Digital Work Practices and Capabilities: Developing an affordance scaffold for teaching journalism students

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Abstract

This article describes the development and implementation of a learning and teaching scaffold designed to better prepare graduates for the digital workplace. Application of the scaffold is intended to improve employment outcomes for students in several discipline areas in which automation, data analysis and networked communication tools are reshaping professional work. In an attempt to address this challenge, a scaffold has been planned and trialed as part of a wider action research project. This article focuses on a case study of journalism. It highlights the importance of addressing technology affordances and associated capabilities in a systematic and holistic way, including functional (the 'what and how-to' of using technology), perceptual (the 'when and why') and adaptive ('extending, emergent'). Key recommendations for educators are to foster developmental learning about digital work practices by interpreting the scaffold concept for existing curriculum or for new program development; and to foster a mind-set about the interconnections of functional, perceptual and adaptive affordances. If students learn to articulate ways in which the potential of technologies can be harnessed – usefully and realistically, in different and emerging contexts – we believe that as graduates they are likely to be in high demand.

Introduction

For some time, changes in technology have resulted in new job roles and capabilities required in organizations (e.g., Coldwell-Neilson 2017). However, particular features of the internet and the many informational technologies that it supports present especially acute challenges for news production and commoditization. As a result, journalism graduates entering the digital workplace face an uncertain future. The problem is exacerbated by a higher education sector struggling to coordinate an effective response. As noted by Fray et al. (2017), 'journalism'

degrees have inconsistent structures (Tanner et al. 2014) and it is difficult to achieve consensus on what should be included: generalist or narrowly journalistic, theoretical or practical? (Cullen et al. 2014).

Furthermore, there are institutional and practical impediments to highly responsive tertiary education – certainly in terms of technology-specific training. Planning pedagogy for uncertain and evolving skills and broader capabilities is complex; developing programs/courses and implementing changes can be time consuming and bureaucratic; to prepare work-ready graduates, educators must anticipate changing industry demands, often in advance of employers; specific technologies may only stay relevant for a short period, making it hard to focus on narrow skillsets. In such circumstances, it is unsurprising that the delivery and focus of 'digital teaching' remains a priority concern for universities worldwide across the disciplines, with calls for 'heightened media literacy and advanced higher order thinking, which can be facilitated through technology-enhanced pedagogies' in support of graduate employability (Kinash and Crane 2015: 148).

There has been considerable discussion about graduate employability, which 'means that higher education alumni have developed the capacity to obtain and/or create work' (Kinash and Crane 2015: 150). The need for adaptive capabilities also underpins a number of recent initiatives in higher education. In the United States, for example, Stanford University has funded the scale-up of immersive, intensive, international learning experiences as a way to strengthen graduates' ability to 'respond to new situations and new problems…[because] across disciplines, what matters is how workers respond to problems that are a departure from their everyday procedure' (Stein 2017). In Australia Scott (2016) also emphasizes the need for students to learn how to cope with dilemmas, rather than being able to solve problems only in known and predictable circumstances. If we overlay this need for graduates to have adaptive capability, with the need to be able to operate in digital environments, it can be challenging for educators to tackle the planning of learning environments for their students.

This article describes the development and implementation of a learning and teaching scaffold to support journalism students towards digital work readiness. The scaffold is a response to the call for educational experiences designed to enhance the employability of graduates in contemporary and future work scenarios, which include an ever-increasing need for digital/adaptive capabilities. It should be noted that we are not advocating here for an educational model that prioritizes work training above all else. We are responding to an education environment in Australia that markets 'employability' to students whom expect to be work ready when they graduate (Helyer 2011, Oliver 2015).

The theoretical work described here was conducted as part of the Digital Work Practices (DWP) action research project funded by The Australian Technology Network of Universities

(ATN): 'universities focused on industry collaboration, real-world research with real-world impact' (ATN 2017). The DWP project was a collaboration between three ATN universities to better prepare graduates for disrupted work futures. Simply put, it involved identifying the digital capabilities needed and how to embed these in the curriculum. For the purposes of the project, digital capabilities include the knowledge, skills and attributes required for a user to interact productively with technology.

