074

Designing for Responsible Innovation in the AI Era

Yun WANG
Yingqing XU

98–103

From a cross-disciplinary research perspective, the design discipline has launched a new round of expansion. Design scholars are encountering new challenges in research projects that deeply integrate science, technology and design. With Artificial Intelligence (AI), rapid technological development will change how we think and live in the future, reshaping social protocols and moral ethics and resulting in an immense but immeasurable impact. AI's implemental nature also provides a means for the possibility of self-correction. Designers' depth and diversity of understanding and speculation about such a new tool are still far from enough. As important stakeholders of innovation, designers need to actively engage at the forefront of promoting innovation value and design ethics. Responsible design in the context of responsible innovation should formulate more forward-looking goals and tasks as a facilitator, stressing the ignored points in the world.

#design thinking

#design ethics

#responsible design

#cross-disciplinary research

After presenting the idea that design needs to address *wicked problems* in society, Richard Buchanan stated at Ohio State University's first conference on doctoral education in design in 1998 that '*neoteric thinking was based on new problems encountered in practical life and serious theoretical reflection, and that the goal of neoteric education was to gather resources to find new ways of approaching new problems*' (Buchanan 1998). Two decades later, in 2017, Ken Friedman noted that practice-orientated PhD degrees should be encouraged with new research fields at MIT Leonardo's special section on a PhD in art and design (Friedman & Ox, 2017). Facing today's redundant products and technologies, the developing extremes of design activities (Fallman 2008; see Figure 1) will likely be cross-disciplinary studies (pursuing truth) and cutting-edge possibility exploration grounded in humanity and sociality. Therefore, new research topics are bound to emerge in the continuous interaction and collision of different disciplines. A crucial question is the possibility of design scholars generating new perspectives on academic value and research methods in these new fields.

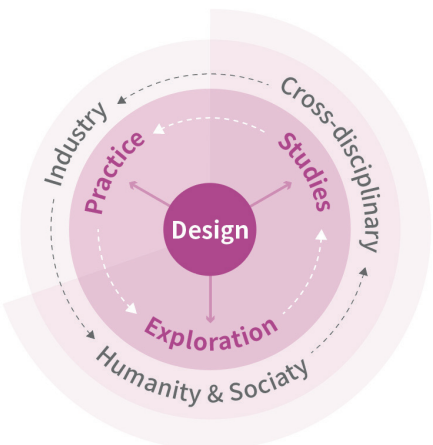

Figure 1. Three extremes of design activities. *Source: Authors, adapted from Fallman (2008).*

Compared with other research fields, the number of design PhDs is still limited worldwide. According to studyportals.com, 69 universities, primarily located in Europe and the United States, offer English-taught programs in design, and also serve as major contributors to mainstream design literature. In mainland China, the Ministry of Education adjusted design to be a first-tier discipline in 2011. According to the report of the fourth China University Subject Rankings in 2017, some 16 institutions are authorised to offer PhD degrees in design, including comprehensive universities and independent art colleges (Ministry of Education Degree and Graduate Education Development Center 2007). For example, the Academy of Arts & Design at Tsinghua University was one of the first institutions to set up such a PhD programme, and its enrolment size is growing. In 2019, 94 PhD candidates were admitted – nearly three times more than in 2017. With the increasing exploration of new research paradigms, Chinese design scholars have become a new force that cannot be ignored by knowledge producers in this field.

Moreover, China is currently at the forefront of global Information and Communications Technology (ICT) application development, with a huge physical and virtual consumer market. Chinese scholars in design have never before been in such a position: within reach of a substantial number of excellent technical experts, efficient means of technology and massive-scale data. From the perspective of cross-disciplinary research, the design discipline has launched a new round of expansion. In the past century, many pioneer organisations have integrated theories and technologies from diverse fields to spark innovation, from Bell Labs (established in 1925) to Hewlett Packard (1939), Xerox PARC (1970) and Tesla (2003). Design research began playing an important role in the latter three pioneers. The number of cross-disciplinary PhD programmes has increased gradually in recent years, and the intersection of design and ICT is one of the most eye-catching combinations.

