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# Graphic design and artificial intelligence: Interdisciplinary challenges for designers in the search for research collaboration

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**Abstract:** The introduction of electronic publishing, multimedia, the web and social media have influenced and presented challenges for graphic design. Now the implementation of artificial intelligence (AI) features within graphic design software enables practitioners to automate many design processes. However, this threatens to deskill the profession and create a second tier of ‘non-professional’ designers, particularly within less creative work that emphasises fast turnover and functional artefact production. Research at the intersection of AI and graphic design has been led by computer scientists. This paper argues, from a designer’s perspective, that a paucity of scholarly engagement by graphic designers with their own practice and of AI research has resulted in computer scientists defaulting to functional approaches to design. Acknowledging that discursive and methodological differences between computer science and graphic design renders interdisciplinary collaboration problematic, this paper places the onus on design practitioners and researchers to engage with research into AI-supported graphic design.

**Keywords:** automation, graphic design, interdisciplinary collaboration, graphic design research

## 1. Introduction

The wall of a design agency I once worked at had a sign posted that read ‘never give a geek a copy of Photoshop’. It had been placed there following an incident, where a member of the IT staff had created a company Christmas party poster, using badly composited clip-art and images from photo libraries. This vignette metaphorically symbolises, from a graphic design perspective, the divide between visual communication focussed graphic design professionals



and, what this paper shall describe as, the 'functional' disciplinary approaches of computer technology-based disciplines, such as HCI.

The above vignette suggests a cultural divide, which John Maeda encapsulates well;

We've heard the complaint before – 'Our engineers can't communicate with our designers, and vice versa'... One side envisions; the other side builds. Usually the side that builds doesn't particularly respect the other side's professed superior imagination. And the group whose duty it is to invent usually looks down on the manual labour of its compatriots (Maeda, 2000).

However, it also indicates an interdisciplinary challenge. For example, Kari Kuutti argues that HCI's adoption of design focusses largely on functionalities such as usability, which is enough to hamper communication with designers' broader visual focus on, for example, aesthetics, styling and consumer appeal (Kuutti, 2009). With this paper's focus specifically on the practice of graphic design, such interdisciplinary challenges are even more acute.

The contemporary history of graphic design has been integrally linked to its relationship with technology – sometimes embraced, at other times resisted. The emergence of desktop publishing in the 1980s revolutionised the industry, arguably professionalising it for the first time. Designers engagement with the interactivity of multimedia and online communication from the 1990s was a paradigm shift for the industry, as was social media. The increasing integration of automation into graphic design in the twenty first century as well as potential future developments in AI, presents new challenges for the profession and for researchers. As issues around artificial intelligence (AI) and graphic design are predicted, to become increasingly relevant (Kaiser, 2019) to both industry and research, the seemingly existential methodological divides between graphic design and ICT become relevant when engaging with research about automated approaches to graphic design.

This article approaches the topic from a graphic design perspective. It is an intentional approach and will discuss how much existing literature on AI and graphic design (almost exclusively computer-science-driven), suffers from flawed assumptions about and definitions of graphic design. Such existing literature is not necessarily incorrect within its own computer science parameters. However, by often starting with reductionist premises about graphic design theory and practice, much of this research renders itself limited for graphic designers and risks distorting and stunting the development of future research of this nascent topic, at a time when the AI is becoming more prominent within academia and, potentially, industry.

Critically, despite approaching the topic from a graphic designer perspective, this article argues that these limitations do not lie entirely with the 'geeks' of computer science. On the contrary (and irrespective of the technical difficulty involved in conducting AI research all but excluding the vast majority of graphic designers), this article argues that the lack of a developed and coherent graphic design discourse, may be hampering AI research into graphic design. Not only does this weaken the case for graphic design as a (already

underrepresented) specific research discourse within academia, but also leaves professional graphic design practice unprepared for future industry and organisational developments.

The article starts by locating the influence of technology in contemporary graphic design practice. It discusses its role in the changing organisational and cultural practices of the profession within industry, with particular regard to bringing graphic design practices in-house. It is a process largely influenced by the de-professionalisation of graphic design practice, within which much existing AI research appears to be trying to insert itself. Indeed, this article discusses how a by-product of this de-professionalisation is that a focus on the technological aspect of graphic design fails to acknowledge the emergence of a two-tiered system of graphic design, potentially negatively impacting on the creative agency of graphic designers.

This article looks at some existing AI research into graphic design, as well as some existing commercial AI products. The article critiques existing approaches, as well as offering evidence of discursive areas of graphic design that have been overlooked by computer science researchers. However, the article also highlights how the lack of an established graphic design research discourse may have contributed to the functionally focused AI research thus far.

The article suggests that building on the nascent, yet growing, literature on graphic design as a specific discipline can help to establish the practice as discourse, thereby allowing for a more solid foundation upon which disciplines, such as computer science, can draw from. However, given the methodological chasms, the article further argues for closer collaboration between computer scientists and graphic designers, so as to offer opportunities to more effectively and accurately define parameters for the future direction of research of AI's application to graphic design. In doing so, this potentially also offers opportunities for industry to plan, and for graphic designers to adapt, to future AI developments in their professional practice.

Without diverting the scope of this discussion into wider debates (and acknowledging the interchangeability of the terms within much popular discourse), AI is the chosen term for the broader issues in this article. However, as will be shown, automation is the more applicable term when discussing most current applications with graphic design. Moreover, in acknowledging the graphic designer perspective of this discussion, this paper does not claim to technically inform HCI developers. Rather, its aim is to promote cross-disciplinary understanding on areas of AI intersection between HCI and graphic design.

