one of the more problematic is that design knowledge can be regarded as both 'hard' and 'soft' to use current descriptors. This has been long understood, and to quote one source, the late Professor Geoffrey Harrison, this is what he said in introducing his project *'The continuum of design education for engineering'*, which was completed for the Engineering Council and the Engineering Employers Federation in the early 2000s.

'Engineering is a universal experience. Since the beginning, our environment – the tools we use and the artefacts and systems we depend on – have evolved, and been designed, improved and crafted – 'engineered' – by men and women drawing on the accumulated knowledge of previous generations as well as on their own observations and their own tacit or intuitive understanding. From earliest childhood, this unarticulated knowledge and understanding is observable and we know that it can be stimulated and developed.

Capability in engineering and engineering design depends upon the creative use of both the scientific/articulate and the intuitive/tacit forms of knowledge. Universal education for a technological society must cultivate both forms of knowledge and understanding more systematically than at present.

It should support the process whereby, as learners, we progress from one form of understanding to the other: from tacitly understanding that something works (the 'use it' stage) to articulating how and why something works (the 'explain it' stage).'

Design areas lie on a spectrum and engage with different proportions of scientific/articulate and the intuitive/tacit forms of knowledge, or 'hard' and 'soft' forms of knowledge. Industrial design requires greater understanding of visual and human factors, amongst many other areas, and hence greater engagement with the intuitive/tacit forms of knowledge.

There is also the additional difficulty that Janet Daley noted in the 1980s that some of these intuitive/tacit forms have not been articulated yet, because they cannot be articulated. They can be expressed and understood in other ways, such as through visual languages or artefacts, but they are not expressible in natural language. The pattern recognition capabilities of the human brain can allow schemata to be created that lie outside of those related to natural language. However, experienced eyes looking through students' portfolios would have little difficulty in discerning what the students had learnt.

Consider engineering drawing, which is often thought to be a relatively mundane skill. The use of scale drawings dates back to earlier human history with its uses in architecture, landscape design and shipbuilding for example, but engineering drawing evolved in parallel with the industrial revolution. In his book *Design Methods: Seeds of human futures* which was published in 1970, J Christopher Jones analysed the emergence of engineering drawing and discussed the economic factors that were at play during its evolution. He also introduced the concept of the enhanced perceptual span that engineering drawing enabled. Engineering

drawings facilitated the division of labour between people and places, and it made it possible to plan the manufacture of things that were too large for a single craftsman to make. New production strategies could be developed and the speed of production could be increased. However, beyond these economic factors, the enhanced perceptual span that engineering drawing gave the designer enabled them to investigate the design with greater freedom. As J Christopher Jones said:

'The designer can (by the use of drawing) see and manipulate the design as a whole and is not prevented, either by partial knowledge or by the high cost of altering the product itself, from making fairly drastic changes in design. Using his ruler and compasses he can rapidly plot the trajectories of moving parts and predict the repercussions that changing the shape of one part will have upon the design as a whole'

In the introduction to the *Art of the Engineer Exhibition* in 1978, Ken Baynes and Francis Pugh further acknowledge the multiple roles of the engineering drawing as follows:

'Jones concentrates on the significance of engineering drawings for design and for production control. They were also means for communicating ideas and they even became symbols of industrial prestige. As a result it is difficult to ascribe a single function to any particular drawing.'

Engineering drawings had roles to play in marketing and sales, as much as design and production. If you are teaching engineering drawing you are not teaching a mundane skill, but enabling design students to enhance their perceptual span, as well as contributing to production and marketing. The majority of Loughborough's design students went out on placement in companies after their second year and their ability in engineering drawing was one of the keys for them being able to make immediate contributions. Whilst I was at Loughborough the engineering drawing modules were led by Syd Pace who maintained exacting standards.

With the advent of CAD the ways in which drawing can enhance the designer's perceptual span have continued to evolve, and if you've not done so already, it is worth downloading the iD cards that were developed by Dr Mark Evans from Dr Eujin Pei's PhD research. They can be downloaded from Loughborough University's website and are also available as an app. Their development has been supported by many design organizations, such as the Industrial Designers Society of America (IDSA), the German Design Council, the British Industrial Design Association, Design Denmark, the Design Institute of Australia and the Brazilian Association of Designers.

The iD cards show 16 2D and 16 3D methods of design representation. They explain the purposes of these modelling methods and when they might be used. There is no doubt in my mind that designers who have mastered these 32 methods have the potential to greatly enhance their perceptual span if they use them effectively... and that designers do actually know something.

Fig 4.6



ARE THERE DIFFERENT WAYS OF KNOWING?

Eddie Norman

Talking D&T podcast, published on 9 June, 2020

Clearly I had already formed many preconceptions concerning design epistemology before I read the Expert Panel's report, but doing so certainly focused my mind. It was disturbing and it was apparent that despite the wide recognition of the value of design education within higher education, it was not recognized as being a central concern for general education. The often expressed idea that for the design field the knowledge that might be drawn upon is unbounded can lead to the lazy assumptions that designing is a process-based activity that draws its knowledge from other fields and hence that it does not have its own epistemology. Although there are aspects of that position that are credible, I never supported it as an adequate description of design activities. This is what I wrote in 1998.

'Individual designers operate within a particular design area and it is possible, from the design activities in that area and its products, to identify knowledge, skills and values which it might prove helpful for the individual designer to acquire. This is not a causal relationship i.e. the acquisition of these knowledge, skills and values will not guarantee the designer success; neither is it an exact relationship i.e. there is no guarantee that for a particular project the designer might not need to acquire further knowledge, skills or values. Knowledge, skills and values so identified represent common elements associated with the range of activities and products studied. It is not an irreducible minimum in the sense that each element occurs in each activity and product - they are likely to be more disparate than that. They are elements that are associated reasonably frequently with activities or products in a particular design area. This is the essence of the difficulty faced by all those charged with the task of determining design curricula.' (1998: 40-41)

Design curricula in higher education often focus on a more tightly defined design area than those in general education, and it would seem to me that this is the underlying reason that it is more possible to establish a consensus on which their curricula can be built.

I had also had personal experience of different ways of knowing. I had worked as a research engineer at The Welding institute and each project was undertaken by a research engineer with an academic background like mine (I had studied engineering as an undergraduate and welding technology as a postgraduate) and a welding engineer who had served a full apprenticeship. It was quite apparent to both me, and presumably the management who provided the working structures within the organization, that these different ways of knowing led to different ways of thinking about a problem. I had also been working on the polymer guitar project and I was fully aware that Rob Armstrong had made 600-700 guitars at that point, now over 900, essentially all different and all successful. He knew exactly what he

was doing and was able to advise us on the polymer guitar project concerning such matters as material selection and strut patterns based on his wealth of experience. I recognized in Rob's practice what others, such as Maria Abu-Risha and John Langrish, have called 'purposive pattern recognition'. Rob Armstrong clearly fully understood technology for guitar design, although he might not be able to articulate it in the manner that a scientist might expect.

