Digital work practices: affordances in design education

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Abstract:
This article draws from a multi-disciplinary, multi-institutional research project on digital work practices and graduate work readiness. Utilising the concept of technology affordances, we focus on the potential for domain-specific learning experiences within design education. For the purpose of this project, we have articulated digital capabilities in design by adapting affordance categories in terms of three levels of complexity for scaffolded learning: functional, perceptual and adaptive. In order to further develop the relationship between technology affordances and design education, we analyse data from an industry roundtable in relation to our developed digital capability descriptor. The findings suggest that employers need designers with highly adaptive capabilities to work in increasingly complex interdisciplinary work environments. We also found that the role of designers has changed significantly in recent years that require higher educational institutions to involve industry when developing curricula.
Keywords: affordance, employment, design education, digital capabilities, interdisciplinary design

1. Introduction

This article has been developed within a national project to prototype a digital work

practices learning model for a range of disciplines. In terms of digital capabilities, there is a

gap between what industry wants from graduates and what students are taught at universities

(Fray *et al*. 2017; Hajkowicz *et al.* 2016; Peterson 2015). This article works inside this gap,

focusing on the relationship between design education and the creative industries in Sydney,

Australia.

Identifying which software packages are industry standard, for instance, is a concern for

some academics developing curricula (see, for example, Underwood *et al*. 2015). However,

broader discussions about the ways in which digital capabilities are linked to the affordances

of technology are the priority of this research. The intention is to encourage support for

students to develop functional, perceptual and adaptive digital capabilities, which are related directly to technology affordances at these three levels, in the context of current but also future technology requirements in industry. We use affordance theory (Best 2009; Evans *et al.* 2017) as a framework to interpret industry concerns about the digital capabilities of graduates and to explore the potential for improved learning experiences within design education. We also draw on the subject-artifact framework offered by Davis and Chouinard (2016), which addresses '*how* artifacts afford, *for whom* and *under what circumstances*' (emphasis in original, 241) to analyse the relationships of design professions and design education to digital technologies.

Utilising an affordance scaffold, we analyse the responses from a design industry roundtable conducted in Sydney in 2017 to understand how technologies and digital capabilities operate in industry. The aim was also to better understand how people learn to be designers amid a quickly changing material and cultural landscape. This article extends on perspectives and debates raised in this journal (Adams *et al.* 2013), finding space in the gap between academic training and practitioner expectations contributing to the discourse of curricula development in Australian universities.

While this research is concerned with the relationship of curricula and teaching in universities and the perspectives of industry, we also acknowledge the important learning that needs to be done within creative industries themselves about the affordance of technologies and how these are shaping lifestyles, culture and politics. Furthermore, paradoxically, the nature of many of the jobs in the creative industries, which is at the same time precarious and perpetual, informs the relationship between designers and the digital technologies they use. In this sense, while the type of employment is over casualised, it

produces expectations of perpetual engagement with the work in its practical, social, intellectual and affective dimensions (Friedman 2012; Gregg 2011; Ross 2010). While universities are beginning to understand this paradox in Australia and to address it in undergraduate curricula, they are yet to implement significant changes to the ways digital capabilities are taught over people's working lives, beyond the course of a degree (Cawood *et al*. 2018).

Design, as a discipline, covers a wide spectrum of commercial and artistic endeavours. While academics may be committed to the university as an institution that ought to deliver broader social good, they can be divided on the means or mechanisms by which those benefits are delivered in an educational and research context. In this regard, the question of the university's relationship with industry can be divisive in design education: should universities be serving society in a way that makes use of the affordances of a public institution and run against the grain of the commercial sector? Or should universities mediate between the changing needs of students and their likely future employers? The friction in strategic decision-making contexts within design education is often a product of how academics conceive of themselves in relation to these questions. Design education, and the expectations of educators is commensurably broad ranging in the sense. In alignment with the funded research project, this article focuses on data collected from a commercial industry roundtable. As our roundtable participants were engaged from commercial and media organisations, there was also a strong focus on new and emerging digital technologies and 'disruption' as a positive force for industry and organisational innovation (Christensen, Raynor & McDonald 2015). This may not be reflective of a broader consensus in tertiary design education at a global or local level.