In line with Carr and Kemmis (2004), our aim in the DWP project was to support educators in an authentic way – from a theory and practice base – to strengthen or, ideally, transform the learning and teaching experience and produce a different future for graduates. As participant researchers in the DWP project we have attempted to explain the theoretical basis for our practice, as well as the context and evolution of our practice (Kemmis and McTaggart 2008).

In this article, synergies are explored between affordance theory and educational theory to underpin the development of a rigorous learning and teaching scaffold. The detailed process we followed in developing the scaffold for journalism is explained, representing the 'planning' stage of the DWP project. The article does not attempt to evaluate the learning model trialed, given the small sample of postgraduate journalism (taught program) students with whom we worked (n=9). However, the integration of theory and practice to date is intended as a springboard for further research, including scale-up of the model.

The article builds upon a previous iteration of the scaffold concept in response to journalism education being in a 'highly disrupted state' (Fray et al. 2017: 2). It also builds upon different action research for leading change to enhance employability through scaffolded or developmental learning, from basic skills in digital communication and collaboration to sophisticated capabilities for complex problem-solving projects in virtual teams and networks (Peterson 2016).

Affordance Model

Affordance theory

Tertiary educators may struggle to respond to the pace of digital development: as many researchers have described, these technologies pursue a logic of acceleration (Virilio 1977, Hassan 2009, Pond 2015). It is clearly challenging to train students to use specific technologies when product cycles are short and competition between providers is intense. Given the length of degree programs, technologies presented in the first semester may be irrelevant at completion. An educator might wonder if certain approaches to technology can be more 'timeless' than others – that is, more resilient to changes in features and fashion over time. Such questions suggest that any approach to digital pedagogy needs to be informed by a viable

theory of technology use, adaptation and intelligence.

Simply put, 'affordance theory defines a technology in terms of the uses, interactions and possibilities that the technology affords to its users' (Fray et al. 2017: 4). A technology is not a bundle of features but, rather, the product of communicative interaction with a user – technological potential must be perceived to be realized. Gibson's (1979a: 129) original formulation of affordance theory offers clear potential to educators: suggesting that it may be possible to develop skills of perception and interpretation that can be effective across technological contexts. In discussion of affordance theory (Joinson and Piwek 2013), there has been a growing emphasis on the enabling potential of interaction between a skilled user and technology to make possible a full range of potential outcomes.

In the late seventies, the language of affordances was adopted by design scholars seeking to articulate a relationship between 'good' design and intended use. 'The term affordance refers to the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used' (Norman 1988: 9). This creates a logical complication. If an affordance refers to a property, and a property can be perceived or actual, are there then two types of affordance (one real and one not real) and where would these different categories reside? As Oliver (2005: 405) notes, 'the implication… is that 'real' affordances are unknowable. If any given set of perceived affordances may be different to the 'real' one, how can we ever know which set is 'right'?'

We argue that it is neither necessary nor especially helpful to insist on this real-unreal dichotomy; moreover, we suggest that it is precisely their ambiguity that makes them so useful. By framing technology use as a communicative (inter)action, we can identify the specific affordance-related capabilities required to use technologies effectively across a range of contexts. All affordances are functions of perception. It is possible, for example, to use a laptop to hammer nails, though this is hardly an outcome intended in the design or construction of the laptop. It is precisely this interpretative or communicational dimension of the affordance that makes it useful to educators. Rather than focus on the 'fixed' features of a technology, the educator can focus on the user's ability to identify (and, later, to imagine) possible uses for those features. To be technologically adaptive, then, requires interpretative and communicative skills as well as dexterity, resource-knowledge and process familiarity.

Towards an affordance scaffold

An affordance is neither a feature nor an outcome of the technology; it depends upon the perception, intention, skill and imagination of the user to act in different ways, or to effect outcomes in different contexts (see Evans et al. 2017, Fray et al. 2017). It is thus useful to categorize affordances according to their interactive potential. As Best (2009: 1020) points

out, 'a technology's functional affordances allow us to accomplish a task, and its perceived affordances allow us understand and manipulate the technology itself'.

Drawing upon Best (2009) and Evans et al. (2017), we argue that a user must first be able to 'read' the features of a technology – interactions that we frame as **functional** affordances. To achieve a desired outcome, a user must also be able to perceive the potential of different features within known contexts of use; these interactions we call **perceptual** affordances. Finally, in order to achieve full 'control' over her interaction with a technology, a user must be able to read properties and new contexts simultaneously, with imagination, so that she can extend the potential uses of known properties in previously unexplored and emergent contexts. We call these **adaptive** affordances.