Fig 4.7

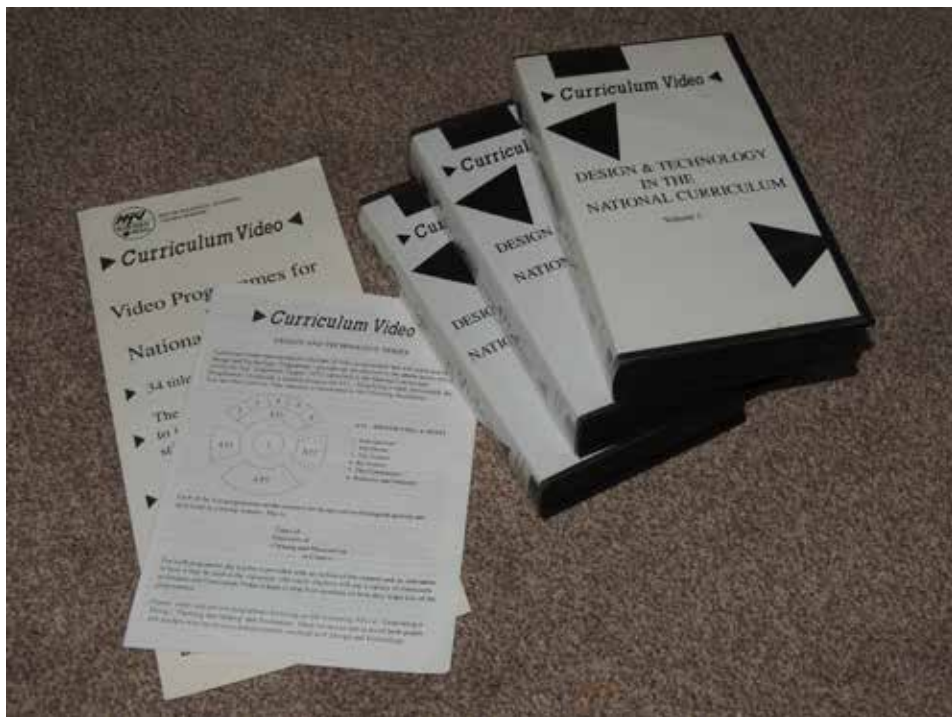


My 2013 Editorial concerning 'Design epistemology and curriculum planning' was founded on 3 elements. The 1982 APU report on *Understanding Design and Technology*; Walter Vincenti's analysis of technology for the purposes of aeronautical design and, as Ken Baynes reminded me, the work of Vitruvius concerning Roman architecture. Design and technology in general education had always been based on designing within selected design areas and with associated curriculum development projects. It had developed into a very important set of learning experiences for children, but it would always struggle to demonstrate disciplinary coherence unless the underlying reasons for having to select particular design areas was properly understood. As I wrote in the Editorial:

'A curriculum derived from the lobbying conducted by special interest groups and selective curriculum development projects tends to be something of a patchwork and lacks a core disciplinary strand. When it comes under challenge there is a serious risk of fragmentation and the whole looking rather less than the sum of the parts, and, at least to some extent, that is the position that D&T in the English National Curriculum now finds itself in.'

As design and technology always offered a selected range of design experiences, it would always be contested, and rightly so. That is what helped to keep it refreshed and relevant for many years, as changes occurred in the design world and the technologies available to it. Such a curriculum construct was a healthy enough position, and didn't have the risks associated with adopting a more generalised experience of design education.

Fig 4.8



The move towards a single GCSE curriculum has provided an opportunity to demonstrate that much has been learnt about offering children design contexts to explore since the previous attempts in 1990. Having just helped to complete an A-level textbook *Advanced Design and Technology* in 1989, I was in the process of re-setting my research targets when two interesting offers came along. The first was from Curriculum Videos who were based at Aberystwyth University and were looking for authors for video scripts to support the introduction of the new subject 'Design & Technology' in the National Curriculum. With Steve Garner, a colleague in the Department of Design and Technology at Loughborough, we wrote the scripts and supported the editing for 6 video programmes to help bring the then new design contexts into the classroom. These were 'The Home', 'The School', 'Recreation', 'The Community' and 'Business and Industry' and together with an Introduction, the 6 programmes focused on identifying design opportunities. The programmes were completed in 1991 and sold around 400 copies. Regrettably the curriculum they supported was abandoned in 1992 and we never had the chance to evaluate the effectiveness of this strategy.

There was an inevitable concern that children could identify design opportunities that were difficult for them to pursue, and for teachers to support, within the existing physical and educational constraints. Consequently when I was approached by Longman to see if I had any ideas on publications that might support the introduction of Design & Technology into the National Curriculum, I sought to collaborate with Leicestershire Advisory Teachers on a book that explored Leicestershire's approach to design education. I was aware that under the leadership of Andrew Fairbairn as the Director of Education, Leicestershire had

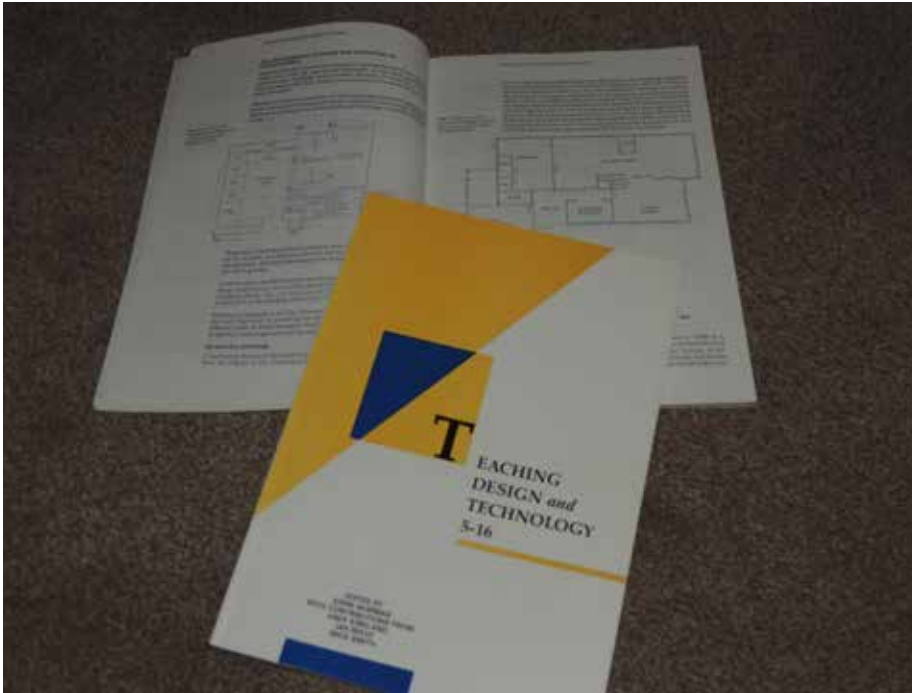


Fig 4.9

developed broadly based design facilities and associated strategies for teaching and learning that might offer some support to the new approaches being pursued nationally. Regrettably this book was no more successful than the videos, so, in my view, they were worthy efforts to support the challenging strategy that had been adopted for Design & Technology in the 1990 National Curriculum, but not significant enough to have had any impact in resolving the difficulties that had resulted from the new curriculum.

It has to be hoped that recent changes to the design and technology curriculum will be given sufficient time to mature and for supporting curriculum initiatives and resources to emerge.

INITIAL EXPLORATIONS OF DESIGN EPISTEMOLOGY ... HOW CAN WHAT DESIGNERS KNOW AND HOW THEY KNOW IT BE APPROACHED?