This article integrates discussions of technology affordances, employability and design education in five sections. Following the introduction, Section Two provides a background to the research project including the methods used. It also introduces working definitions of key concepts, namely affordance and digital capability, making space to mediate between academic curricula and industry perspectives. Section Three includes data from the industry roundtable by organising it into four themes. Section Four synthesises the roundtable data around the digital capabilities descriptor created for use by educators in developing curricula and the need to consider the role that context plays in teaching digital capabilities. In Section Five we conclude with areas for further research, and make recommendations for the integration of industry perspectives in developing curricula.

2. Scope and methodology

Background to project

The research described here was part of the 'Digital Work Practices' action research project funded by the Australian Technology Network of Universities. 'Digital Work Practices' was a collaboration between the Royal Melbourne Institute of Technology (RMIT), Queensland University of Technology (QUT) and the University of Technology Sydney (UTS), to better prepare graduates for disrupted work futures in Creative Arts, Communications, Business and Management, Engineering and potentially other disciplines. For the purposes of this project, digital capabilities include the knowledge, skills and attributes required for a user to interact productively with existing and emerging technology.

Affordance Theory and Digital capabilities: a design education approach

In affordance theory, a technology is defined 'in terms of the uses, interactions and possibilities that the technology affords to its users' (Fray *et al*. 2017, 4). In developing a

strategy for articulating digital capabilities in design, we build on a framework developed during the foundational stages of this multifaceted project:

Functional – affordances/capabilities relating to the operation of a technology, including naming, knowing and operating the features of a technology to perform tasks.

Perceptual – affordances/capabilities relating to interpretation and being discerning about technology tools and practices for their suitability and in-context operation for outcomes in known contexts.

Adaptive – affordances/capabilities relating to imagining, adapting and extending technology use in previously unexplored and emerging contexts for innovative outcomes; this requires functional knowledge/skills and perceptual experience.

(Source: adapted from Best 2009; Evans *et al*. 2017; Fray *et al*. 2017; Peterson 2018)

Listed in Table 1, we describe the adaptive capabilities of four practice domains shaped around design graduates. The domains proposed are: persuasion; collaboration; complexity and systems; tools and making. Their descriptions are by no means complete, but are used to prompt conversations about digital capabilities specific to design education and practice.

Table 1. Digital Capabilities Descriptor for Design

1: Persuasion

Adaptive capabilities

Storytelling:
Tell the right stories to the right audiences; bring histories and futures into stories about the present; use complex language to tell stories in multisensory ways; translate and adapt transmedia storytelling; make worlds and ecologies of stories; shape futures using stories of future scenarios; work with generative systems, AI and machine learning to tell stories, developing new tools and platforms (or new uses) to tell and disseminate stories.

Presentation:
Synthesise the tonal needs of different contexts and show how different exchanges matter in the context of a bigger picture (e.g. pitching a part of a bigger project); present experience to audiences, and explore multiple potential outcomes (using clickable prototypes or virtual reality).

2: Collaboration

Adaptive capabilities

Project management:
Define and develop relationships, taking account of cross-cultural dynamics, professional and disciplinary differences, socio/economic and political context of project; combine different tools in response to the collaboration; determine when text or audio visual communication is appropriate and productive (telepresence); create new types of projects and new types of project management (try projects in different contexts with different combinations of people); assemble project fragments and iterations; self-initiate projects; work out new forms of design collaboration rather than follow a set methodology; acknowledge the impact of design work (accountability).

Working with different specialists:
Advocate for design within productions; communicate the big picture; integrate different disciplinary knowledge and communication styles for better outcomes; connect your team to relevant expert knowledge in response to design iterations (e.g. using online platforms); create cohesion from diversity; expand the scope of design collaborations (e.g. Indigenous designers in Australia); learn to collaborate with machines and data (machine learning, artificial intelligence).

3: Complexity & Systems

Adaptive capabilities

Making sense:
Generate new insights; link user interfaces with data; bring unconventional data sets into contact; facilitate interaction within the system; use predictive analytics; translate quantitative data to stories in new ways.

Rich pictures:
Make a rich picture that has impact; articulate impact in diverse ways and new contexts.

Business empathy (digital context):
Advocate for design led business strategy; see and pursue possibilities; adapt design for business imperatives in relation to broader social, political and cultural imperatives.