Our central proposition for the scaffold is that functional affordances are foundational, easier to learn and a necessary precursor to 'higher level' perceptual and adaptive capabilities. Perceptual capabilities can be developed given functional familiarity and carefully structured learning environments. Adaptive capabilities are the most cognitively and pedagogically complex: they require functional familiarity, environmental awareness and the imagination to combine these attributes – to adapt functional knowledge and skills for unfamiliar contexts and emerging possibilities.

Educational theory

We see the integration of affordance theory and pedagogy as a natural fit; therefore, a review of educational theory also informed development of the learning and teaching scaffold. Contemporary ideas on scaffolded or developmental learning can be traced to the seminal work of 20th Century educational/psychology theorists such as Piaget (1936), whereby learners achieve higher cognitive levels in stages through interactions with the environment; and Bloom (1956), whereby three domains of learning are defined as cognitive, affective and psychomotor, with the cognitive domain focused on moving from knowing (identifying) to comprehending, applying, analyzing, synthesizing, and evaluating. More nuanced ideas followed in a revised Bloom's taxonomy (Anderson et al. 2001), with the cognitive domain now adding *creating* to include synthesis; and highlighting that learning activities might involve factual, conceptual, procedural and/or metacognitive knowledge. Biggs and Collis (1982) had also put forward the Structure of Observed Learning Outcomes (SOLO) taxonomy, whereby a range of complexity is acknowledged for learners whose knowledge and skills may vary from being minimal, to including high-level abstraction to new contexts. These developmental learning ideas resonate with the affordance concept, which sees learning on a spectrum (albeit integrated) from functional to perceptual and adaptive capabilities.

Gagné (1984) focused on learning hierarchies and developed ideas to guide the design

of learning experiences, whereby the cognitive level of learners should be known and the conditions of learning should be designed in line with the desired outcomes. The concept of a hierarchy also applies in digital affordances (functional, perceptual and adaptive); however, the associated knowledge and skills are not necessarily learned or practised in a linear way. Holistic approaches to problem solving are recommended, in terms of digital affordances.

Knowles (1975), Wood et al. (1976), Vygotsky (1978), Jonassen (1997), Wenger (1998), Biggs and Tang (2007), Woolfolk (2008) and Weimer (2013) focused on learning communities and social constructivism, whereby learners are motivated and assisted to achieve higher levels of learning and problem solving through social interaction and the co-construction of knowledge. Social constructivist ideas for learning about and through technology have been documented (de la Harpe and Peterson 2009) and have been applied successfully such as supporting retention of online learners (Ludwig-Hardman and Dunlap 2003).

Siemens (2005: 4) argues that connectivism is more relevant than constructivism to digital environments and includes an 'ability to see connections between fields, ideas, and concepts'. This has obvious relevance to the concept of interconnecting affordances. A combination of connectivist and social constructivist approaches has successfully underpinned supporting learners to work collaboratively online with industry mentors, for open-ended and increasingly complex problem-solving projects related to the networked digital world (Peterson 2009). In such cases, the educator initially provides structure and resources for learners, then gradually fades support as they move towards greater independence in their learning and achieve higher cognitive levels. This resonates with the affordance scaffold and builds on Schön's seminal ideas on professional learning.

Towards a learning and teaching scaffold

Schön's (1983) work is of particular relevance to the DWP project because he highlighted the significance of reflection on and in action for professional learning and practice. Schön differentiates reflection-**on**-action as being useful for improving one's future practice; whereas, crucially, reflection-**in**-action means that the practitioner can adjust her practice as circumstances change or unfold. Reflection-in-action draws on practitioners' prior knowledge, skills and experience, as well as their *adaptive* capability to cope with and make the most of the new context and opportunity.

Acknowledgement of a range of complexity for the learner (e.g., the SOLO taxonomy) and particularly reflection-in-action underpins the scaffold under discussion. Social constructivism also informs the design of teaching strategies for implementing the scaffold, which is intended to improve graduates' employability prospects through creating collaborative learning environments and experiences that develop students' capabilities 'to face new and unexpected

challenges in their fields' (Stein 2017). The ideas of some earlier theorists shifted (e.g., Maslow; Bloom) in terms of hierarchies being conceived holistically and dynamically rather than as a linear process. Similarly, the affordance scaffold hierarchy of interconnecting functional, perceptual and adaptive layers is unlikely to be addressed in a purely linear fashion.