Eddie Norman

Talking D&T podcast *What designers know and how they know it*, published on 7 April, 2020

Allowing students in schools and colleges to identify design opportunities in different design contexts gives a seemingly immediate boost to design and technology's relevance, but there are major curriculum management challenges associated with such strategies. It is important that a design project that is to be part of students' assessments provides the opportunities for them to demonstrate what they are able to do and not simply expose what they cannot. I led the final year design projects at Loughborough University for 5 years and this was always the essential concern. Students were encouraged to seek advice from several design tutors, including professional designers, as well as their peers.

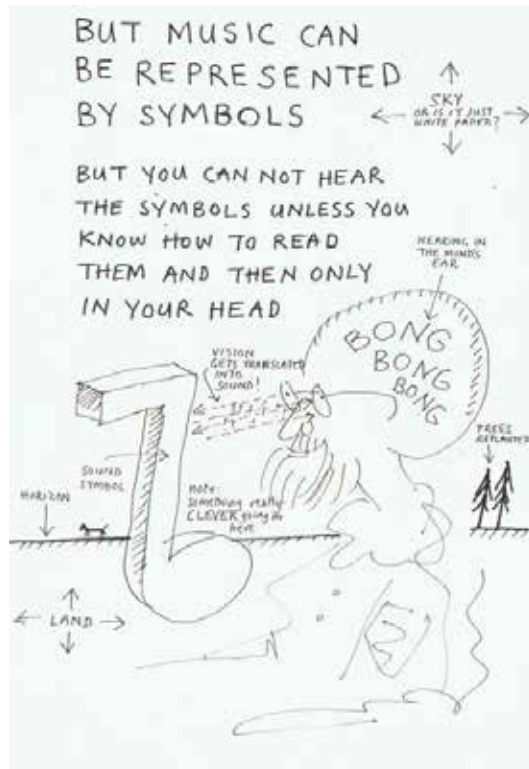
Advising students on their project areas was not so much about restricting their choices as helping them to identify opportunities to show their talents and with manageable risks ... perhaps considering different endpoints to manage the risk of running out of time, different prototyping strategies to avoid excessive costs if sponsorship could not be found or different modelling techniques that could bypass difficult or inaccessible technologies. It seems highly likely that these are the same kind of conversations that teachers will be holding with their students as they tackle the new GCSE contexts.

Underpinning all of these conversations is design epistemology ... what is it that designers need to know and how do they know it? As designers take on a new design area there can be a rapid learning curve to be surmounted within the project timeframe and it is no different for students. Teachers will be making judgements about their students' starting points and their likelihood of getting to where they need to be as they offer any advice they are allowed to give to their students on their projects. I have seen advertising materials from the Design and Technology Association for CPD programmes that have been designed to tackle these issues, so hopefully this initiative will have more longevity than its predecessor in 1990, when the then new national curriculum was introduced. This required children to design in 5 different contexts which provided many challenges to design and technology teachers.

Design educators should by now have reached a consensus and be able to audit design thinking across a curriculum and articulate design epistemology for particular design areas and more generally, but I don't think that is the position we are in. Consequently, in 2017 Loughborough Design Press published some initial explorations of design epistemology and curriculum planning.

The book was centred on an editorial written for *Design and Technology Education: an international journal* in 2013, which was called 'Design Epistemology and Curriculum planning'. Colleagues were asked to consider what their response might have been to the Expert Panel's conclusions and the circumstances that could have led to them. These were published alongside the original editorial in an effort to set out the issues. This book was not about trying to provide answers, or even to consolidate different perspectives, but to open the potential for debate, and for further contributions to be made.

Fig 4.10



However, it was decided that one further matter deserved to be included, 'epistemology and visual thinking'. Discussions of epistemology are usually restricted to those matters that can be expressed in the conventional symbol systems associated with written languages or mathematics. It seems apparent that this can never be sufficient for design epistemology where some matters can only be articulated through visual images, making meaning without words. It is also well-known that much design modelling takes place through visual methods in both two and three dimensions and that some aspects of design languages can only be expressed visually. And so, Ken Baynes published his cartoon-style drawings revealing aspects of making meaning without words. It seemed the most appropriate way to make the point.

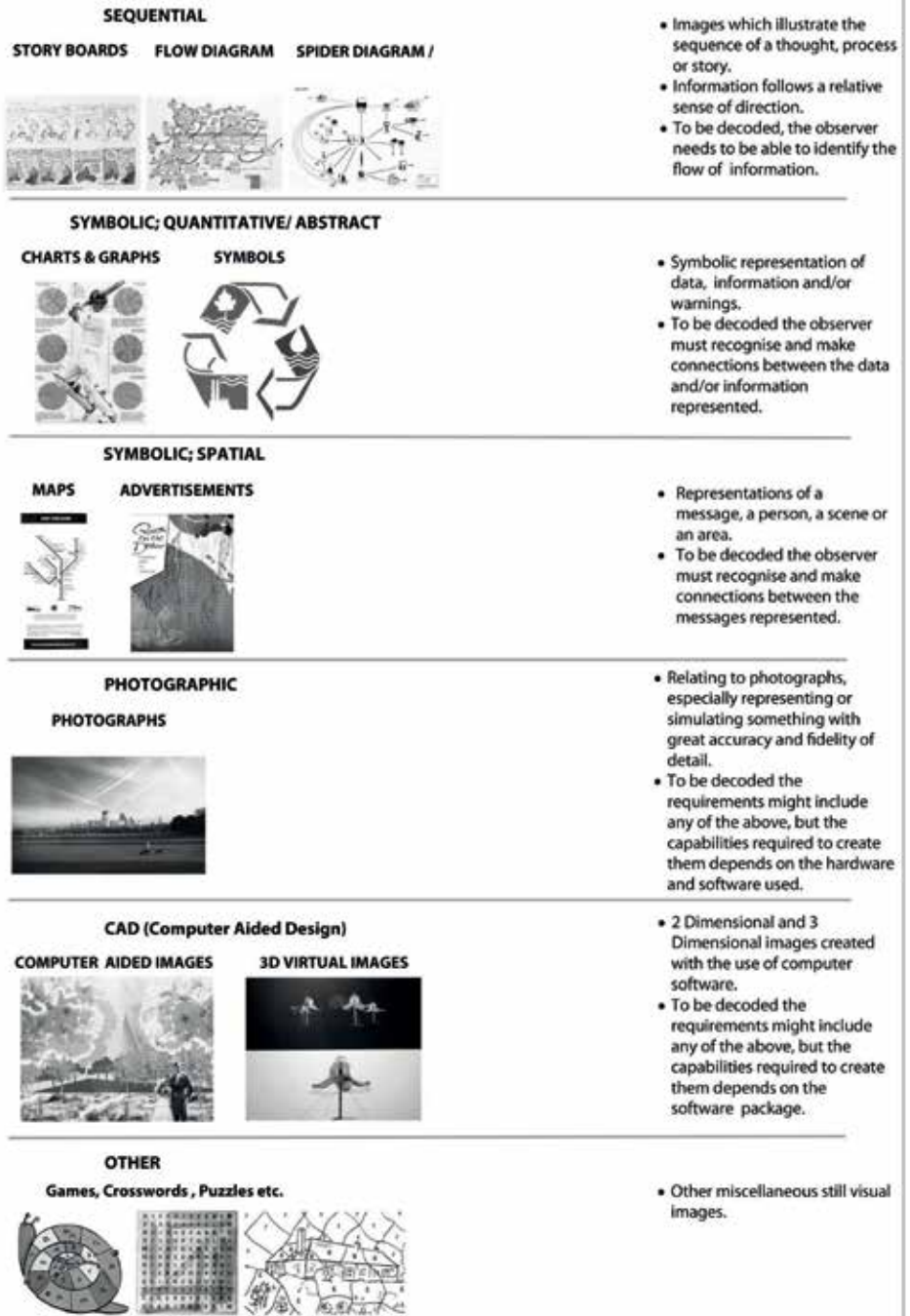


Fig 4.11

It also seemed appropriate to emphasise the cross-curricular nature of modelling through images by including a section on Xenia Danos' work on graphicacy. Numeracy, literacy and articulation have been much discussed and analysed, but comparatively little effort has been made to structure the teaching and learning of graphicacy across the curriculum. Xenia's work shows one way in which this could be pursued and if the full nature of design thinking across the curriculum is going to be articulated and audited, then its relationship to a taxonomy of graphicacy across the curriculum is going to play some part.