4: Tools & Making

Adaptive capabilities

Using software:
Respond to life spans of digital files/tools; anticipate future tools; hack; adapt software to alternative uses; open closed files, tools and systems; scrape data; repair tools and files.

Source: Adapted from Peterson 2018.

As Fray *et al*. (2017, 6) explain, the affordance scaffold posits that:

> … functional affordances are easier for a user to master than perceptual affordances, which in turn are easier to master than contextual affordances. Furthermore, the mastery of these three types of affordance places a user in full *control* of a technology. Control enables the user to innovate with that technology – that is, to imagine new uses of known features in new contexts.

Drawing on the concept of affordances-in-practice (Costa 2018), we have approached digital capabilities in design education with a consideration of design practice, rather than with an attachment to teaching specific tools that may have different uses to those intended by their creators, and that may become obsolete over the duration of a student's degree program. Our aim is to shift the focus from analysing the architecture and features of specific technologies and towards 'practices of usage within situated environments' (Costa 2018, 3). As there was not project scope to explore all the possible employment contexts of graduates, this article deals with the situated environments of design workplaces in Sydney.

Methods

As participant researchers working in a transdisciplinary team, we used affordance theory and developmental learning as a foundation to develop Digital Capabilities Descriptors for the fields of Journalism, Design, Music Industry and Engineering based on literature and data collection (for extended project information, see https://sites.rmit.edu.au/digitalworkpractices/). These Descriptors were tested and refined over three stages of data collection and analysis: an educator survey; five industry roundtables; and two teaching interventions. Although we use the Descriptors here to frame the research, they should also be considered 'live' and continuously under (re-)construction.

This article focuses particularly on a design industry roundtable held in August 2017 at UTS. Participants were identified through existing institutional partnerships and invited via email. There were nine participants, all with more than five years of experience in industry. The participants provided written and then verbal responses to a series of questions relating to digital capabilities and graduate employment. Discussion was audio recorded and transcribed, then analysed to identify key themes. Quotations from participants refer to the city and discipline, for this roundtable 'Sydney' and 'Design' ('SD') and participant number.

3. Industry Roundtable

The design industry roundtable gathered design experts from private practice, media, finance and private consulting practices. Their roles include practice leader, technology editor, independent designer, experience designer, service designer and design strategist.

When asked open questions about digital capabilities, participants were most interested in talking about graduate attributes that pertained to qualities of adaptive affordances. Conversation also circled around the relationships of employees with technologies rather than the technologies themselves. This section collects the responses of the roundtable thematically. The roundtable data was initially analysed through targeted keyword searches and secondly by interpretive analysis organised around the four domains of digital capabilities in Table 1:

1. Persuasion

2. Collaboration

3. Complexity and Systems

4. Tools and Making

Persuasion

Among the discussants, there was a clear consensus on the need for designers to have not only digital literacy and tools to solve problems, with empathy and sensibility to interpret complex contextual issues, but also to have communication skills to translate issues and solutions across their organisation. While persuasion overlaps with a transdisciplinary set of capabilities related to communication, it also recognises the inherent rhetorical value embedded in a design and the necessity of communicating its story to a variety of audiences through a variety of techniques. Designers embedded in organisations need to choose and use appropriate media, technology and tone to persuade effectively across the organisation.

Given the complex roles designers have on project teams, nuanced approaches that speak within the organisation and advocate for design within projects were identified as an important capability. As Bridgstock (2013) points out, the ways that artists and designers are employed outside the creative industries, for example in health or banking, demand 'distinctive skill and professional capability requirements' (178).

Roundtable participants talked about designers having to 'drive' the process, and to have 'literacy' and the right 'language', even if they are managing their own careers in a range of employment settings. This was particularly relevant, given that the student cohort at UTS is diverse and graduates work under a range of employment conditions all over the world.