## **2. Technology and graphic design**

The influence of technology is a critical contemporary issue for professional graphic designers, who have been gradually facing the march of disruptive technologies (Drucker & McVarish, 2013). Starting with the electronic publishing revolution of the late twentieth century, a process that once empowered graphic designers, recent technological advances

have enabled the democratisation of design, allowing non-professional practitioners increasing access to many aspects of graphic design. This is especially signified by the growth of in-house graphic design departments. Often motivated by utilitarian reasons and enabled by new technologies, many non-design organisations have increasingly adopted formerly specialist graphic design services (such as basic page layout and photo-editing) in-house (Geraedts et al., 2012; Silk & Stiglin, 2016) to create fast turnaround, non-creative yet essential design materials. This is part of an industry trend which has increased steadily in recent years (Duggan, 2013; Silk & Stiglin, 2016), with 98% of in-house creative agencies offering graphic design services (Fedun, 2019).

Technological incursion into graphic design practice, especially as manifested within the in-house paradigm, presents challenges for the practice and its practitioners. For example, in-house designers are sometimes perceived as lacking the same degree of creative skills as external designers (Baker, 2008; Brown, 2008; Flavin, 2017). This perceived lack of creative authority has led to struggles around legitimacy and respect (Fishel, 2008). Indeed, many organisations indicate a preference for external agencies for creative and conceptual input, while relying on 'non-professional' in-house designers for speed of turnaround and low cost (Morrison, 2017; Walsh, 1996). This resulting ambiguity over graphic designers' roles (Girard & Stark, 2002), leads to battles over professional gravitas (Fishel, 2008) and insecurity over their professional value (Barnes et al., 2009; Lunenfeld, 2004). This reinforces a two-tiered system of graphic designer; one creative and conceptual, the other a template-driven implementer. Such technological challenges are not unique to graphic design. However, for a profession defined by its practitioners' love of design (Oldham, 2017), motivated by dreams of a creatively exciting and rewarding career (Leonard, 2016; Wood, 2015), the challenges for professional practitioners are existential. Indeed, such creative limitations are even at odds with the design industry's own marketing portrayal of itself (Dorland, 2009).

It is also understandable how the more functional 'non-professional' model of graphic design (such as in-house models), might seem attractive for academic research into machine generated approaches to graphic design. The outcomes are likely to be more template driven, predictable and replicable. With in-house graphic design work often described as uncreative and dull (Baker, 2008; Brown, 2014; Flavin, 2017), it becomes easy to envisage the attraction for industry of machine generated solutions for in-house, corporate, or other less creative graphic design environments and outputs.

Nevertheless, the increase in these approaches solidifies a functional outcomes-limited definition onto graphic design as a whole. A formulaic view of graphic design, that the AI research that this article engages with also appears to engage with. This may partially be due to the nascent state of research into AI and graphic design, as well as the disciplinary methods of computer science. However, this article argues that one reason for these limitations, can be traced to graphic design's lack of establishment as a specific educational discipline and academic discourse. This, in turn, leaves graphic design susceptible to a lack of

depth, gravitas and authority when it becomes a subject of investigation by computer science-focussed AI researchers.

### **3. The computer science approach to AI and graphic design**

AI's intersection with graphic design can be usefully divided into three categories. Automation within professional commercial software, amateur (often online) template-driven design tools, and experimental—academic research into graphic design. The first two are discussed for context. However, because of its front-line research intersection with the creative practices (and thus future development) of graphic design, it is the latter that is of most concern for this article.

With professional graphic design applications (such as InDesign and Illustrator) remaining complex for design novices to use, recent years have seen a growth in easily available online graphic design tools. For example, products such as Canva (<https://www.canva.com>) and Adobe's Spark (<https://spark.adobe.com>), are aimed at non-professional graphic designers. While surely utilising underlying AI and machine generation technology, these products are essentially template driven creative tools. Moreover few, if any, of these tools can currently be considered complex or customisable enough for (nor aimed at) the professional graphic design industry and so are not the focus of this article.

While amateur graphic design applications largely rely on templates, AI within professional graphic design software has tended to focus on automating laborious tasks – something that creatively driven professional graphic designers welcome. For example, Photoshop has long had 'actions' to automate duplicate editing effects for multiple images, as well as tools for simplifying isolated complex compositing tasks, for example the 'healing brush'. Aside from such targeted implementations of AI technology, professional graphic design software tools remain largely immune from the influence of AI. Indeed, professional graphic design software tends to promote its ability to allow professionals precise control of the creative design process, such as incremental control of font kerning and colour management. Thus, one can see how automating the more tedious and repetitive 'artworking' tasks of graphic design creation would be popular and useful for professionals, allowing designers 'more opportunity and time to concentrate on the creative side of projects' (Nolan, 2018). Conversely, a template-driven solution would tend to be unpopular with professional practitioners, whose role is to create unique creative solutions. It is something that Adobe, as the market leader in professional visual design software tools, appears very aware of when developing using its AI technology 'Sensei'. Indeed, Adobe's focus is on automation, increased accuracy, and time saving approaches; claiming to enable designers' to 'Find what you need. Faster', 'Eliminate time-consuming tasks' and to 'Unleash your creativity to design without limits' (Adobe, NA). With this professional background in mind, it is informative to engage with the academic incursions into graphic design and AI.