Danos' taxonomy is an update of much earlier work by Fry (1981). The update was necessary because as times have moved on, the Internet has emerged, computer drawing tools have become more common in schools, and the nature of drawing within the school curriculum provision has changed with the additional use of colour, photographic and 3D images to name a few. This illustrates the additional complication that design epistemology is a moving target and that both what designers need to know and how they know it will change. Designers work within, and are products of their culture. They acquire knowledge from that culture, and work with technologies, which embody the accumulated knowledge of their society. So the challenge is to identify common elements from different times and cultures, as well as those that depend on particular circumstances.

This does appear to be problematic, but it is this kind of research that will shed light on the human capability to design, the part it has played in human evolution and the ways in which the changes in human culture have influenced this capability. Graphicacy only reflects one aspect of the human capability to design, but analysing the differences between Fry's and Danos' taxonomies would bring out some of the ways that graphicacy has developed in the last 30 years or so. Of course this would only be a small step, and exploring the relationship between graphicacy and designing is not a straightforward matter either, but all journeys begin with small steps. The important matter is to take a step in the right direction.

EDDIE AND ALISON IN CONVERSATION

Eddie Norman and Alison Hardy

Talking D&T podcast, published on 26 May, 2020

Eddie Norman 0:00

... that sounds a little bit odd, or whatever the design ... the expert panel exactly said. But that was the kind of my starting point. But I can imagine you re redoing the whole of the start of the thing with a much more extensive analysis of the decline of Design and Technology.

Alison Hardy 0:15

Yes ... because I wrote this chapter as I was kind of like in the final stages of finishing off my thesis, I think, it was just like, I had looked and thought this is one of the shortest chapters in that book isn't it?

Eddie Norman 0:25

... and I think your original version, where you focus a little bit on the Expert Panel was really to do with the way I set that book up. It was my starting point, saying this all looks a bit weird in 2011 : this doesn't look quite right or the way I would hope that Design and Technology would be regarded. But it probably isn't the starting point you'd have now. You know this is this is quite a few years down the road isn't it? ... and you'd probably start thinking that there's much more to say about the starting point for all the reasons why you might consider a restart for Design and Technology.

Alison Hardy 1:01

I think a lot of it's to do the conversations we've had around ... we don't talk about what we mean by knowledge in Design and Technology. And the arguments that have been presented by people like Michael Young and Christine Counsell, have come from a particular perspective about knowledge. And that's not to say they're wrong, it's just to say that nobody said, hang on, there's different ways of looking at knowledge in Design and Technology.

Eddie Norman 1:30

I think... I mean that's absolutely right. And I think the the problem with design knowledge is that, certainly within general education, it's never really ... people don't seem to have made real efforts to explain what it is that design knowledge might be. I mean they'll talk about things that can be easily defined from science or from maybe from the humanities, but the things that are more difficult ... maybe understanding visual languages or developing visual languages, or even something like engineering drawing, which I think I focused on when I was trying to

explain this in one of the later podcasts, was it's simply ... it's viewed as a very obvious, straightforward skill, when in fact, it's a much bigger thing than that. And unless people have made explicit the arguments for it and what it actually does, I think you can discard such things from the curriculum without really knowing what you're doing. I mean it's not really valued enough to be held as significant and I think part of that, you know, goes over to people who are designing the curriculum, and kind of creates a fairly poor impression about design knowledge and what it is that you really need to know.

Alison Hardy 2:49

Yes, yeah. And I think the lack of conversation ... the lack of conversation that sounds really critical, is the the debate around why do we do these things in Design and Technology? What are they contributing? What's the point? What are they for? for me tends to focus on justifying it around the vocational element. And I always struggle with that. I mean, it is part of our justification for being, I think, but that diminishes the fact that Design and Technology is an important subject for general education, if we just focus on the vocational. Whereas if we start thinking about design knowledge, it opens it up.

Eddie Norman 3:32

Yes, I think ... thinking about design knowledge and the various forms, the many forms it can take, definitely opens it up. But I think getting away from the vocation argument, I think you've got to think about design in a sort of general education context. Thinking about what the nature of most real world problems is. And as many people have pointed out, from Rittel & Webber back in the 1960s, I think it was ... a long time ago anyway, that most real-world are wicked problems, and they are not well defined. So we're then dealing with a subject in the curriculum, which is one of the few, which is actually enabling children to engage with real-world problems or wicked problems, and actually showing them how they can be approached. And most subjects aren't. There are certainly ... certainly areas like science are, you know, the essence of science is to extract from the real world, so you get a situation which you can model and you can manage and you can define, and then deal with in a more precise way. And a wicked problem, you can't do that. So you have to use other methods, other strategies, and that's what everybody does ... I was gonna say, in most of their lives, most of the time, but obviously designers have developed strategies and approaches, which enable them to engage in those difficult situations and find ways forward. And they're not ... they're not solving problems and people talk about re-solving them or resolving them as being what's really happening. And because time moves on and values change, and all sorts of things happened, you can never really reach a kind of final conclusion. The problem is always there. You

reach a point of temporary satisfaction. 'Satisficing' was the term which I think was used in the UK by the Open University authors years ago ... I think that might have been Nigel Cross. But anyway, I mean, there were a lot of people talking about that kind of idea that we can reach a temporary state of contentment, but we can't reach any kind of final outcome. You know, when I was leading design projects at Loughborough, we had students saying they wanted to do chair design or a similar topic, and they would say, they're worried there isn't enough scope for innovation. It's all been done. You can't say that ... it's not really like that. It's never all been done. There's a whole chair Museum in France, they have thousands of them, where you can go and look at them. And time moves on, things move on, and you can actually bring your approach and your new ideas and it can be an innovative project. It is just a question of how you do it really. I mean, obviously, something like chair design, it can show the difference between craft and design very quickly. Because, you know, you can also make a design which has been beautifully made before and then what you're really doing is craft, you're copying something that's been done before, but it's about the approach, you take. Both are valid, of course and there's nothing, absolutely nothing wrong with craft. It's just if you're engaging with design, you're trying to move things on and trying to do things in a different way. But there's no projects that were off limits in that sense. So if you're kind of getting away from the vocational, you know ... it's not a vocational subject really, it's a subject, which is enabling people to deal with real world issues. And you know, okay, people talk about it being a context for other subjects in the curriculum and for bringing out or providing a context for them, which it does, of course, but that's not the real centre of it. That's just an aspect of dealing with real world problems. I mean, if the problem you're dealing with, happens to engage with some aspects of science, well of course, you course you go there, or with the humanities or with ethics. You know, anything can be part of it. So it's kind of a weird conception of Design and Technology that makes it vocational.