Top Chinese universities have started to set up cross-disciplinary programmes, such as a master's programme in information art and design jointly constructed by the Academy of Arts & Design, the Department of Computer Science and the School of Journalism and Communication at Tsinghua University and the Information + X doctoral programme at Zhejiang University. Several new research centres have also been established, such as the Art and Science Research Centre and the Future Laboratory at Tsinghua University, the Digital Innovation Centre (CDI) and the Sustainable Future Design Research Centre (SustainX) at Tongji University and the IDEA Lab at Zhejiang University.

Design scholars are encountering new challenges of innovation in research that deeply integrates computing thinking, engineering thinking and design thinking. The development of AI has significantly improved scholars' skills in data mining and analysis, and the mastery of related technologies has also directly affected the efficiency and quality of design innovation. Bombarded with the dense knowledge network of research fields such as sociology, cognitive psychology, brain science and big data computing, scholars with a design education background often feel overwhelmed and confused about the academic value of cross-disciplinary design. In the rapid waves of the technological revolution, designers need to rethink their role as a bridge between art and science and between humanity and technology and observe and explore new wicked problems in today's world from new perspectives. AI will transform our future thoughts and lifestyles, reshaping social protocols and moral ethics, while resulting in an immense but invaluable impact. On the one hand, AI has unambiguously revealed many neglected social problems of inequality and discrimination; on the other hand, it often draws conclusions based on big data. However, due to its inability to distinguish the authenticity of data, it magnifies longstanding biases and further accelerates social inequality. Batya Friedman's value sensitive design theory summarises three types of biases in computing: the pre-existing bias rooted in social institutions, practices and attitudes; the technical bias from the resolution of issues in technical design; and the emergent bias generated in the context of use by real users (Owen et al. 2013).

As we know, before the invention of Graphical User Interfaces (GUIs), the visually impaired workforce interacted with computers via keyboards. The development of GUIs has drastically improved the user experience for many people, but regrettably, it has reduced the experience for visually impaired computer users (Owen et al. 2013). Due to data discrimination, decision-making AI systems make it more difficult for ethnic minorities, women and people with a history of mental illness to find jobs (Buolamwini & Gebru 2018), while the disabled, the elderly, people on low-incomes and other less-privileged groups left behind by the digital era have found themselves out of the spotlight. AI bias certainly has its destructive potential, yet its implemental nature also provides a means for the possibility of self-correction. The guide book *Understanding Artificial Intelligence Ethics and Safety*, compiled by David Leslie, raises key issues, such as fairness, accountability, sustainability, safety and transparency (Leslie, 2019). Today, scholars are paying increasingly more attention to narrowing the gap between the promises made by science and technology and human beings inheriting the future. Awareness and debate on this issue can have a positive effect on promoting social responsibility in innovation: '*Responsible innovation is a collective commitment to care for the future through responsive management of science and innovation at present*' (Owen et al. 2013). As important stakeholders in innovation, designers need to actively play a leading role in defining innovation value and design ethics.

Responsible innovation entails a collective and continuous commitment with four dimensions – anticipatory, reflective, deliberative and responsive – calling for '*an iterative, inclusive, open and adaptive learning approach with a dynamic capacity*' (Friedman

1996). This coincides with many viewpoints from various design campaigns, such as design activism, critical design, speculative design, responsible design, socially responsible design and participatory design. Design activity intervenes with people's lives imperceptibly and elaborately rather than being a direct protest or demonstration. The potential social influence of design lies in raising awareness (Markussen 2013). Designers have the ability, as well as the obligation, to integrate values into their creations; thus, careful reflection on design activities is crucial. Designers should respond to social responsibility issues, including sustainable development, social inclusiveness, the problems of developing countries, gender equality and environmental protection as well as the needs of the excluded, discriminated and disadvantaged groups who account for the vast majority of the population. Today's complex systems, such as products, services, interactions, experiences and processes, have become an integral part of the social environment. AI will continue to accelerate the iterative speed of those systems while also amplifying the impact that every design decision may have on the future of the public. The social role of designers as provocateurs is perhaps as significant as accounting for user needs emphasized by user-centered design methods (Grimpe et al. 2014).