With AI's origins at MIT (Bratteteig & Verne, 2018), it is perhaps unsurprising that most literature about AI and graphic design has tended to be initiated from within the field of

computer science. Moreover, the technological and scientific skills required to drive practical AI research would lie well outside of the scope of most graphic design professionals and researchers. For example, in the normal course of practice, graphic designers would never engage with mathematical formulas for gauging the importance of design elements on the page, as O'Donovan et al. (2014) do in their study of single page layouts, discussed shortly.

With such disciplinary disconnect, emerging research into AI and graphic design is reflective of the disciplinary practices of computer science, primarily engaging with and contextualising graphic design in relation to technology. For example Cook and Sekyeong (2019), while acknowledging the functional approach of AI (which they refer to as 'scientised'), define graphic design as causally and indissolubly intertwined with available technologies. It is a reading of graphic design that, while having a relational connection, does not align with dominant histories of graphic design, which tend towards definitions relating to visual communication (Meggs & Purvis, 2012; Newark, 2002). Moreover, their provocation, while unique, remains a pastiche of graphic design as a craft comprised of generative artefactual-focussed tasks.

The computer science origin of AI may explain the functional starting point of much existing research into AI and graphic design, much of which focuses on machine learning for the automation of specific graphic design tasks and outcomes. For example, O'Donovan et al. (2014), discuss a project for creating single page design layouts. It is an approach that is especially targeted at 'improving graphic designs' for untrained 'novice' designers (p. 1200). The authors clearly struggle with the subject of their investigation, conceding that they found that 'many books on graphic design principles are vague and difficult to build tools from directly' (p. 1212). In describing graphic design literature in this absolutist way, it appears that the authors are looking for more unambiguous definitions than the discourse of graphic design is able to easily supply. As a result, the authors' computer science-entrenched research parameters can appear clumsy, as they attempt to compartmentalise the more nebulous language, definitions and practices of graphic design. For example, they describe graphic design as 'a set of visual elements, including text' (p. 1202), alongside observations that designers 'often use grids' (p. 1201). In adopting these definitions, the authors describe their goal to 'create layouts which respect the principles of graphic design, such as alignment and symmetry in a variety of styles' (p. 1202). These somewhat formulaic definitions, while indisputable in isolation, are sparsely informed by professional context. Similarly, the study's choice of task, the automated design of a single page layout, continues this functional path, with goals consisting of 'pleasing arrangements of elements' (p. 1200). These are notions of aesthetic pleasantries in AI that Kaiser (2019) critiques as reliant on culturally situated definitions of creativity. Thus, normalising unproven computational assumptions of creativity in the pursuit of enhanced productivity in commercial design applications.

This lack of discursive engagement further reduces graphic design to a functional task-driven practice of page layout, having been removed from both the professional and discursive context within which such tasks would normally be carried out. For example, there is no

acknowledgement of a creative brief, which would normally indicate the direction which a page design would take, the subject matter, intended audience, its role and intended use (Meron, 2021). Notwithstanding the potential technical limitations of AI for addressing these omissions, without even acknowledging them it is debatable that isolated tasks can even be considered graphic design. In doing so, academic research into AI and graphic design risks contributing to a reductive pedagogic mechanisation of a creative procedural practice. Reducing graphic design practice to technically implementing aesthetic or 'layout' solutions, can result in rendering graphic designers as mere stylists (Lunenfeld, 2004), reinforcing everyday challenges to the freedom of self-expression and the professionalism of graphic designers (Barnes et al., 2009) which has already been enabled by existing technological advances (Drucker & McVarish, 2013).

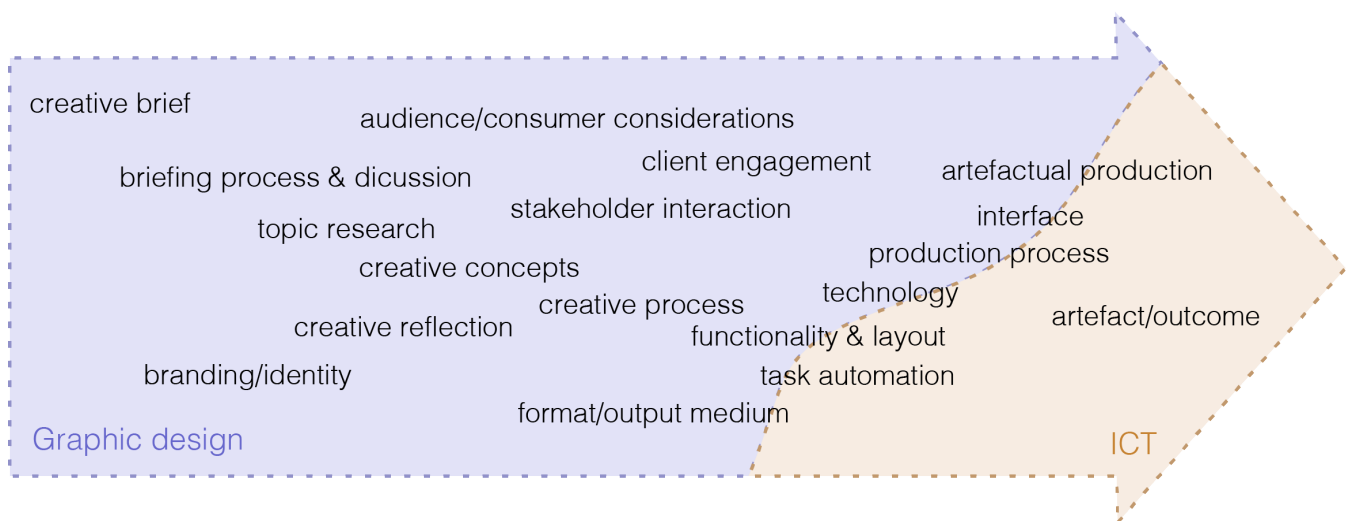


Figure 1. Current AI research tends to intersect with the later, functional stage of the graphic design process