Alison Hardy 7:41

Yes. Well, I think it's, it's an argument you can put to any school subjects, whether it's vocational, and to a certain degree, or a lesser or greater degree. But I've always thought it's just too ... too restricting really, and, and it saying, well, it's a subject for the 'some' and not for the 'many' and in fact, not for the 'all' and going back to what you're saying, I also really like that term, that you and Ken introduced me to that term 'wicked problems' and it being resolution not solution. And we have got to this sort of idea that in Design and Technology, we're teaching children to solve problems, when in actual fact we're teaching them to learn about compromise as well. About well, you know, ideally, I'd like to have material that did this, but this is all I've got available. And really, I'd like

to be able to shape it like this or to have this cost or to have this form or whatever. And, and I have to make some compromises, but I have to decide which of those different factors values and influences takes the greater priority. And that's all I can get as far as at this moment.

Eddie Norman 8:48

But yeah ... and as you're doing that, you're also imagining or or conceiving of things that could happen in the future. If only we could develop this new technology which could do this, this thing I need, then we will be able to do a design that could look like this. I mean ... I think I remember the example of glass roofs on cars was one of the one of the classic problems. Everyone wanted their glass roof to be very domed, and unfortunately, it wasn't very easy to do that. And so, you know, for a lot of time, it ended up flat and then as the technology moved on, and suddenly you could dome it more, and suddenly the designs would get more extensive. But I think drawings of cars with beautifully domed glass roofs had been done years before you could actually do it. And it was ... it was just that you had to compromise to actually produce something at the time. But I mean, I think that that kind of process enables you to visualise, you know, not only what could happen in the future, but the kind of kind of research and development and explorations which might move things on, might take them forward. So I think it if you get away from the kind of, the idea of 'solving', I used to get quite paranoid actually, when I was lecturing or marking essays or something where you find the word solving has been put in and I would always spend my time underlining it in some colour, highlighting it or something. I can't remember what I did, but I'm sure the students could tell you, but it was probably red. Anyway, probably should have been green. But there we are. But anyway, it probably was red. But that's saying that's not what we're about, we're not about solving problems, we're about resolving them. And, as you say, the problem of compromise and balance, and understanding users and their requirements and their values so that you can actually match the decisions that you make with the people you're designing for, which is it and that's an art in itself, which is really to engage with users and to really understand what they want, and then to understand the compromises you've got to make and then say, we'll look ... for you ... or you wouldn't say that to them, perhaps but you would present a range of options which might prove to be the kind of thing they were looking for, and then get some feedback on that and see what they think ... you'll see what people think. That process is, is part of the way that you're ... you're engaging in resolving a wicked problem. But you're not, you're not solving it for all time, or for all people or anything like that. It's not that kind of a subject. And that is the value to children or pupils or students, or even to me actually, it has value to everybody ... is the fact that you

get better at doing that, and actually getting into that process. And other schools ... other subjects in schools, I don't think equip you in the same kind of way to deal with the future and to deal with the, to deal with the creation of new possibilities in the same kind of understanding and intuitive way. You know, if you just engage expecting to solve it, that kind of hard-edged approach ... 'I've done it', you know you really haven't quite got what the task is. You know, and there are very few ... I used to love mathematics when I was at school, and I used to love the fact there was an answer. And you could tick it, you know, and that was great. But that's not what design's about. It's not that kind of a subject. And I think too many people almost get away with presenting it in that kind of a way. I think I used to say to students ... I was First Year Tutor for a long time, 19 or 20 years at Loughborough ... and you'd have students coming in saying, you know, they wanted to know where they've gone wrong and how they could do better, and all these kind of things. They want to exact forms of feedback and after awhile, you say well, yeah, shouldn't you be studying maths? I think you're in the wrong department. That's not the way it is. You know, tutors are going to do the best they can to explain, from their perspective, from their value point, how they would have suggested you approach the thing differently. And even worse, if you go and ask another tutor for a second opinion, you know, inevitably, you're going to get a second opinion which is different, because that's the nature ... they've got different values, they're different people ... you know. If you want something precise then don't study design.

Alison Hardy 13:17

No. I mean, it's about dealing with ambiguity.

Eddie Norman 13:21

Absolutely.

Alison Hardy 13:22

And I remember on the undergraduate course at Nottingham Trent when students were doing their final projects, and the students used to do their final projects at the end of year two with us before they went on to do the teacher education year, and and you know, they'd have access to the three or four of us and would have one main tutor and we'd say, well why don't you go and talk to Jamie because Jamie really knows about this, or Sarah ... because when they come back and they go, but you all give me different answers ... yeah? ... and?

Eddie Norman 13:50

Of course

Alison Hardy 13:51

And you know, this is part of the way you've got to make a judgement. And I think maybe in schools ... and I'm thinking back, I mean, to the conversations, we've had ... because you've maybe look back at when I was teaching thinking, yeah, I kept on the solve it and fix it and get the children to an endpoint, because I got so hung up on them having something to take home or, or being ready for their examinations, that they had to have this thing that was finished, rather than me understanding the underpinning idea around ... this is ambiguous, this is about compromise. This is about a resolution and that's okay. And actually, part of what I'm doing in my role is to help the children deal with that. And manage that.

Eddie Norman 14:34

I think the problem that the teachers ... I'm sure you would have had and teachers will have now ... is the assessment process isn't it, which drives you down some of those routes where you've got to take away some of the ambiguity, and almost the joy of dealing with ambiguity which the children can have, or the students can have. We know that there aren't any answers so you know, they know that the tutors when they're coming to give them a grade are looking at it from different perspectives. But it may be ... I think Loughborough students, in the end, really enjoyed that, you know, that they were actually engaging with an area of uncertainty. They themselves knew that they could go in a variety of directions, they'd get a variety of feedbacks, that was all all normal, and you know ... that's part of it, but I think the assessment systems they try to use in general education, I think kind of draw you into trying to be much more exact and precise about what somebody has achieved, and what exactly they have to do to improve. Which is kind of odd, you know, because, yeah, and I think you used to read them ... there were kind of these ... I think it was the very first version of the National Curriculum I think I read which had 10 levels, I think it had a large number of levels. And they were desperate attempts to define what the difference was between say Level 3 and Level 4 and then, when you look at the wording and you're thinking ... Well, I'm not sure I can tell the difference between that set of words and that set of words, and what it might mean, and how it meant anything to children, I've no idea. I mean, teachers obviously have to deal with this stuff. And so I think there are problems which the education system is kind of loading on to design, which is taking away from it a lot of the potential joy and a lot of its potential value that the children can have if they were really allowed to engage with, with wicked problems, with real world problems, and not be burdened with the idea that there are 'answers', there are 'methods' and they can do it in the right way or the wrong way.

