



## Report

# Distributed Knowledge Building and Flows at the International Conference on Design Futures

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## Abstract

*Facing the drastic changes in the current international society, thinking and looking into the future picture is becoming a new starting point and foothold for design innovation. Considering that, in this report, the International Conference on Design Futures (ICDF) as a durational event was analyzed from the aspects of its concept, pattern, and contribution to design and futures studies. Distributed evolution concept is applied to knowledge building and flows in the conference for shaping the design futures ecosystem. The dynamic process of knowledge-action networks enables the community to connect more stakeholders and achieve sustainable development.*

## Keywords

Design futures, Distributed Intelligence, Knowledge Building, Conference Events

## Introduction

Design Futures (DF) starts from design and futures studies, and focuses on how to use the future to redesign the present. It aims to realize more desirable futures for the community with shared futures through co-design, speculative method and reflective time (Fu et al., 2022). In this interdisciplinary field, continuous and effective dialogues across diverse dimensions are crucial for designers and futurists. Mapping long-term visioning can empower short-term design action. Meanwhile, design language can be used to interpret the futures. Therefore, the designer needs futures studies and the futurist also needs design. The combination of design and futures is necessary to address societal challenges meaningfully (Scupelli, 2022).

The International Conference on Design Futures (ICDF) is an annual durable event to build the global design futures network, which started online in 2020. As of ICDF2022, more than 100 speakers from design, futures studies, philosophy, science, education and other fields have been invited to explore the opportunities and challenges that mankind needs to face together in the 21st century. Apart from that, over 200,000 participants from universities and companies not limited to design backgrounds followed. For the dialogue between futures thinking and design thinking, a series of conference activities are executed and changed dynamically based on the environment of society, technology, economy, and culture for sustainability. According to the perceptive of distributed knowledge building and exchange, the conference was held beyond space and time to construct an inclusive and interdisciplinary ecosystem of design futures.

## Background and compass of activities

Global common challenges, such as climate change and sustainable development, arouse people's concern about the harmonious coexistence relationship among ecology, nature, and mankind. Human beings begin to pay attention to various social problems for pursuing sustainable development, especially in the section on sustainable

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development goals (SDGs). As the three pillars embedded in SDGs, social equity, economic growth, and environmental protection are the fundament (United Nations, 2012). Considering the full complexity of our current societies, culture is often recognized as the fourth pillar for achieving sustainable development (Hawkes, 2001; Sabatini, 2019). As the form of raw data for future research, weak signals can be transformed into meaningful insight for policy action, but the premise is that tolerance and fluidity of the collective cognition are required (Mendonça et al., 2012). Observation and discussion around the future signals of society, technology, economy, environment and policy are crucial to insight into future trends and behavioral shifts. Wild cards refer to incidents with a perceived low probability of occurrence but with potentially high impacts on an organization, like the September 11 attacks (Mendonça et al., 2004). By scanning the signal environment, imagining, experiencing, and discussing the scenarios triggered by wild cards, the organization can prepare for possible changes or adjust the strategy to reduce the probability of occurrence. In the United Nations (UN) documents, the concept of “Community of Shared Future for Mankind” was adopted in 2017, reflecting the shared aspiration of most countries and serving the common interests of the international community.

With the trend of working together for a shared future, there is emerging interdisciplinary dialogue between design and futures studies (Barbara & Scupelli, 2021; Candy & Potter, 2019). Design is the catalyst for social dreaming (Dunne & Raby, 2013). More international and local organizations are committed to utilizing global resources to develop effective solutions and provide reference cases, development models, design methods and tools. How to design to face the challenges of the future society? How to shape the future social culture? What is the design method for integrating futures thinking? What is the future of futures in design education? In order to gather the collective intelligence to explore the answers of this series of questions, continuous ideological collision and knowledge production is required. Therefore, the three design institutes from different regions, namely the Academy of Arts and Design at Tsinghua University, the Design Department at Politecnico di Milano and the School of Design at Carnegie Mellon University, jointly initiated the event under the framework of the design futures ecosystem.

Knowledge-action networks (KANs) aim to broaden the composition of the network with a diversity of actors holding different types of knowledge (Moeliono et al., 2014; Muñoz-Erickson & Cutts, 2016). As one of the salient features in KANs, distributed structure has the advantages of reducing centralization and improving interactions among disciplines. Distributed building and learning are beyond time and space, focusing on communication and cultural background, cooperation and co-creation (Hewitt & Scardamalia, 1998; Walker, 2003). As design future is a long-term, continuous and dynamic process, it is necessary to build a virtuous circle of ecology, thus further constructing a knowledge-action network. Thus, a design futures ecosystem is structured to link both ends of timeliness (Figure 1). As a crucial node in the ecological chain, ICDF plays a key role as the booster and bridge in knowledge building and flows. Meanwhile, it also coordinates with the community (Global Design Futures Network), educational program, practical program, workshops, and innovation new infrastructure to form a “pacing” in the timeline.