Cross-disciplinary research enables design scholars to take part in rulemaking in the early stage of system development, introduce participatory and human-orientated design thinking into all stages of innovation and incorporate consequence assessment into design decision-making. Since the human factors/engineering and cognitive revolution, the third design paradigm in the multidisciplinary field of Human Computer Interaction (HCI) is a situational perspective that focuses on defining the significance of HCI systems and values in specific environments. To some extent, design is '*a natural fit for the third paradigm that similarly values and addresses the complexity of design situations*' (Harrison et al. 2007). Facing a world that encompasses various subsystems of technologies, artefacts, biophysics, societies and metaphors, Findeli (2001) proposed the need for a new design epistemology and methodology whose '*theoretical framework is inspired by systems science, complexity theory, and practical philosophy*'. If we try to combine the anticipated, reflective and responsive dimensions of responsible innovation using Stuart Candy's framework on potential futures (see Figure 2), which is often implicated in speculative design (Dunne & Raby, 2013), new design research problems may likely concern how to reflect on the probable future, how to anticipate and respond

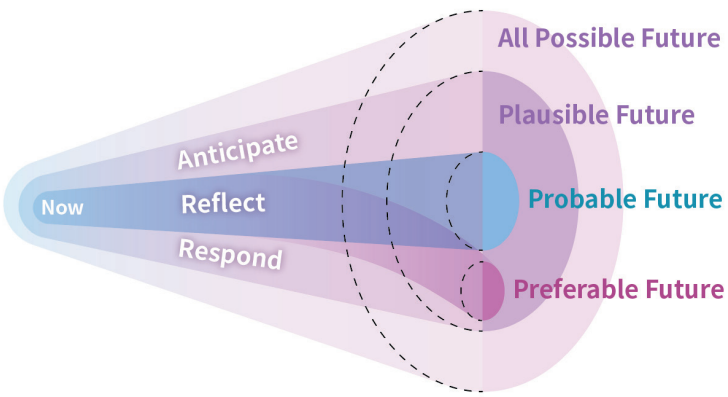

Figure 2. Responsible design for the future. *Source: Authors, adapted from Dunne & Raby (2013).*

to the plausible future and, based on the first two questions, how to finally approach the inclusive preferred future.

With the popularisation of AI, what new paradigm can evolve from the academic value and research methods of design? *Responsible* design in the context of *responsible* innovation needs to formulate more forward-looking goals that are more in line with the characteristics of the AI era so that the design wave has more opportunities to trigger the technological trend. This indicates that design scholars have the important task of raising sufficiently meaningful questions and cutting-edge perspectives. Design research always pays attention to how ergonomics, cognitive psychology, computer science and so on can be integrated with diverse designs. Inspired by the social technology integration research protocol decision components for midstream modulation (Owen et al. 2013) and the 4Ps (product, process, purpose and people) of design innovation in the ICT field, a preliminary design decision responsibility protocol (see Figure 3) has been generated. From different perspectives of identifying what to innovate, how and why it should be done and which stakeholders should be involved, this protocol can be used to help mediate the overall innovation process between the corresponding responsible parties. Based on this, designs may be comprehensively upgraded.

The application of AI has certainly raised several old and new *wicked problems* for the world, but it also provides an unprecedented operating tool that can be used for interventions. Much room for improvement still exists in designers' understanding and speculation of such a new tool. Looking ahead at the unpredictable future brought about by technological development, designers hold an indispensable position in awakening social responsibility. We should be at the frontiers of building cross-disciplinary teams, discussing the ethical bases of technology from the perspective of design epistemology and formulating decision-making and application principles. To reach this goal, design scholars will need to bravely step out of their comfort zones, seek new ways to share knowledge and responsibility with science, technology, humanities and social science communities and become facilitators who stress the ignored points in the world. In the wave of cross-disciplinary design research, design scholars will unavoidably face the problems of unknown research topics and ambiguous divisions of responsibilities with other disciplines. There are no standard answers to these questions. In almost every design movement, these issues are gradually resolved through designers' constant reflection and intervention. More importantly, designers should carefully consider what kinds of values to uphold and how to undertake the obligation of integrating them with design innovation.