Alison Hardy 16:42

Yes. I suppose to some degree, there is stuff that we do in Design and Technology that we teach in the classroom, that there is the right way and the wrong way ... we were talking about engineering drawing for example. Or we might talk about the way we threaded the sewing machine and use the sewing machine and join two pieces of MDF, for example in a temporary fashion. There are those rights and wrongs. But we're making decisions about when to use those and when not to use those as part of leading to this resolution. And I do think the new GCSE in England has attempted to redress some of that issue, about having a finished product, by talking about a high quality prototype, By using that language, and again, the words high quality ... can get ... very, different people have different perspectives on what those two words mean.

Eddie Norman 17:34

Absolutely, yeah. And you can get drawn into all sorts of ideas about what a high quality prototype is. And I remember going to... I think it was a seminar from a visiting ... someone from New Zealand was talking about prototyping and fidelity of prototypes and the exactness of the prototype and how exact it had to be. And yeah ... it had to be exact enough, obviously, to get you the feedback that you needed. So in a sense, a high quality prototype is one that's good enough to actually get you the feedback that's required in order to move to the next stage. If you do something of higher fidelity than that ... better made, actually you're wasting your time, because you know, you're not really ... so if what you need to enable somebody to understand a set of drawings is a cardboard model, which is full size, so they can walk through it, and that's what they need, and some people have quite difficulty in interpreting architectural and engineering drawings, because they're not used to it, so ... but if you build a cardboard model, you know, 1:1, then people can walk in it, they can mark it out on the floor and all this. If that's what you need, then you don't need to spend a lot of time doing a virtual walkthrough in CAD, so that people can actually you know, experience the whole thing. You could do it ... same result ... but you'd have spent an awful lot of time creating something that didn't have any value so you'd have to question what then people really meant by high quality. High quality in what sense? Are they getting ... are they getting hooked back on craft? You know, is that what they're talking about? Or are they talking about understanding design, which is about doing something which is appropriate and fit for purpose? And that's that's what, that's what we're after.

Alison Hardy 19:17

And maybe we don't have those sorts of conversations. I mean, ... we're talking, I'm imagining teachers listening to this and thinking, Well, you

know, that's okay to say you need to have those sorts of conversations. But I think there are times and places that you can have those sorts of conversations, so that when a child comes to an independent project, they can say ... is this appropriate for the context? for the real world situation that I'm designing for? So if they were designing a one off item for a single person, you might well expect something to be almost fully formed and will not be a model in a cardboard sense. But if you are designing something that is a new way of approaching, for example, the entrance to a building ... then it will be much more, let's use the language 'rough and ready' ...but there'll be a much ... different type of thinking and exploring some stuff that's quite conceptual and abstract ... and also trying to project, as you say, what it might be like in the future.

Eddie Norman 20:19

Yeah, I mean, I think the important thing is that the student or the designer can articulate why they're doing that, you know, and they can say why they've done it that way. I mean, if you've got ...I think that I suppose ... when we were assessing Loughborough students, they'd all been taught a lot of design skills and knowledge in modules. So we kind of assess that somewhere else You know, we kind of knew that they could do engineering drawing; we knew that they could do multiple forms of graphic modelling, because they'd all been taught that in Drawing for Designers and the same with CAD and 3D modelling, so we weren't in Design Practice ... you were not really assessing that in the same kind of way. What you're assessing at that point, is whether from this sort of vast armoury of techniques that people have had potentially available to them, whether they'd actually selected wisely and judiciously to achieve what they needed to achieve. I mean, that's what you were looking at, because you can't really ... you're not really saying to the student, you know, I'm testing your sketching again, because you're not really. This is design practice. It's different... and I think there's a kind of confusion, and part of the problem with not acknowledging design knowledge, and not actually recognising that certain things can be known and rehearsed and fully ... sort of embedded in your subconscious. If, you know ... Once you've gone through that, and you say, OK, well there are things like that and we can assess those somewhere else. you don't kind of need to then dwell on that when you're actually assessing design. And I think the two things get a little bit potentially confused. As if, you know, when you're doing your designing you've got to kind of use all of your design skills and knowledge all to maximum potential or something, then, when it might not be appropriate to do so. You know, you don't necessarily need the most, you know, perfect CAD model, even if you can produce one and we know you can produce one ... it just might have no point in that particular context at that time.

Alison Hardy 22:22

And it's back to that whole idea ... and you and I have talked often about this ... about 'the design process', 'a design process'. Is there even a process? Can we define a process?

Eddie Norman 22:33

Yeah, exactly ... so I don't think anyone at Loughborough University taught 'a' design process or 'the' design process. And I had the rare privilege of taking Design Contexts ... I mean, it was a rare privilege ... and I'd meet all the students in the first year and the the task was to try and get them to understand wicked problems. That was the first thing, because it affected their attitudes to assessment; it affected their attitudes to the design process, which I had to convince them didn't actually exist. It wasn't really there, and we had to try and understand why, you know, it wasn't there. So, you know, if you go and see a tutor, and you say, I've done this, what do I do next? You know, there's no simple answer to that question. You know, there isn't a process of that kind that you can tell people. People can talk about the way they would undertake a task. And of course, we were surrounded by professional designers who would come in as tutors on projects, and they would talk about how ... what they might do to set about it, but they're not talking about a design process. They're talking about what they would do, you know, next but if you talk to another tutor, you might well find that they'd say, well, maybe I'd do this next. And if you add it all together, you've got, you know, a mass ... most of the ... probably most of the wisdom of the of the design world there somewhere being offered to you. Now you're still gonna have to pick what you're going to actually do, but there isn't a kind of simple thing, like ... I used to teach mathematics when I was teaching in schools, and that was great because you could tell people exactly what to do next to solve a quadratic equation or something. Again, wrong subject, if you want it to be that simple. It's not, it's not that simple. It's that, you know, there are various ways of going about it. And, you know, if you talk to experienced designers in a particular design area, they'll have their own strategies. They're very, very effective, very fast at getting the outcomes they want. And it's partly to do with their kind of having worked in that area before. They get used to sort of strategies which cut down the solution space. So there's whole masses of solutions out there, you know, that they just don't think about, because they've managed to engage in a task or explore a user's requirements in such a way that there are kind of whole areas of the design, you know, the potential design directions that are simply not pursued. And that kind of expertise is hard to reach. I used to like try and join the analogy with a chess game. it was just the sort of thing you, you don't find chess players or grandmasters ... they don't think about each step, you know, each move. They're thinking about broad strategies, you know, to achieve things. And they ... I remember watching

a series of televised quick matches where they got the Grandmaster sort of making moves very fast, and they were just describing what they were doing very broad visual terms. They weren't describing it ... they didn't do what a computer does. They didn't analyse the first move and then think through the next five moves or the several billion possibilities there are. Nothing like that. They were just actually saying, you know, the way I'm going to approach this game is to put pressure on the centre or they want to open up and get more pieces so that towards the left ... these kind of broad terms descriptions. And that's kind of what design is more like, it's more like, you know, the general ... people, will talk in terms of general strategies, ways of approaching it, rather than very precise, little ... little steps, you know, which is not the way really. And I think again, you know, I think it's inspiring for students to be talking to professional designers and to be given insights into the way they approach it. I think in a way it's a bit debilitating and a bit demotivating to be told, here's a series of steps, you've got to go through one after the other, do this, do that, do that. I think that's kind of joyless. You know, I don't think that's what it's about. It takes away the excitement and some of the things ... maybe you know, those kind of ideas are sort of, are kind of what undermines the subject, you know. It doesn't give the kids the excitement and the opportunities that it could?