The affordance scaffold posits that:

1. The functional affordance layer is easier for a user to master than the perceptual layer, which in turn is easier to master than the adaptive layer.
2. The mastery of these three layers of affordance places a user in full control of that interaction with a technology.
3. Control enables the user to innovate with that technology – that is, to imagine new uses of known features in new and emerging contexts.

According to the scaffold, affordances can only be mastered given a (functional) knowledge of the features or properties of a technology. Features include the materiality of the technology – the buttons, sliders, forms and links on a webpage for instance – as well as the operative tasks that depend on that materiality. Hammering a nail for instance requires knowledge of the hammer, which end to hold and which end to hit with, and a sense of how to swing the hammer and to connect with the nail effectively and safely. Once a user has some functional knowledge of a technology, she may operate that technology to effect an outcome. This requires perceptual knowledge and involves interactions that produce desired outcomes. Conceptual adaption requires both functional skills and knowledge of specific technologies and perceptual experience of operating those technologies. It also requires the ability to 'read' contexts as they present themselves – that is, professional and social knowledge and experience beyond the technology domain.

The practical implication of the theoretical digital framework is that there are functional, perceptual and adaptive capabilities to be learned and developed, to enable a user to control her interaction with a technology and to produce a desired outcome. That means that educators must be able to name those capabilities, locate them in the scaffold and support their students to learn them. The knowledge and skills in question are defined by their contribution to an affordance, but affordances become relevant only when they contribute to a desired outcome – outcomes are productive, industry-relevant digital tasks, processes or actions. Therefore, the process of developing an affordance scaffold and then a teaching strategy, begins with a survey of an industry and the identification of industry-specific digital outcomes.

Translating the Scaffold into a Teaching Strategy

Process for developing the journalism scaffold

Journalism serves as a useful test case here because so many of the productive and commercial practices of the profession have been subject to rapid technological change, which means that industry practitioners and educators must re-evaluate regularly the priorities for their businesses and students (Cullen 2015). There is also an established body of literature on the challenges facing journalism because of digital technology, much of which proposes potential responses in terms of professional action and training (Finberg and Klinger 2014, Stencel and Perry 2016, Wake and Farrer 2016, Fray et al. 2017). This material is particularly useful because our first task in developing the affordance scaffold was to survey journalists, educators and the specialist literature to establish a list of the core outcomes that employers expect digital-ready graduates to produce (effect). First, we conducted a wide-ranging review of the literature and produced a summary table of required attributes, knowledge and skills (Fray et al. 2017). Second, we held roundtable discussions with industry leaders and requested their assessment of both current digital practices within the industry and emerging trends that might influence those practices in the near future. Third, we surveyed academics from five Australian universities and asked them to name the key digital capabilities required of graduating students.

These three information streams were collated into a summary 'digital capabilities descriptor' for the journalism industry. The descriptor formed the basis of planning for the affordance scaffold and then for the teaching strategy. It was conceived in a tabular form (see Table 1 below). Outcomes were grouped into broader categories based on a reading of the tasks, processes or professional responsibilities of journalism and journalists. It is important to be clear about what 'outcome' means in this context: it is the effect that the user intends to produce by engaging with the technology (Evans et al. 2017). A freelance journalist may seek to engage with Twitter to source comments on a news story. The finding and recording of those comments are the outcome; searching, visibility or publicness, and open messaging are the affordances; Twitter has various features that afford this functionality to the user.