> *I think it's another disconnect between the outcome being the customer*
> *experience and very specialised technical folks that don't necessarily have the*
> *business understanding or business language to drive it the way that the*
> *business needs to or the customers want to.* -SD6

Another respondent concurred with this need for sensibility that is distinct from skills:

I think there's some kind of distinction that you can draw between skills and sensibilities …. It's not the same thing as skills necessarily and I think we still need to emphasise skills. Or the ability to gain skills rapidly or to actually execute. –SD7

While designers have the capacity—if not always the agency—to shift the mindset of management to adapt to these rapidly evolving digital environments:

Is it the product or the channel or a service? There's all these arguments about which one it is. It's all of them, it doesn't really matter. That's not the point. Yet, people still hang onto old school product management style of managing revenue streams and that sits around that product. Just it's mind boggling that business hasn't figured that out. –SD6

Collaboration

In addition to emphasising persuasive communication as part of required digital capabilities, participants suggested that collaboration was an important digital capability. The need for designers to work effectively in teams with diverse skill sets, learning needs and communication styles is well documented. As Poggenpohl (2015, 46) reminds us '[m]embers of high performance teams in collaborative settings learn from each other and this continuous learning is a competitive advantage.' Effective collaboration involves being aware of this diversity and knowing how to operate within a team, both in terms of personal involvement and how others are working. This suggests that design education should be

embedded in dynamic situations, in which students can develop their ability to adapt to changing socio-technical environments. This experience would support students' broader development as designers.

Roundtable participants drew on very broad concepts of collaboration, emphasising the importance of networks outside the project team or workplace. They pointed out that the future of these networks will require digital tools and capabilities of increasing complexity to create and maintain:

> *I think that the ability to network and build relationships with people is probably going to be really critical. I mean it's always been critical but I think it probably is going to be even more critical in the future. Because even design will be automated. –SD3*

> *So designers - well, we have to teach the designers those bigger skills. So the collaboration, the co-creation, the strategic thinking and moving them from wire framing to bigger design. –SD9*

Communities of practice (Eckert 2006; Poggenpohl 2015) that support designers once they are in work are another aspect of collaboration recognised by the industry roundtable. These communities allow designers to leverage the collective skills of their networks and the capabilities of their colleagues. McWilliam and Dawson (2008) refer to this skill as 'network agility' and argue that it needs to be recognised as part of the development and navigation of supportive social networks in increasingly digitised spaces. A roundtable participant underlined the importance of networks:

The best skills a designer can have are adaptability and resilience, right? That comes

from your network. So the really good designers in my team are the ones that are

deeply connected with other learning circles. –SD8

The ability of designers to tap into other networks with empathy and an understanding of reciprocity was seen as complex yet necessary.

We don't teach empathy appropriately, not at all. We don't have effective

empathy models for the range of empathy skills we need. It's not a thing. It's not

a static thing. There's a range of skills in there. –SD8

Participants also expressed frustration with the modelling of these capabilities at university rather than enacting them. One participant suggested that the failure of universities to collaborate with industry at a project level was leaving graduates with only the theoretical (rather than the practical) tools of collaboration.

Well, why don't you teach it in practice? Like put it into practice and get people to

have to do that as part of the curriculum. Not just in this topic, we're going to deal

with this company for this project and that's our industry collaboration. –SD6

Complexity and Systems

The networked structure of organisations and the role of designers within them suggest a stepwise progression to understanding organisations, not merely as a collection of actors but as a subset within the ecosystem of their industry. At times they may be part of multiple

ecosystems, but at the very least we believe that graduates need to belong to a primary professional network. As well as their function as collaborators in communities of practice, these networks should also consider the role of 'things' such as technology, the role of the customer and the ability of designers to 'create' their own ecosystem.

It is a really interesting relationship between customer centric and technology capability… -SD5

Extending the idea of designer as the interface between different dynamic teams and disciplines, organisations are increasingly interested in the role of designer to translate technological capability that can lead to customer-focussed solutions. Strategic designers will also need to understand how business works and the role technology plays in leveraging advantage.

Because design doesn't live in a vacuum. It actually lives within the business - or within an ecosystem of all sort of different things. So I think business acumen is really, really important. Also understanding technology and where technology is coming from because again, we are not designing in a vacuum. We're designing for something. I think the basics are still there. –SD8

This baseline business acumen could also potentially allow the designer the agency to create their own ecosystem; that is utilising their entrepreneurial skills, networks and client list to detach the designer from a traditional firm mode of employment.

You don't need to have everything. You can spin up render farms overseas by clicking a button on a website. I think within creativity, you're looking at this dispersed model... it's happening all over the place, where the best work is being done by people that don't work in big traditional agencies... and they're just hiring someone from Venice to do the typography and hiring someone from New York to build the website. –SD5

The participants also highlighted the role of designer as an interface, able to reconcile conflict and to position their organisation through prospective scenarios. Designers often work within multiple complex systems simultaneously.