Alison Hardy 26:58

Yeah, so I'm going to defend a little bit what happens. It's back to the conversation we were having earlier ... there's this constant tension isn't there, that teachers are having to present and show what the children are learning and what they're doing and how they're progressing? And so doing that ... steps ... makes it in some ways more straightforward. But I think that's where we're coming from and having these conversations. That's why I really like having these conversations with you, because it's made me think, actually, yeah, there's something that I've got to remember as a Design and Technology person ... underneath all of that there are times when I'm teaching ... when I was teaching in schools that I had to go through those small steps to be able to help the children have that way of looking at it so as to give them another way of looking at it, so that as they grew in their design and technology capability, that they then became more confident to make their own judgments about ... ah, well, she's taught me how to do that in Year 7, and then she taught me how to do that in Year 8 and here in Year 9 ... she's still with us, but I can decide which one of those is right for this context, that's what I'm striving for.

Eddie Norman 28:06

That sounds absolutely great. And I think that's the key. Once you get to kind of a more balanced view of design knowledge, you can be comfortable

because those, those you can teach. You know, you can say look, I've got to teach you about this particular technique. And we can explore it to, you know, to see who can do the best 3D rendering or whatever it is, you know ... we can do that, or whatever other technique it is. Whether it's an aspect of user-centred design or co-designing where you're kind of learning to sketch to enable somebody who can't sketch to express their views, you know, these things can all be taught. They are all skills that can be developed. But that's not the same as designing, you know, and I think if you had a more balanced view of design knowledge, then teachers could comfortably teach and assess design knowledge. And I think many of the things that you're talking about, you know, bringing on Year 7 and bringing on Year 8 and bringing on Year 9, so they've got more skills and knowledge available to them to bring to bear. But then when you get to actually designing, I think that's when that's when the tricky part starts, you know, because at that stage it's a different game now. It's kind of ...

Alison Hardy 29:17

But the problem ... I think also the other problem becomes is when we think we've got to do all of those things, we've got to have taught all of those things before the children can be able ... are able to solve ... 'solve' oh there you go ... resolve a wicked problem. And actually that's ... that's not true, because they're faced with wicked problems day in, day out, outside of the classroom. And they're coming to a resolution. They're weighing the pros and cons of, you know, that pair of jeans compared to that pair of trousers or that pair of trousers or that pair of shorts. They're having to kind of weigh up the pros and cons. So, we're actually doing them a disservice by saying, well, they can't do a full... what we'll call a 'design and make project' until the end of Year 9 when they've learned how to do all these things, and they've practised these things. And, you know, they've been graded on those things. And ... but actually what we need to be doing is giving them differences of complexities ... I'm now seeing complexities of problems. As I think they do get complex problems, particularly in primary, where they're not inhibited so much by having to make, because the schools don't have that facility to make. And so the children's creativity and ability to weigh up the pros and cons and to think of a resolution is almost more free, than maybe what we end up doing in secondary school. But that's because we're narrowing down to this final assessment at the end on which we as teachers are judged. That's the other tension isn't it?

Eddie Norman 30:45

That's why the whole thing needs looking at, you know ... the teachers are within a system. But in terms of you know, a sophistication of young people I've been ... perhaps it's a generation thing, perhaps it's me ... but I find mobile phones quite complex, you know, in terms of some of the

definitions of memory and capability and cameras, and all the rest of it. I mean when children are deciding to actually ... which phone they would like, which ... they are very well able to balance a vast number of quite complex criteria of things that a phone is able to do or not do. And I remember seeing this on several occasions when their discussion was almost at a level more sophisticated than I could cope with in terms of buying a phone. OK, they're not designing it, but they work at that purchasing decision ... it was complex, and they would they were well able ... these youngsters were about say, probably Year 9, I should think something like that ... you know very able to deal with that kind of complexity and without any difficulty. And so I think some of the problems that they're actually presented with in say Design and Technology can be conceptually seemingly a lot more straightforward than some of those quite complex problems that they're actually dealing with, in real life, before they ever come into the classroom. You know, they're dealing with complex trade offs and balances and working out strategies for reaching decisions in complex situations all the time anyway. So it's kind of, you know, it's what the subject adds or the opportunities it adds, that needs to be looked at. And design as a ... well, obviously experienced designers of any product could demonstrate the kind of methods that their experience and professionalism can bring to those kind of areas. Because when you take any design area, it's extraordinarily complex, and being able to actually find your way through that complex field and into a place where we can achieve some kind of temporary satisfaction for a user, that's difficult. But you know, there's thousands of professional designers out there who can demonstrate what the difference is between a professional designer and somebody who does it all the time in their ordinary life, but they're doing the same thing. What's going on is not dramatically different. It's just that, you know, the professional designers have learned a lot about how to take that problem on.

Alison Hardy 33:23

So I think I'm going to ask you a question in a moment and I'm going to give you a heads up about my question. We keep using this phrase design knowledge? So I'm going to ask you in a moment, can you explain a little bit more about what you think that is? And how you see that? And while you're thinking about that, I'm going to think about some stuff going back to the beginning about Christine Counsell. She talks about substantive knowledge within a subject and disciplinary knowledge. So the substantive knowledge is the content that teachers teach as established fact. I've taken it as a quote from one of her papers. Whether by common convention concepts or an account of reality, and so for us, I suppose in Design and Technology we might say some of that's around materials knowledge, and about process knowledge, and about craft knowledge, and communication knowledge, but also about different ways of being

creative and different ways of viewing a problem ... and those are kind of substantive knowledge. But she says that disciplinary knowledge is about how the knowledge within that discipline was established, which is what you're talking about. It's design knowledge, I presume, really, and how it continues to be revised and developed by scholars, artists, professional practice, and it kind of touched on a lot of these things. So I suppose my question is, so if the disciplinary knowledge within Design and Technology is design knowledge, what is it? What is it like?

Eddie Norman 34:56

I think yeah ... I think you may, you may have asked a similar question a little while ago ... I'm not quite sure if it's the same, but anyway ... I think I remember recording the second podcast here with an attempt to actually answer that question where I was looking at engineering drawing, as an example of design knowledge. It was something that you could master independently of designing, you could become expert, you could assess it, you could be ... you can pass all your tests. But what it actually enables you to do is things like plan production, to alter entire designs on paper without any cost. It enables you to explore the possibilities of making things remotely in different countries or on site. I think it was J. Chris Jones who referred to it as enhancing the perceptual span. It enabled designers to do vastly more than they could before that Now, I think we then went on to ... I think I mentioned Mark Evans' work at Loughborough, who actually went on to explore with Eugene Pei, who did a PhD there, and they were looking at modelling techniques and they went on to explore 16 I think, 2D ones and 16 3D ones or they they may have been the ones they published. I think they may have been more actually in the original PhD, but they they were modelling techniques, which industrial designers employ. That was just industrial designers. So, if you went outside that design area, there probably will be more. Now those can all be mastered and they all enhanced the perceptual span. So a designer who has mastered these is able to imagine, to manipulate, to create in a in a broader way.