The use of AI for non-professional designers is similarly explored by Jahanian et al. (2013a). Once again, the authors' approach appears rooted in notions of task-driven production of design artefacts. However, they go a step further than O'Donovan et al. (2014), in acknowledging the requirement for the designs to have a wider purpose. For example, they differentiate between, what they describe as, 'high-level' and 'low-level' design tasks (p 95), where high-level refers to more conceptual design requirements, as opposed to low-level aesthetic tasks. Nevertheless, the systems discussed still fall within the boundaries of automated aesthetic layout of visual elements for design products; 'to evaluate aesthetics of the visual design' (p 102), often channelling rigid assumptions, that the graphic design process is initiated by 'choosing a good image and then extracting the color palette from that image' (Jahanian et al., 2013b, p 1). Once again, while not incorrect in isolation, it



indicates a linear immersion into the practice of graphic design, limiting (and perhaps even distorting) the scope of the research.

Similarly, other computer science researchers also approach the use of AI within graphic design as largely a mechanical, product creation, or evaluative tools for automated product creation (Bylinskii et al., 2017). Tan et al. (2019) see the role of AI as striving to improve machine generated outcomes for results driven aesthetic design outputs. Albeit, they also explore notions of cooperation between AI driven machines and humans. Like the previous examples, Tan et al. (2019) define rigid criteria of graphic design rules. For example, they specify a mode of enquiry based on, what they term, 'Color and Style Rules Extraction' (p 572). This is justified by what they argue are the universal existence of 'eleven basic perceptual color categories' (p 572) for humans. Nevertheless, from that graphic design perspective, even where the AI research's aim is to engage with more conceptual or semantic elements of graphic design, the focus appears limited to assumptions about functional elements of design, such as fonts, colours and layout parameters (Zhao et al., 2018), and suggestions that the core of graphic design is centred around physical concepts such as 'page layout', with success and failure gauged by measurable visual outcomes (Zheng et al., 2019).

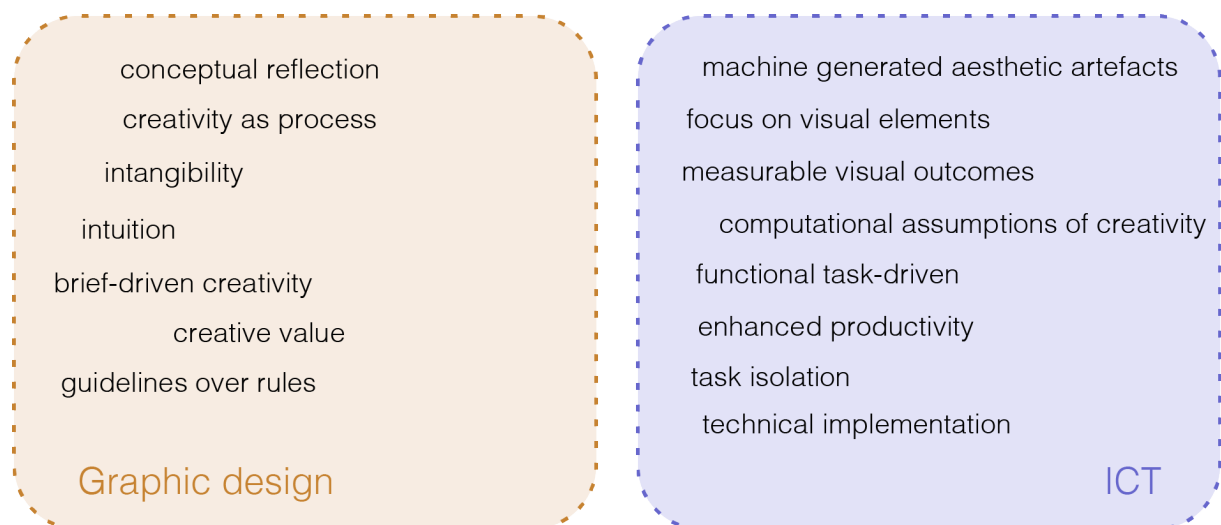


Figure 2. Someday the twain shall meet: methodological challenges for graphic design and ICT practices in AI

These articles highlight discursive issues that some AI computer scientists have come across when attempting to investigate graphic design. Many of the above projects into AI and graphic design indicate an increasingly sophisticated and impressive progression; often engaging with semantics, notions of creativity and even content aware layout design. This is clearly a route of progress. However, as discussed, these technological advances appear to

remain hampered by a lack accessible graphic design sources with which to inform their algorithms. Irrespective of the technical efficacy, if future excursions into graphic design and AI are to move beyond machine generated aesthetic artefacts, then more input from professional graphic designers (incorporating their professional goals and aspirations) becomes critical. Doing so, requires increased collaboration with graphic design literature, practitioners and researchers. Thus, from an HCI perspective, variations of hybrid intelligence approaches (for example) may offer future opportunities (Lasecki, 2019; Li et al., 2020).