So instead of managing one set of products that are experiences, they're managing legacy revenue streams and then digital experiences and they can't quite reconcile the two things. As a designer, you just get stuck in the middle of those two ways of thinking about the world. –SD7

Finally, to highlight the complex role designers have within organisations, one participant focused on the perspective of an outsider looking in:

Interestingly enough, I had a strategist say to me–a very senior strategist in the last organisation I worked for. He came to a whole lot of [affinity] sessions. He sat there and he said "I would hate your job". I said to him why? He said the volume of information you deal with is overwhelming. He said it comes from so many different sources and somehow you and your team are processing it really quickly and you're making clear insights out of it. He said I would hate your job.

He said I would feel sick having to do this. I thought how are you making

decisions? What input are you taking into it? But a normative business model is

about elimination. –SD8

The responses from this theme acknowledge that the workplace is not a closed system insulated from organisational, institutional or industry change. Cruickshank (2010, 21) surmises that 'a sophisticated understanding of innovation requires going beyond simple collaboration to an engagement with a systemic or networked view of innovation processes'.

Tools and Making

Making is core to a designer's work. Changes in technology have increased the diversity of tools available, and designers need to be able to adapt their skills and knowledge of making in this always-changing context. This will involve knowing what new tools they should be able to use for the best advantage, the levels of proficiency required, and how to successfully map enduring design capabilities onto this new context.

What is it, coming up to 25 years since Berners-Lee threw the white paper on his

professor's desk to create the world wide web and yet, businesses still are

struggling to understand the true impact of it and how to become digital from

the ground up. –SD6

Disruption and innovation are integral to the design profession, requiring those who work within it to respond to these challenges. Participants recognised these challenges and identified some examples where technological advances are having pervasive effects on traditional industries such as television and programming, suggesting that a highly adaptive making capability is also required within an organisation:

There are traditional standard formats, like for TV shows. It's got to have half an hour, it's got to have someone at the desk, it's got to have an intro title and this. I was talking to someone at [organisation] in New York and the concept of what is a piece of content is very different. People are struggling with that with YouTube. –SD5

The standard 30- or 60-minute television slot no longer needs to be adhered to, with a proliferation of online streaming and on-demand services. YouTube, for example, and other streaming platforms have fewer requirements and a less standardised format than traditional programing. The flexibility this enables blurs the division of product and service, and the resulting ambiguity leads to problems for rigid firms in adapting or responding to changing audience needs.

However, in the sea of uncertainty about the potential of future technologies and technical requirements of content formats, there is consensus that the digital capabilities required of future designers require making customer-centric experiences. Regardless of technological changes that dictate how design is made and disseminated, the future is relational:

Because you have to be customer centric to survive in that world. To even get a critical mass of customers in the first place. Otherwise you don't get off ground zero. –SD6

> *Whereas audiences are demanding more and more online and on devices. Part of giving audiences what they want is giving up control over what you've got power to present and what people might do with it. –SD4*

This reciprocal relationship of disinvestment in skills and technology, especially in larger organisations, detaches the flow of their organisation with the barriers facing their design teams. This collective refusal of organisations to respond and adapt to industry trends leaves a technical and design debt that especially hinders the performance of design teams. The pace of change is not only specific to the organisation, but also the role of the design professional and the relationship that plays with other traditionally orthodox positions with classically defined responsibilities.

> *It's right now and it challenges their entire perception of their own expertise. What we actually need is a redefinition of what an expert editor is. It's not happening fast enough to match our customers demand for that technology. So we're really out of sync. –SD8*

These responses suggest a need to apply greater attention to contextual specificity and a nuanced understanding of the relationships between all the objects, actors and processes involved in the creation and delivery of design services. The role of affordances and an affordance approach to education has value and currency in the nurturing and training of future graduates and graduates of design in particular.