So there is that whole area of modelling techniques, which I could use as an answer. But there's other directions that you know an answer could go as well. And I think this is a later podcast as well ... are there different ways of knowing? Because if you think about ... I was lucky enough to work with someone called Rob Armstrong, who is a wonderful guitar maker who has made about 800 and something guitars now ... all different, for George Harrison and you know, Fairport Convention, all sorts of people, but they're all different. But if you ask him a question, he can't really articulate an answer. He can't give you an answer saying, what you have to do is this. But he can tell you what to do. And in my mind, this is simply because inside his head, he's got so many connections, connected

together, you know, between so many nodes in his mind between playing styles and sounds and scale lengths and timbers, that if you got a certain ... if you want to play a certain style on certain instrument, this is the kind of thing you need to do? Now that's basically just his brain has been hardwired. It's just absorbed this through ... decades of work. And you know, and I kind of identify apprenticeship style learning as being much more like that where people kind of learn things through ... I think it was called purposive pattern recognition by somebody. I think ... anyway there are patterns in the mind, you know, actually saying, well, these things are connected. When you see a certain set of circumstances, they light up and you say, okay, that's what I've got to do. You can't say why and it annoys people. It's a bit like neural networks in artificial intelligence, where you can kind of ... you can get a computer to do exactly what a human can do, but if you then ask it, how does that work?... It can't tell you, so you can never validate it in that sense, but you so there's that other form of knowing as well that ... it's is not just articulated knowledge. I might say engineering drawing is articulated knowledge, but there's more than that. There's another ... other forms of knowledge which are which are not articulated. And there's other ... if I take a third line of approach in terms of answering it you know, there's a kind of ... we might say there's also the visual as well. Because I'm sure Ken Baynes who, you know, if he was here would be saying you ought to be talking about visual languages, because people can develop visual languages. They can learn how to design a 'happy kettle' or they can learn how to make create something that looks like Art Nouveau or an Art Deco style, or they can learn the design language between a car brand I better not mention any, I suppose, but anyway ...

Alison Hardy 39:45
... we're not sponsored.

Eddie Norman 39:47
... we're not sponsored. But you know, you can learn what makes a particular car look like a car and if you look at them on the road, you can see it looks like a certain brand before you get anywhere near it. Now that kind of being able to understand visual languages is again, it's ... almost articulated in the sense that you can show people on a on a kind of mood board or something, you can say this is the style of ... and people can see it if they can see it. But you can't articulate it in sense of writing it down. And it was always one of the big problems between the marketing department and the design department in companies where you know, who owns the kind of design language for that brand. Because you know, the marketing people would all want to write it down in language, and all of the design people are saying that's all very well, you can't really do that, it's here in this mood board, but you can't really articulate that. So

there's a kind of ... there's another set of language which I might say you can learn ... visual languages ... by engaging with them and designing with them, which would be a third way of knowing. So at least there's there's articulated knowledge which might or might not prove useful, and there's our knowledge which we are yet to articulate, and we might struggle to articulate, that people have just accumulated through practice, really? And there's this ... there's things like visual language. Now, I would say, those are some of the kinds of things that we ought to be able to say are design knowledge. But there's probably more, you know, and and probably someone listening to this would say, yes, so that's a start, but, yeah, there's probably more to say, but you know, I think, you know, it's not that hard to begin to define the kind of underpinning disciplinary knowledge in design. And it's not going around the rest of the curriculum and grabbing bits from there. That's not what it is. You know, you might be in a design situation and you might well, you know, be analysing a component and choose to use stress analysis, which belongs in the engineering science discipline or something like that. That's fine, but we're not claiming engineering science as being you know, necessarily, part of that design knowledge. That's not what it is. The engineering science belongs happily in engineering science ... that's where it belongs. But it might well ... we might well use that, but but we don't have to, I think define design knowledge with reference to those things, I don't think that's necessary. Yeah ...so that's how ...

Alison Hardy 42:12

OK ... that sounds ... so that's kind of slightly blown my head off, and left me with plenty to think about and as you say, you know, going back to those challenges ... what people are talking about about disciplinary knowledge, and what's substantive, some of those things kind of link into substantive knowledge and then the disciplinary is about how do we ... how do we think and how do we make claims in Design and Technology about what is valid? and what what is evidence? it's around back to where we started in this conversation, I think ... around children understanding that there is only a resolution to a real life problem or context, there is not a solution. And what they are being called upon to do is to work out the compromises, the value judgments, the use of the substantive knowledge to come to that resolution, that is only fixed for that moment in time. And I would say that, for me is our discipline, is what we're doing.

Eddie Norman 43:17

Yeah, absolutely. And it's, that's the excitement, they're expressing themselves. They're engaging with this task and they're producing their answer their ... their approach, their strategy. You know, it's not ... it's not anybody else's is it? And I think once they come to realise that ... that,

you know, designers are expressing themselves and their personality, that makes it exciting. And I think if you if you go too far down the prescriptions or prescribed routes you're taking, you're taking that away. You know, you can't ... you're not ... it's no longer theirs. They're trying to achieve, what is somebody else's vision of designing, not theirs, not their vision of designing. It's not their product. It's kind of ... it's somebody else's process. Yeah, so ...

Alison Hardy 44:02
... there we go.

Eddie Norman 44:04
There you go.

5. OTHER THOUGHTS, QUESTIONS AND RESPONSES

AUTHOR PROFILES

Alison Hardy

Alison Hardy is a senior lecturer at the Nottingham Institute of Education, part of Nottingham Trent University (NTU). She has been involved in design and technology education since 1993, as a teacher, head of department, mentor for student teachers and teacher educator. Since joining has NTU she has been an External Examiner for undergraduate and postgraduate programmes. She also worked in further education where she was responsible for curriculum development and as an overseas lecturer at the University of West Bohemia in the Czech Republic. Currently completing her PhD, *The value of a school subject: Investigating the values attributed to design and technology by different stakeholders*, Alison has spent time exploring the influences and origins of the values we attribute to D&T. She is also a Trustee for the Design and Technology Association and in 2015 she was recognised by the Association for her outstanding contribution to D&T.

alison.hardy@ntu.ac.uk

Eddie Norman

Eddie Norman is Emeritus Professor of Design Education at Loughborough Design School (LDS), UK. His research concerns the relationship of technologies and designing in relation to general and higher education, and associated pedagogical issues. He was leader of the Design Education Research Group, published widely and supervised 7 PhD students. He contributed to teaching at LDS on undergraduate and masters design programmes. He has been an External Examiner for undergraduate and masters programmes and PhD research submissions (eg Bath Spa, Brunel, Goldsmiths, NIE Singapore and the University of Limerick). He was Editor of *Design and Technology Education: an international journal* from 2005-2015 and has recently founded the specialist publisher Loughborough Design Press Ltd with Ken Baynes. Prior to joining LDS he had careers both in secondary education and as a professional engineer.

eddie@ldpress.co.uk

David Spendlove

David Spendlove is Professor of Education at the University of Manchester and is a member of numerous local, national and international strategic boards and is a member of two international editorial boards. He has an extensive list of publications and has presented at a large number of national and international conferences on a range of subjects.

David's research interests are diverse but are primarily located around curriculum, pedagogy and teacher development. In 2013 he received an 'Outstanding Contribution Award' from the Design and Technology Association, their highest accolade, and he is currently head of initial teacher education overseeing a number of high quality programmes providing different routes into teaching.

Most recently David has worked with colleagues at Kings College and other universities developing Teacher Development 3.0, examining how we create a sustainable high quality teaching culture. He is also currently researching teacher stress, design thinking and the context and unique contribution of universities to teacher development.

david.spendlove@manchester.ac.uk