Some AI-HCI research has dealt with aspects of creativity that could be argued as allied to graphic design, for example art or illustration, often challenging philosophical boundaries of the human versus artificial creativity (Audry & Ippolito, 2019). Utilising allied research that informs understanding of practitioners' potential technophobic concerns about AI (Ragot et al., 2020), as well as methodological frameworks for encouraging user collaboration with AI technology (Oh et al., 2017), may also strengthen the HCI contribution to cross-disciplinary collaboration with graphic designers. Nevertheless, challenges to interdisciplinary collaboration remain from outside of HCI.

Interdisciplinary obstacles appear most prominent from within graphic design itself. As will be discussed now, the methods and practices of graphic design remain fluid, often intangible and, in the case of its practitioners, sometimes even overtly resistant to academic research.

#### **4. Interdisciplinary challenges**

The studies discussed appear to have brought disciplinary-informed functional definitions of graphic design into their AI research. However, graphic design (academically and professionally) is imprecise and, by default, interdisciplinary (Davis, 2012; Harland, 2015). Indeed, Heller refers to graphic design as 'somewhere between science and superstition (or fact and anecdote)', with its dissemination requiring a 'variety of tools and sources' (2019, par.3). Moreover, others have highlighted graphic designs' reliance on the intangible, such as intuition (Bennett, 2006; Taffe, 2017). None of which lends itself easily to computer science. Where graphic design research has emerged as a nascent academic discourse, its methodologies are diverse. Some researchers have contextualised it diagrammatically (Harland, 2011), others visually (van der Waarde & Vroombout, 2012), and even as a self-authored and entrepreneurial practice (Armstrong, 2009). Thus, as graphic design continues its complex, even fractured (Ambrose et al., 2020), interdisciplinary evolution, reflected in its professional (Dziobczenski & Person, 2017) and pedagogic (Littlejohn, 2017) formats, the research challenges for computer scientists are many.

Moreover, with graphic design still struggling to define and assert itself at relatively rudimentary levels (compared to more established design practices such as architecture, UX, or product design), it is understandable that computer scientists may be bewildered by

graphic designs' practices. As is discussed now, this is a challenge that emerges from graphic design in both academic research and professional practice.

#### *4.1 Graphic design research challenges*

Academically, graphic design has been accused of lacking theoretical reflection (Harland, 2011; Logan, 2006) and research discourse (Laurel, 2003), with an erratic professional history (Julier & Narotzky, 1998). Moreover, graphic design has often been treated as a supplementary topic within design research, or largely as an aesthetic discipline (Heller, 2015; Jacobs, 2017; Walker, 2017). Indeed, there are unfinished debates as to what the practice of graphic design comprises of (Corazzo et al., 2019), with practitioners themselves sometimes unable to agree on what term to use (Meron 2021). As such, it is unsurprising that research focussing on graphic design was described by the 2014 UK Research Excellence Framework as possessing a weak intellectual underpinning (HEFCE, 2014).

Lacking a broad canon of authoritative academic literature to draw upon, it is understandable that many computer science AI articles have drawn from graphic design practices which are most accessible. Seemingly, this has resulted in drawing on graphic design practice's most visible functional aesthetic outputs, such as the page layouts focussed on in many of the above articles. Thus, it would also seem prudent for computer science AI researchers to collaborate with graphic designers, perhaps even working directly with professional practitioners. However, this approach is not without its own potential pitfalls.

#### *4.2 Professional challenges*

Challenges to interdisciplinary collaboration are potentially compounded by studies suggesting that graphic design practitioners are particularly resistant to research (Banks et al., 2002), seemingly being flippant (Roberts et al., 2015) and at times even obstructive (Dorland, 2017). Potential cross-disciplinary collaborators may also note the paradox that, while being experts at communicating on behalf of clients, graphic designers can be less adept at advocating for themselves (Phillips, 2015).

These studies offer no blueprints for potential cross-disciplinary collaborators. However, research suggests that practitioners have more respect when stakeholders have knowledge of and affinity with the graphic design process (Ambrose et al., 2020; Banks et al., 2002; Holzmann & Golan, 2016). Thus, it is advisable that computer scientists working on AI research with graphic designers factor these potential difficulties into their methodologies. In particular, that AI researchers ensure that they have a good grounding in graphic design practices and processes, over and above the generation of artefactual outcomes of the

profession. However, with a still evolving pedagogy, the wider onus for practice clarity is perhaps on graphic design researchers, as it is they who may have most to gain.

## **5. A broader challenge for graphic design?**

While collaboration and bridging disciplinary gaps in AI research is important for both computer scientists and graphic designers, it is graphic designers who have most to benefit. The functionalisation of graphic design threatens to further de-professionalise the industry and reduce the everyday creative authority of graphic designers (Drucker & McVarish, 2013; Helfand, 2002). As such, it is to the benefit of graphic design researchers to address discursive gaps and strengthen the academic authority of the wider discipline.

While cautioning that the voices of design students themselves be influential in the process, Kaiser (2019) suggests addressing the redirection of graphic design pedagogy, by adding relationships between designers and technology to the syllabus, thus promoting a more holistic interrelationship between design and ICT. It is a caution that appears well founded, in the context of technology potentially rendering graphic design as a purely functional practice. But it is a balancing act between creativity and technology that appears historically necessary for graphic designers to embrace, if not enthusiastically. At least until the future capabilities of AI and graphic design become more apparent, we are largely left with speculation.