Table 1: Digital capabilities descriptor for journalism
Source: Fray et al. 2017, adapted from Gibson 1979b, Norman 1988, 1999, Hutchby 2001, Hartson 2003, Best 2009, Hunter and Nel 2011, Joinson and Piwek 2013, Cullen et al. 2014, Finberg and Klinger 2014, Schmidt and Rosenberg 2014, Schmidt 2014, Tanner et al. 2014, Cullen 2015, Davies and Cullen 2016, Mullin 2016, Schwab 2016, Wake and Farrer 2016

Table 1: Digital Capabilities Descriptor for Journalism

1. Coding domain

Functional capabilities	**Perceptual capabilities**	**Adaptive capabilities**
Language of code: Name and define programming concepts; name the principles and limitations of automated processing and define them appropriately. Relationship between code and journalism: Name and define programming concepts; articulate ways in which code can be used to support journalism	Language of code: Use concepts appropriately in communications with programmers. Relationship between code and journalism: Employ code directly, or employ programmers, in the most effective way to perform journalism and to tell stories.	Language of code:: Use concepts to direct programmers strategically to achieve journalistic outcomes. Relationship between code and journalism: Explain the influence of code (and automation) on the production and consumption of news; translate into journalism.

2. Data domain

Functional capabilities	**Perceptual capabilities**	**Adaptive capabilities**
Statistics: Name basic statistical concepts and perform basic statistical calculations. Data processing: Operate data processing software packages; control user interface.	Statistics: Interpret statistical findings to identify news value; use statistical findings in support of stories. Data processing: Produce analysis and visualizations to support a story.	Statistics: Select appropriate statistical tools to investigate data sources, to identify news value and to illustrate news value in innovative ways. Data processing: Select software appropriate to data and to news value; support new forms of storytelling, in collaboration with design, business/IT, advertising/PR, marketing/sales.

3. External communication domain

Functional capabilities	Perceptual capabilities	Adaptive capabilities
Social media software: Operate a range of social media software packages relevant to audiences; establish connections; publish content; engage interactively. Networked audiences: Name and define concepts and actions related to networks and engagement.	Social media software: Direct social media applications to fulfil journalistic requirements: build personal following; disseminate stories to audience; develop content and storytelling techniques appropriate to medium. Networked audiences: Interpret audience and traffic data; social metrics and engagement measures; differentiate between good and bad strategies.	Social media software: Differentiate strategically between platforms: select platforms appropriate to both stories and audiences; tell stories in ways that maximize the potential of different platforms – media and audiences. Networked audiences: Make strategic decisions based on network knowledge and news value in collaboration with advertising/marketing/ PR, design, business/IT, to increase audience engagement with stories.

4. Internal communication domain

Functional capabilities	Perceptual capabilities	Adaptive capabilities
Collaboration: Name and define internal communication and project management principles. Security: Name and define security concepts and tools: anonymity, encryption, virtual private networks (VPNs)	Collaboration: Apply those principles to support journalistic practices. Security: Employ tools appropriately during journalism to ensure privacy and security for all participants: journalists, stringers and sources.	Collaboration: Adapt established principles to emergent contexts to increase productivity and minimize risk; work with different specialists Security: Respond to emergent security threats by employing available tools appropriately; develop new approaches to enhance security for vulnerable stakeholders.

In the digital descriptor reproduced above we group outcomes into four categories. First, there are outcomes that result from a technical manipulation of code; second, there are outcomes from the collection, processing and analysis of data and textual information; third there are outcomes that relate to the external audience or marketplace; fourth there are outcomes that relate to an internal audience, the management of tasks and processes. These categories are not meant to define the practice of (digital) journalism nor limit the required skillset; nor should they be read as preordaining the technologies that journalism employs – they do not name the tools or technologies that journalists should be able to operate. Rather, they specify the outcomes that experts believe are possible through digital interaction and they reflect the priorities of practitioners, educators and theorists identified by the Digital Work Practices (DWP) project team in 2017.

For instance, according to the digital capabilities descriptor, experts are interested in how journalists might use the vast supply of commercial and publicly available digital data to find and research stories with high news value. The outcome is clear: an audience engaged in innovative data-driven storytelling, but the technologies and interactions required to effect that outcome must still be decided. The digital descriptor does not specify any of these items in detail, but it does summarize the interactions in shorthand: working with digital data, operating statistical packages and so on. The informed educator must then decide upon specific examples of use and contextualize those examples for teaching.

Translating the descriptor

The descriptor identifies different outcomes and sorts related outcomes into capability 'domains' or skillsets. It defines what is to be taught – or, more accurately, the outcome of what is to be taught – but does not specify how that thing should be taught. A teaching strategy requires that each outcome be viewed as the product of different affordances.