Design Innovation	Decision Component	Required Capacity
Product	Oppotunity	Reflective
Process	Alternatives	Responsive
Purpose	Considerations	Reflective+Deliberative
People	Outcomes	Anticipatory

Figure 3. Design decision responsibility protocol in the ICT field. *Source: Authors, adapted from Owen et al. (2013)*.

Bibliography

Buchanan, Richard. 1992. "Wicked Problems in Design Thinking." *Design Issues* 8 (2): 5.

Buchanan, Richard. 1998. "Doctoral Education in Design." *Proceedings of the Ohio Conference*, October 8–11.

Buolamwini, Joy, and Timnit Gebru. 2018. *Gender Shades: Intersectional Accuracy Disparities in Commercial Gender Classification.* FAT.

Dunne, Anthony, and Fiona Raby. 2013. *Speculative Everything: Design, Fiction and Social Dreaming*. MIT Press.

Fallman, Daniel. 2008. "The Interaction Design Research Triangle of Design Practice, Design Studies, and Design Exploration." Design Issues 24 (3): 4–18.

Findeli, Alain. 2001. "Rethinking Design Education for the 21st Century: Theoretical, Methodological, and Ethical Discussion." *Design Issues* 17 (1): 5–17.

Friedman, Batya. 1996. "Value-Sensitive Design." *Interactions* 3, 6 (Nov./Dec. 1996): 16–23.

Friedman, Ken, and Jack Ox. 2017. "Special Special Section: PhD in Art and Design: Introduction." *Leonardo* 50 (5): 515–19.

Grimpe, Barbara, Mark Hartswood, and Marina Jirotka. 2014. "Towards a Closer Dialogue between Policy and Practice: Responsible Design in HCI. In P*roceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI'14)*. ACM, New York, NY, USA: 2965–74.

Harrison, Steve, Deborah Tatar, and Phoebe Sengers. 2007. "The Three Paradigms of HCI." In *Alt. Chi. Session at the SIGCHI Conference on human factors in computing systems*, San Jose, California, USA: 1-18.

Leslie, David. 2019. "Understanding Artificial Intelligence Ethics and Safety." arXiv preprint arXiv:1906.05684.

Markussen, Thomas. 2013. "The Disruptive Aesthetics of Design Activism: Enacting Design between Art and Politics." *Design Issues* 29 (1): 38–50.

Ministry of Education Degree and Graduate Education Development Center. 2017. "Results of the Fourth Round of National Discipline Evaluation Announced." http://www.cdgdc.edu.cn/xwyyjsjyxx/xkpgjg/. Accessed on 15th Jan 2021.

Owen, Richard, John Bessant, and Maggy Heintz. 2013. "Responsible Innovation: Managing the Responsible Emergence of Science and Innovation in Society." Journal of Research Administration, 44(2): 127-130.

Bio

Wang Yun received a Ph.D. in design from the Academy of Arts & Design and the Future Laboratory of Tsinghua University, Beijing, China, in December 2024. She is an associate professor at the School of New Media Art and Design of Beihang University, Beijing, China. Her research focuses on user experience design in natural human computer interaction and responsible design research methodology.

Prof. Yingqing Xu is a professor at the Academy of Arts & Design of Tsinghua University and director of the Future Laboratory of Tsinghua University, Beijing, China. His teaching and research fields include natural user experience design, immersive and tangible interaction and E-heritage. Prof. Xu has published 100 peer-reviewed papers and granted patents. He is a China Computer Federation fellow, a senior member of the IEEE, and a member of the China Artists Association and the Association for Computing Machinery.

DOI: 10.31182/cubic.2024.7.74