Current successful advances in AI and graphic design appear to be entrenched within the realm of time saving automation and machine learning for the design software tools themselves – something that, despite the potential threat of deskilling, still allows graphic designers creative control of projects. Thus, allowing practitioners to maintain creativity, but consign tedious and repetitive tasks to automation.

Whether AI systems have begun to get close to being able to produce usable visually aesthetically pleasing graphic design artefacts, is debatable. When it comes to advancing creative graphic design, such as the layout projects discussed in this paper, AI appears to be still at an early experimental stage. From a technical perspective, it is a process that is likely to continue to be improved by computer scientists. With that in mind, it appears prudent for graphic designers to embrace collaboration in this field, so as to have agency into this eventuality. Moreover, for this to be successful in a professional and industrial setting, it will require the collaboration of graphic designers, within industry as well as academia. For the disciplinary reasons discussed in this article, the methods by which this collaboration can be most effective remain largely to be explored.

## **6. Conclusion**

This article has contextualised AI as the latest in a series of technological challenges that professional graphic design has faced in its post-1980s digital era. It is a challenge that offers opportunities for the fledgling academic discourse of graphic design to add to its canon of

knowledge and begin to further distinguish itself as a specific research discipline. However, until a degree of consensus or, at least, a critical mass of literature has been assembled on the discipline, external researchers are likely to default to the more overt manifestations of graphic design. For computer science researchers looking at graphic design and AI, the default appears to entail a focus on the functional artefactual outcomes of graphic design, such as page layout creation. These may achieve the stated aims within an HCI paradigm, but their outcomes, even in an experimental setting, indicate a lack of disciplinary engagement with graphic design.

This article has argued that this largely presents a challenge for graphic design practitioners and researchers, where the artefact is predated by client briefs, stakeholder engagement and process management, research, and (critically) the creative conceptual stage. These are graphic design practice areas that AI is unlikely to address even in the near future. Thus, current omissions in research into AI and graphic design are at least partially attributable to an underdeveloped and underrepresented graphic design discourse. While impacting academic research, it also leaves professional graphic design practice unprepared for ongoing industry change and future development.

This lack of preparedness, combined with the aforementioned lack of disciplinary authority, suggests broader challenges for graphic design within industry as well as academia. While graphic design continues to struggle, practices such as architecture and UX design have established themselves as distinct design disciplines. The former has a long-established professional tradition. However, despite still being an emerging design practice and remaining somewhat disciplinary-fluid within formal design education, UX's conscious embrace of interdisciplinarity has resulted in a professional acceptance within a diverse-range of industries (Kou & Gray, 2019). Thus, there is precedent for graphic design to look to other disciplinary models while, at the same time, seeking to assert its own status within an interdisciplinary environment. Even the process of pursuing such a goal may help graphic design to better establish disciplinary distinction and authority, and research collaboration with established practices can only be of benefit.

In summary, computer science AI scholars and their research may benefit from collaboration with graphic designers. Albeit, this may require acknowledging the interdisciplinary challenges discussed in this article and adopting (and adapting) practice-specific methodologies accordingly. In turn, if graphic designers wish to preserve and assert the creative, conceptual and organisational aspects of their practice, it may well be time to start sharing that metaphorical copy of Photoshop.

## 7. References

Adobe. (NA). *Adobe Sensei empowers you to create — and wow your customers*. Adobe. Retrieved 19 February 2020 from <https://www.adobe.com/au/sensei/creative-cloud-artificial-intelligence.html>

- Ambrose, G., Harris, P., & Ball, N. (2020). *The Fundamentals of Graphic Design* (2 ed.). Bloomsbury.
- Armstrong, H. (2009). *Graphic Design Theory: Readings from the Field* (Design Briefs). Princeton Architectural Press.
- Audry, S., & Ippolito, J. (2019). Can Artificial Intelligence Make Art without Artists? Ask the Viewer. *The Artist and Journal of Home Culture*, 8, 35.
- Baker, D. (2008, August 08, 2008). *Can In-house Design Departments Be Respectable?* AIGA. Retrieved 1/2/2018 from <https://www.aiga.org/can-in-house-design-departments-be-respectable>
- Banks, M., Calvey, D., Owen, J., & Russell, D. (2002). Where the Art is: Defining and Managing Creativity in New Media SMEs. *Creativity and Innovation Management*, 11(4), 255-264. <https://doi.org/doi:10.1111/1467-8691.00257>
- Barnes, C., Taffe, S., & Miceli, L. (2009). Multiple Information failure: A case of different Investments in Form and content in Graphic design. *Visible Language*, 43(2/3).
- Bennett, A. (2006). *Design Studies: Theory and Research in Graphic Design*. Princeton Architectural Press.
- Bratteteig, T., & Verne, G. (2018). *Does AI make PD obsolete?: exploring challenges from artificial intelligence to participatory design* Proceedings of the 15th Participatory Design Conference: Short Papers, Situated Actions, Workshops and Tutorial - Volume 2, Hasselt and Genk, Belgium.
- Brown, N. (2014). *5 Advantages and Challenges of In-House Designers*. HOW. Retrieved 7/11/2017 from <http://www.howdesign.com/in-house-designer-blog/making-jump-agency-house/>
- Brown, T. (2008). Design Thinking. *Harvard Business Review*, 86(6), 84-92. <https://doi.org/10.1024/0036-7281.150.6.297>
- Bylinskii, Z., Kim, N. W., O'Donovan, P., Alsheikh, S., Madan, S., Pfister, H., Durand, F., Russell, B., & Hertzmann, A. (2017). *Learning Visual Importance for Graphic Designs and Data Visualizations* Proceedings of the 30th Annual ACM Symposium on User Interface Software and Technology, Quebec City, QC, Canada.
- Cook, R., & Sekyeong, K. (2019, 9-11 October 2019). Speculating on the Future of Graphic Design in the Age of Intelligent Machines. Beyond Intelligence: Desform 2019, Massachusetts Institute of Technology.
- Corazzo, J., Harland, R. G., Honnor, A., & Rigley, S. (2019). The Challenges for Graphic Design in Establishing an Academic Research Culture: Lessons from the Research Excellence Framework 2014. *The Design Journal*, 23(1), 7-29. <https://doi.org/10.1080/14606925.2019.1682446>
- Davis, M. (2012). *Graphic design theory*. Thames & Hudson.
- Dorland, A. (2009). Routinized Labour in the Graphic Design Studio. In G. Julier (Ed.), *Design and Creativity : Policy, Management and Practice* (pp. 186-214). Bloomsbury Publishing.
- Dorland, A. (2017). The View From The Studio: Design Ethnography and Organizational Cultures. *Ethnographic Praxis in Industry Conference Proceedings, 2017*;
- Drucker, J., & McVarish, E. (2013). *Graphic design history : a critical guide*. Pearson.
- Duggan, B. (2013). *The Rise of the In-House Agency*. A. o. N. Advertisers.
- Dziobczenski, P. R. N., & Person, O. (2017). Graphic Designer Wanted: A Document Analysis of the Described Skill Set of Graphic Designers in Job Advertisements from the United Kingdom. *International Journal of Design*, 11(2).
- Fedun, V. (2019). *2019 In-House Creative Industry Report*.
- Fishel, C. (2008). *In-House Design in Practice; Real-world solutions for graphic designers*. FW Publications.