In the remainder of this article, we report on work conducted by the DWP team to translate the 'collaboration' outcome into an affordance scaffold for digital teaching. A single outcome is sufficient to demonstrate the principles behind the approach as well as the practical requirements of coordinating these principles to improve pedagogical approaches used.

Journalists must collaborate in many scenarios: with each other, with sources, with production staff and, increasingly, with their audience. Different instances of collaboration require different capabilities and different tools; as such, different types of collaboration may involve different affordances. Some of the affordances and some of the functional knowledge may be transferable across contexts, but others will be context-specific. When approaching any outcome, in our experience it is important to scope that range and transferability of relevant affordances: the emphasis for teaching will be different for different courses and different

cohorts. Perhaps paradoxically, then, before naming functional capabilities for the scaffold, it is first necessary to specify the context in which students will be asked to perceive the potential of those functional capabilities.

For example, in one scenario devised during the project, journalism students were asked to consider specific tasks:

Planning a series of articles on the anniversary of World War I engages multiple collaborators, among them reporters (to create the content), line producers (to shape the content), product developers (to package the content), UX design experts (to understand how audience intersects with the product), graphic artists (to create or enhance visual content), photographic researchers (to find content) and editors (to approve the final product).

You want to direct researchers to search archives for suitable images.

Task 1: You need to coordinate this task and to communicate with researchers as they source images.

Task 2: Having identified a set of images, you want feedback from the team on how these images might be used. How could you share these images and coordinate this feedback?

Task 3: Finding images is just one of several tasks involved in producing a series of articles. How could you manage these different tasks to ensure that each is completed on time?

Coordination, communication, image sharing, project management: the task specification names several outcomes that can be achieved with the help of digital technologies. Consider the first task, the coordination of researchers searching for World War I images in different archives. It might be possible to achieve productivity through many email exchanges and a shared spreadsheet for recording searches and successes. Equally, it may be possible to direct, discuss and record the entire process using a group messaging service such as Slack. Ultimately, selecting the appropriate tool for the task depends upon many factors – availability, cost, security – but even in a complex scenario there are likely to be several tools that could be used to effect the desired outcome. In large part, digital training and education involves equipping students to choose between different tools and then to operate the chosen tool with maximum efficacy.

From outcomes to affordances

Initially, then, affordance scaffolding involves matching the features or properties of various candidate technologies to the different outcomes required in a scenario. Outcomes can be complex and are rarely digital-specific (that is, only achievable with a computer). Often, the primary outcome is dependent on the successful completion of constituent tasks (each one an outcome in itself). In the simplest terms, coordination of researchers depends upon communication with those researchers. At the very least, that communication requires the

successful transmission of messages between the coordinating journalist and the individual researchers. It may be desirable for that communication to be shareable between researchers. Coordination may also require record taking. Records most likely need to be editable and it may be efficient if edibility is shared between researchers. Records may need organizing into types: for instance, it might be useful to record both sources searched and images found, and these two records might need to be available independently of each other. It becomes clear that each outcome involves an affordance to realize it.

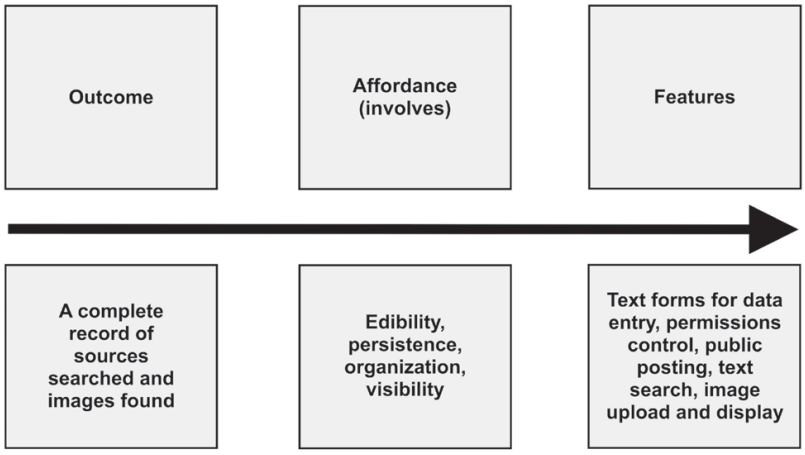

Figure 1: Schematic diagram showing the mapping of outcomes onto affordances onto features

The mapping illustrated in Figure 1 is simplified to illustrate the general principles of the process. It produces a list of technological features that could afford the required outcomes. Put more simply still, in order to keep a shareable record of the image search, the journalist requires a technology that enables the editing, saving, organization and sharing. These requirements translate into a list of features desirable in the chosen technology. Table 2 below lists several candidate software applications and checks them against the required feature list.