The findings from the industry roundtable suggest:

- Designers mediate both within and external to their organisation, and need the ability to communicate persuasively

- There is a distinction between skills and sensibilities, but both are needed to work in rapidly changing environments

- Typical divisions between products and services are no longer clear and need to be considered as whole 'ecosystems' of design work

- Designers need to draw on both personal and professional networks to support their development and adapt to new environments

- Emotional intelligence becomes increasingly important as designers interface with complex issues, changing technological affordances

- Designers need be aware of the design deficit of organisations that do not adequately invest in skills and technology, and advocate for their investment through advanced communicative skills such as persuasion

- Design educators and industry professionals should interface more closely to develop curricula that satisfies both university and industry expectations

- Universities can explore more avenues for graduates to transition to the workplace.

The next section synthesises these findings in more detail, building on the affordance model introduced earlier in the article.

4. Synthesis with an affordance approach to digital capabilities

The roundtable generated insights highlighting the demands of industry that have not been completely met by university education. Participants indicated that discipline specific skills such as creating digital content and the ability to have mastery over technologies are required, but also identified a growing need for the ability to speak and work across

disciplinary boundaries. Considered with our affordance framework introduced in Section Two, there is an industry expectation of at least a perceptual level of technology affordance and associated capabilities. Designers are hired, not merely to do their own job, but to integrate and communicate with other parts of their organisation. Although these abilities are associated with higher-level graduate attributes, the roundtable especially highlighted the need for graduates with adaptive affordances not only to lead their organisations, but also to guide their discipline through uncertain times ahead.

As Bridgstock (2013, 180) argues, design graduates should be leaving university with a sense of '(1) their own capabilities, values and career aspirations; (2) the nature and workings of the world of work in their intended disciplines; (3) the reflective, evaluative and decision-making capabilities to begin to build a satisfying career.' This is supported by our findings of what digital capabilities industry articulates as their requirements and how these can be scaffolded in an affordance framework.

The participants spoke broadly around collaboration, and complexity and systems descriptors during the roundtable discussions. They were specific about the importance of networks for designers now, and into the future suggesting:

> …the ability to build relationships with people is probably going to be really critical… [it] is going to be even more critical in the future' (SD3).

In accord with our developed descriptors, this highlights the importance of communicative and collaborative skills that designers need, and to utilise their networks 'the best skills a

designer can have is adaptability and resilience… the really good designers in my team are the ones that are deeply connected with other learning circles' (SD8).

Our participants highlighted the need for designers who have mastery of contextual (technological) affordances to understand the capability of objects, interfaces and content ecosystems. This mastery allows the designer to identify and respond to emerging technologies in order to deliver rich user experiences, with the best designers navigating the relationships of 'customer centric experiences and technological capability' (SD5). Other designers may adapt to new media platforms that relate to older mediums, but without the same restrictions 'a piece of content is very different… people are struggling with that, with YouTube' (SD5) and designers that are not wedded to existing archetypes will forge ahead and pursue new possibilities attached to technological affordances. Adapting to complex systems have also been identified to be associated with higher order social skills (cf. Table 1). One respondent spoke to this 'we don't teach empathy appropriately… we don't have effective empathy models for the range of empathy skills we need' (SD8). This point leads us to emphasise the importance of designer as interface between technology and customer/user experiences.

These findings point to the need for more nuanced approaches to both adapt educational approaches that mediate between university and industry outcomes, and utilising an affordance scaffold guiding users to innovate with, in the case of this research, digital technologies and capabilities. Such developments enable the designer to be explicitly aware of the need to consider affordances of technologies, but also to see themselves embedded within complex systems, that is, their organisation and disciplines. We are aware that this

relative indeterminacy could also be seen as a weakness of this interpretive approach, but contend that it is also reflective of a changing working environment.

This growing requirement to have higher order skills to develop adaptive affordances leading to innovative outcomes aligns with Friedman's development of six global economies (Friedman 2012). Building in complexity, economies one and two relate to gathering and fabricating materials. Economies three and four relate to transport and commerce. It becomes interesting from the fifth economy that relates to higher order services and the knowledge economy, but the sixth economy relates to paradigm shifting practices that shape industry and society itself. Within the roundtable discussion our participants introduced the case of the Google Home ecosystem.