- Flavin, B. (2017). *Where Do Graphic Designers Work? In-House vs. Agency vs. Freelance*. Rasmussen. Retrieved 3/8/2018 from <https://www.rasmussen.edu/degrees/design/blog/where-do-graphic-designers-work/>
- Geraedts, J., Verlinden, E. D. J., & Stellingwerff, M. (2012, 7-11 May 2012). Three views on additive manufacturing: business, research, and education. TMCE 2012, Karlsruhe, Germany.
- Girard, M., & Stark, D. (2002). Distributing intelligence and organizing diversity in new media projects. *Sociedade e Estado*, 17, 153-192.
- Harland, R. (2011, 2011/01/01). The Dimensions of Graphic Design and Its Spheres of Influence. *Design Issues*, 27(1), 21-34. [https://doi.org/10.1162/DESI\\_a\\_00054](https://doi.org/10.1162/DESI_a_00054)
- Harland, R. G. (2015). Seeking to build graphic design theory from graphic design research. In P. Rodgers & J. Yee (Eds.), *The Routledge Companion to Design Research* (pp. 87-97). Routledge.
- HEFCE. (2014). Research Excellence Framework 2014: Overview report by Main Panel D and Sub-panels 27 to 36.
- Helfand, J. (2002). De Stijl, New Media, and the Lessons of Geometry. In S. Heller, M. Bierut, & W. Drenttel (Eds.), *Looking closer 4, critical writings on graphic design*. Allworth Press.
- Heller, S. (2015). *The Education of a Graphic Designer*. Allworth Press.
- Heller, S. (2019). Teaching tools. In *Teaching Graphic Design History* (pp. 312). Allworth.
- Holzmann, V., & Golan, J. (2016). Leadership to Creativity and Management of Innovation? The Case of the "Innovation Club" in a Production Company. *American Journal of Industrial and Business Management*, 6, 60-71.
- Jacobs, J. (2017). Managing the Creative Process within Graphic Design Firms: A Literature Review. *Dialectic*, 1(2), 155-178.
- Jahanian, A., Liu, J., Lin, Q., Tretter, D., O'Brien-Strain, E., Lee, S. C., Lyons, N., & Allebach, J. (2013a). *Recommendation system for automatic design of magazine covers* Proceedings of the 2013 international conference on Intelligent user interfaces, Santa Monica, California, USA.
- Jahanian, A., Liu, J., Lin, Q., Tretter, D. R., O'Brien-Strain, E., Lee, S. C., Lyons, N., & Allebach, J. P. (2013b). Automatic design of colors for magazine covers. *Electronic Imaging*,
- Julier, G., & Narotzky, V. (1998). *The Redundancy of Design History* Practically Speaking, Wolverhampton University.
- Kaiser, Z. (2019, 2019/05/04). Creativity as Computation: Teaching Design in the Age of Automation. *Design and Culture*, 11(2), 173-192. <https://doi.org/10.1080/17547075.2019.1609279>
- Kou, Y., & Gray, C. M. (2019). A Practice-Led Account of the Conceptual Evolution of UX Knowledge. Paper presented at the Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems, Glasgow, Scotland Uk. <https://doi.org/10.1145/3290605.3300279>
- Kuutti, K. (2009). HCI and design: uncomfortable bedfellows? In T. Binder, J. Löwgren, & L. Malmberg (Eds.), *(Re)Searching the Digital Bauhaus* (pp. 43-59). Springer.
- Lasecki, W. S. (2019). On Facilitating Human-Computer Interaction via Hybrid Intelligence Systems. *Collective Intelligence 2019*,
- Laurel, B. (2003). *Design Research: Methods and Perspectives*. MIT Press.
- Leonard, N. (2016). *Becoming a successful graphic designer*. Bloomsbury.
- Li, Y., Lasecki, W. S., Kumar, R., & Hilliges, O. (2020). *Artificial Intelligence for HCI: A Modern Approach* CHI 2020, April 25–30, 2020, Honolulu, HI, USA.
- Littlejohn, D. (2017). Disciplining the graphic design discipline: The role of external engagement, mediating meaning, and transparency as catalysts for change. *Art, Design & Communication in Higher Education*, 16(1), 33-51. [https://doi.org/10.1386/adch.16.1.33\\_1](https://doi.org/10.1386/adch.16.1.33_1)