The criteria for assessing the presence or absence of features are relatively strict. It is possible to message publicly through email – create a long list of recipients, create threads of messages in which participants 'reply all' – but this is suboptimal. Email may afford group messaging but it does not do so as efficiently as Slack or WhatsApp. In general terms, for the DWP project, a feature was considered present if it was clearly part of the intended design or available to the user with little or no adaptation.

Software application (technology)	Features							
	Text entry	Permissions control	Public posting	Private messaging	Text search	Image upload/ attachment	Public messaging	Mobile
Google Sheets	X	X	X	–	X	–	X	
Slack	X	X	X	X	X	X	X	X
Trello	X		X					
Email	X	–	–	X	X	X	–	
WhatsApp	X	–	X	–	X	X	X	X
Evernote	X	–	X		X	X	X	X

Table 2: Table showing the available features of candidate technologies

From Table 2, it might be supposed that Slack is an appropriate tool for coordinating a group of researchers to search a variety of archives for images of World War I, to share those images with each other, and to record the process as they work through it. It may not be equally well suited to all aspects of the process but it affords the greatest range of appropriate actions. Pedagogically, the challenge is the translation of features into desirable outcomes. Teaching needs to support students to 'read' the features of technology (to recognize relevancy), to know how to interact with these features and to produce action that delivers desired outcomes. The affordance scaffold is intended to support this translation.

Example: scaffolding Slack

The guiding principle behind the affordance scaffold is that teaching should focus on the interaction between user and technology. To discuss this principle, and to illustrate what interaction looks like at the different affordance layers, the final part of this paper describes how an educator might approach teaching Slack to support collaborative working practices for journalists. In theory, we should consider a similar scaffold for any digital journalism tool we intend students to use. However, under the affordance framework, similar tools will share many functional affordances and a significant number of perceptual affordances. As such, the more tools we scaffold, the greater the overlap between affordances and the easier it is for students to transfer their affordance-literacies to new technologies and contexts.

Slack is a proprietary team messaging application that was launched in 2014. It allows users to create accounts and to send messages to each other, either privately and directly or publicly via a grouping mechanism called 'channels'. According to the scaffolding approach, the basic features of Slack – that is, the key functions, mechanisms, processes and prompts – form the functional affordance layer. Functional affordances are non-contextual – they are the interactions required to make Slack 'work' regardless of setting or intention. However, this does not mean that all functional affordances are equally easy to master – certain interactions with Slack are more complex and require more knowledge than others, so we differentiate between lower and higher order functional affordances.

Functional affordances (lower)

Lower order functional affordances (LOFA) are those interactions necessary to respond to Slack as a user without any sort of organizational or administrative responsibilities. In the simplest possible terms, LOFAs are needed to use Slack: to register an account, log in, send and receive messages and so on. Of course, few of these interactions will require knowledge that is Slack specific, and most users will be familiar with these basic operational tasks from using other software applications. The Slack-specific features involved can be listed easily. Slack provide support documentation that explains the basic operation of the software. Specific tasks include registering for an account, setting up a profile, receiving and sending messages publicly and privately, activating notifications, uploading files and writing and formatting public posts.

When establishing a scaffold, it is not necessary to define an exhaustive list of features for the software; rather the aim is to specify the features necessary to make the software work in the given context. Given the relatively limited tasks required of the journalists and researchers working on the WWI project mentioned earlier, we might estimate that Slack will work effectively as long as every user knows how to:

- Register with Slack
- Grant Slack permission to work on the user's preferred platform
- Create and complete a profile
- Send messages to:
  - The project lead
  - Each other
  - Public channels
- Upload images

It is important to note that the list above *specifies outcomes*, *not features nor affordances*. The features are Slack-specific e.g. the service provides both hyperlink and email sign-up; messages are composed via text forms; composition can utilize a version of markup language. It

is the educator's task to match features to outcomes and then support students as they interact with features to effect outcomes. Our suggestion is simply that, at the LOFA level, this support should be easy to provide if it is required at all.