> *Something like Google Home for instance, we are trying to fit conventional audio information into a product that's really not designed for that. We don't have the resources - we didn't have the resources to be able to equip them with anything else prior to that. –SD9*

> *[regarding google] Having said that, they're very, very good at adapting and anticipating what the adaption will be. So that adaptability is just hardwired into the sort of people that are going to digital design I think. –SD9*

Placing this case within the themes of Complexity and Systems and Collaboration demonstrates that technologies like Google Home require industry to adapt, and also afford the opportunity for universities to teach adaptive capabilities. This aligns with Roos' observation that innovation leads to changing the behaviour of individuals who use a

designed artifact (Roos 2012) but in fact, this changes the behaviour of those that design artifacts. They require practitioners to work with new technologies by adapting to industry vanguards and their emergent technological advances.

Participants also increasingly highlighted the importance of digital capabilities that go far beyond functional knowledge and skills in using tools. Adaptive capabilities are highly sought after and in short supply in industry, where grappling with rapidly evolving and emerging technologies (artificial intelligence, machine learning, Internet of Things, etc.) are shared concerns. This was highlighted in the roundtable through all four themes, more critically emphasising the role of designer as communicator, translator and innovator. These findings are good news for educators and curriculum developers, who often work in a range of design programmes, some of which focus on emerging media and digital technologies, others of which have more traditional practice approaches. The digital capabilities emphasised in our research build on critical and relational skills and learning about technology, far more than they do on learning particular software.

Furthermore, the significance to industry of a graduate's ability to develop and work within communities of practice in order to cope with present and future digital challenges suggests that educators should in fact be working more with students to co-design curriculum. It is vital that students can develop and articulate Perceptual and Adaptive capabilities with confidence for new and emerging contexts. The roundtable participants highlight the challenges and need for designers to be agile, adept and adapt to a variety of situations and reconcile difference such as the needs of the user against technical and design debts within their organisation. Such digital capabilities can be fostered within both universities and the workplace for the ongoing careers of graduates.

5. Conclusion

This article presented the findings of a roundtable of design practitioners working in Sydney. We developed a framework of affordances relevant to the design profession and introduced four domains of digital capabilities that were mapped against the industry roundtable data. After synthesising the roundtable data, we found that industry is expecting more of designers both in terms of their core disciplinary abilities and their ability to work at the edges of their discipline in a strategic and leadership sense, acting as advocates for design in different contexts, and drawing on the power of networks to realise new design outcomes through new practices. This is in line with Cruickshank's (2010) suggestion that innovation requires engagement and collaboration outside the workplace and can only be adequately realised with adaptive knowledge of not only domain specific skills, but also transferable and interdisciplinary knowledge to communicate and influence both within and beyond the workplace.

The pace of technological change in the design industry requires university curricula to continually adapt, with curricula planned for future employment possibilities. The effects of globalisation were raised in the design industry roundtable but have not been explicitly addressed and point to geographical scope as one of the limitations to our study. The decision to limit the study to Sydney was to conduct a fine-grained investigation of industry perspectives that necessarily avoided other markets. We also acknowledge that while the roundtable collected perspectives of experienced designers working in commercial industries, many design voices important to the discussion were left out. Future studies would benefit from a comparative investigation examining the effects of local markets in relation to a global field. Another caveat that was not given more space was the general state

of precarity of work. As with other industries, this is an important topic that would benefit from further exploration.

Some of our findings on missing skillsets of graduates have been identified previously by Bridgstock and Cunningham (2016, 21) who suggest that 'these gaps in curriculum may in part be due to a certain hardy Romanticism in creative arts higher education'. This is not a suggestion to displace disciplinary knowledge. Students need to be well versed and grounded within their design practice. This will then enable graduates to communicate influentially and effectively with other disciplines as they gain mastery of adaptive affordances and associated capabilities. Design students not only need to develop digital capabilities at a functional and perceptual level, but also need to develop literacy around affordances so that they too can have clear and flexible analytic tools for working out how digital tools operate in practice, for making good decisions in digital spaces, and for being adaptive practitioners.

We suggest that a dialogue shaped around a framework of affordances developed in Table 1, can act as a medium for mediating the competing demands of industry and universities. Findings from the industry roundtables suggest a growing emphasis on not only changing technologies, but also changing contexts – that is – the ecosystems of work. Although there are distinctions between skills and sensitivities, they are often blurred requiring mastery of both to be applied within and external to one's organisation. Together, the digital capabilities descriptor and a scaffolded approach to learning is both a framework continually under construction, guiding curricula, informed by industry to improve graduate outcomes.

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