- Logan, C. D. (2006). Circles of practice: educational and professional graphic design. *Journal of Workplace Learning, 18*(6), 331-343. <https://doi.org/doi:10.1108/13665620610682062>
- Lunenfeld, P. (2004). Media design: new and improved without the new. *New media & society, 6*(1), 65–70.
- Maeda, J. (2000). Education and Specialization: Who are tomorrow's digital designers? In *Websights: The Future of Business and Design on the Internet*. RC Publications.
- Meggs, P. B., & Purvis, A. W. (2012). *Meggs' history of graphic design* (5th ed.). John Wiley & Sons.
- Meron, Y. (2021). Terminology and Design Capital: Examining the Pedagogic Status of Graphic Design through Its Practitioners' Perceptions of Their Job Titles. *International Journal of Art & Design Education, 40*(2), 374-388. doi: <https://doi.org/10.1111/jade.12353>
- Meron, Y. (2021). "What's the Brief?": building a discourse around the graphic design brief. *M/C Journal, 24*(4). doi: <https://doi.org/10.5204/mcj.2797>
- Morrison, D. (2017). The ISBA In-House Agency Survey 2017. ISBA.
- Newark, Q. (2002). What is graphic design. RotoVision.
- Nolan, C. (2018). *How machine learning and AI are changing design*. Vertical Leap. Retrieved 19 February 2020 from <https://www.vertical-leap.uk/blog/how-machine-learning-and-ai-are-changing-design/>
- O'Donovan, P., Agarwala, A., & Hertzmann, A. (2014, Aug). Learning Layouts for Single-Page Graphic Designs. *IEEE Transactions on Visualization and Computer Graphics, 20*(8), 1200-1213. <https://doi.org/10.1109/TVCG.2014.48>
- Oh, C., Lee, T., Kim, Y., Park, S., Kwon, S., & Suh, B. (2017). *Us vs. Them: Understanding Artificial Intelligence Technophobia over the Google DeepMind Challenge Match* Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems, Denver, Colorado, USA. <https://doi.org/10.1145/3025453.3025539>
- Oldham, C. (2017). Oh sh\*t what now? Honest advice for new graphic designers. Laurence King Publishing Ltd.
- Phillips, P. L. (2015). *Managing Corporate Design: Best Practices for In-House Graphic Design Departments*. Allworth Press.
- Ragot, M., Martin, N., & Cojean, S. (2020). *AI-generated vs. Human Artworks. A Perception Bias Towards Artificial Intelligence?* Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems, Honolulu, HI, USA. <https://doi.org/10.1145/3334480.3382892>
- Roberts, L., Wright, R., & Price, J. (2015). *Graphic Designers Surveyed*. GraphicDesign&.
- Silk, A. J., & Stiglin, M. M. (2016). Build It, Buy It Or Both? Rethinking the Sourcing of Advertising Services. *International Journal of Marketing Studies, 8*(1), 1-13.
- Taffe, S. (2017, 2017/07/28). Who's in charge? End-users challenge graphic designers' intuition through visual verbal co-design. *The Design Journal, 20*(sup1), S390-S400. <https://doi.org/10.1080/14606925.2017.1352916>
- Tan, H., Xu, B., & Liu, A. (2019). Research and Extraction on Intelligent Generation Rules of Posters in Graphic Design. In P.-L. P. Rau, *Cross-Cultural Design. Methods, Tools and User Experience* Cham.
- van der Waarde, K., & Vroombout, M. (2012). Communication Design Education: Could Nine Reflections Be Sufficient? *Visible Language, 46*(1/2), 1-6.
- Walker, S. (2017, 2017/09/03). Research in Graphic Design. *The Design Journal, 20*(5), 549-559. <https://doi.org/10.1080/14606925.2017.1347416>
- Walsh, V. (1996). Design, innovation and the boundaries of the firm. *Research Policy, 25*, 509-529.



- Wood, A. (2015, 1/4/2015). *13 reasons why you should follow your dreams and become a graphic designer*. Creative Boom. Retrieved 6/6/2018 from <https://www.creativeboom.com/tips/13-reasons-why-you-should-follow-your-dreams-and-become-a-graphic-designer/>
- Zhao, N., Cao, Y., & Lau, R. (2018). What characterizes personalities of graphic designs? *ACM Transactions on Graphics (TOG)*, 37(4), 1-15. <https://doi.org/10.1145/3197517.3201355>
- Zheng, X., Qiao, X., Cao, Y., & Lau, R. W. H. (2019). Content-aware generative modeling of graphic design layouts. *ACM Trans. Graph.*, 38(4), 1-15. <https://doi.org/10.1145/3306346.3322971>

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