Functional affordances (higher)

Higher order functional affordances (HOFA) involve those operations necessary for coordinating other users to use Slack. These tasks are still generic but they may be more complex than the lower order tasks or require Slack-specific knowledge. They include:

- The creation and management of channels
- Organizing and sharing files
- Inviting new users and managing user permissions
- Installation of third party applications
- Administrative tasks including setting reminders, creating to-do lists and board customization

The affordance scaffold states that these higher order interactions depend upon the user successfully mastering lower order functionality first. They do not involve higher level affordance knowledge – operation is not context dependent and requires only 'naming' and 'operating' knowledge – but HOFA tasks may involve sequential actions, task chaining or more in-depth knowledge of the Slack software. In effect, we can say that LOFA knowledge is required to use Slack; HOFA knowledge is required to administer Slack.

Perceptual affordances

Perceptual control allows a user to administer Slack within context with maximum efficacy. Perceptual affordances involve interactions that match functional control to the user community and the requirements of the task or project. In our scenario, then, perceptual affordances are those interactions that allow the journalist to deploy Slack to coordinate researchers to search archives for WWI images. To achieve perceptual control, a user requires functional knowledge, knowledge of the community and task (the context), and the ability to match these two domains efficiently and effectively.

According to our model, the perceptual level is where education can be most productive and it is useful to reflect on why educators should concentrate on perceptual affordances. As stated, functional affordances require operational knowledge about a technology – that is, a user needs to know what a technology can do and how to make it do those things. Perceptual affordances require the application of that knowledge in known contexts. This need for 'contextual application' provides plenty of scope for designing learning opportunities. If students lack foundational functional knowledge, then these resources can be provided;

the educator can define context by proposing a scenario and providing resources to support that scenario; the educator can define a desired outcome or outcomes – she may also limit the 'candidate' technologies available to students. Perceptual learning becomes a function of students choosing between available technologies and then operating those technologies in pursuit of the desired outcomes.

It is clear how this might work in the case of Slack and our WWI research project: a brief introduction to Slack's relevant features; access to relevant archives and databases; an allocation of project roles to students; and clear criteria for success. The aim is not to instruct students on how to use Slack but rather how to perceive Slack's enabling potential. It may be beneficial to suggest an alternative technology, perhaps something with similar though not identical features and to have students choose between them. Regardless, the skills of perceptual interaction are recognition, interpretation and application.

Adaptive affordances

The most sophisticated affordances are adaptive. In theory, these affordances will involve two sorts of adaptation. Either users will adapt the features of the technology – or, at least, their interaction with the features of the technology – to expand the range of outcomes possible with Slack, or they will adapt their use of Slack to new contexts in pursuit of a more diverse range of emergent outcomes. They may also make both types of adaptation simultaneously. An educator may propose new scenarios (including some for which Slack is, perhaps, not the ideal tool) and challenge students to adapt their use of the technology to suit.

Concluding Comments

The learning and teaching scaffold is intended as a starting point in an educator's repertoire for developing new programs/courses, or for designing learning activities in line with existing curriculum, with the aim of improving graduates' digital work readiness. Translating the scaffold to the curriculum is not without challenges. We recommend that an educator might start with one learning outcome in a subject guide, which aligns reasonably with one of the key capabilities identified in the digital capabilities descriptor (Figure 1).

It is highly recommended that the scaffold be conceived holistically for problem solving, rather than as a linear process; we do not advocate functional capability development in first year subjects/units and adaptive development in final year. Educators may decide to emphasize different affordances at different times, depending upon their learners, the curriculum, and the problem or challenge to be addressed by students. It is likely that the focus on adaptive capability would be strengthened considerably as a student approaches graduation.

Tools and technologies will inevitably change; however, according to the research

undertaken by the DWP project, adaptive capabilities are in high demand and short supply for contemporary and future digital work practices across many disciplines. From our rapid prototyping of the learning scaffold, we believe that fostering a mind-set about the interconnections of functional, perceptual and adaptive affordances is also promising to give graduates a 'competitive edge' – especially where capabilities include critical *reflection-in-action* (as well as *reflection-on-action*); and an ability to imagine and articulate ways in which the potential of technologies can be maximized in emerging contexts.

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