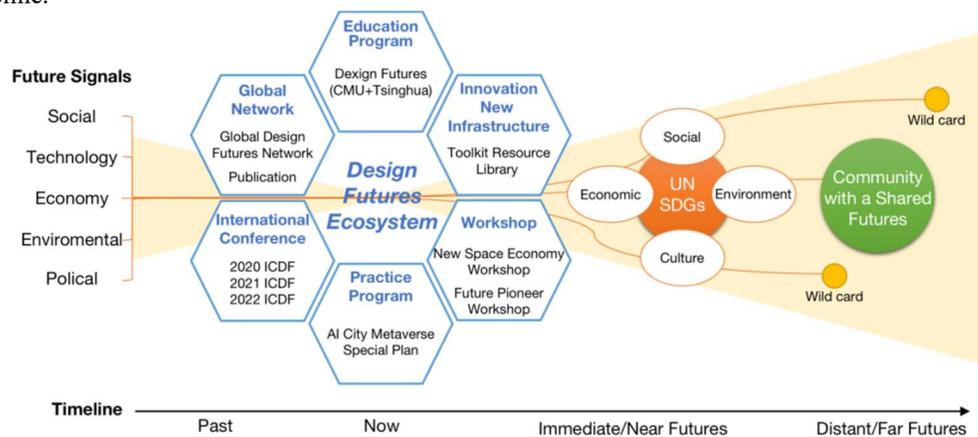


Fig. 1: Map of design futures ecosystem

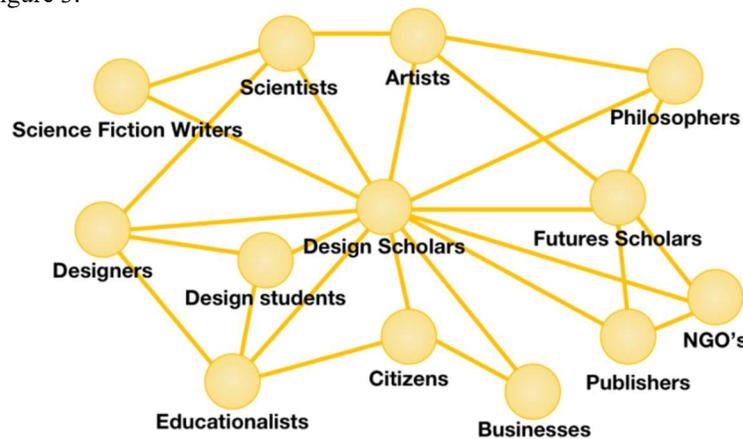
**Knowledge-action network in ICDF**

The conference as a kind of learning community is an important event for knowledge exchange, a form of public pedagogy, and a site for academic community construction. With the rapid development of the Internet and the impact of COVID-19, more academic conferences have been held online instead of offline (Viglione, 2020), which may provide opportunities to increase accessibility and remove or reduce time, financial, and environmental costs (Bellappa, 2020; Raby & Madden, 2021). The detailed information of ICDF in three years can be seen in in Table 1.

**Table 1:** Information of ICDF in 2020-2022

	ICDF 2020	ICDF 2021	ICDF 2022
Host	Tsinghua University	Tsinghua University	Politecnico di Milano
Platform	Youtube LIVE WIZ LIVE Bilibili LIVE Meia	Youtube LIVE WIZ LIVE Bilibili LIVE Meia	Spatial LinkedIn Facebook
Keynote	Futures Theory Futures Exploration Futures Empowerment Futures Trend	Futures Philosophy Futures Creation Futures Society Futures Design Education	/
Panel	Futures Studies Design Futures Design Exploration Speculative Design	Futures Philosophy Futures Creation Futures Society Future Design Education	Future Scapes Future Design Education Future Well-being Future Literacy
Ideas Lab	Future Speculation Future Education Future Communication Future City	Futures Art Futures Literacy Empathy and Symbiosis New Space Economy	coming
Academic Symposium	/	Presentation of Papers Viewpoints	Special Issue in Journal
Other Activity	Physical Exhibition Forum	/	Digital Exhibition GDFN coming

The dynamic conference network tends to identify and fill in knowledge gaps in design futures by pulling from many areas of philosophy, aesthetics, science, and sociology. In this context, the knowledge-action network of ICDF involves interdisciplinary discussions, co-design research questions, interaction with citizens, and academic publishing. By expanding the breadth of credible knowledge types, the interactions between actors with relevant knowledge and those capable of action shape a network (Figure 2). The framework of activities and the evolution process is shown in Figure 3.



**Fig. 2:** Actors network of ICDF

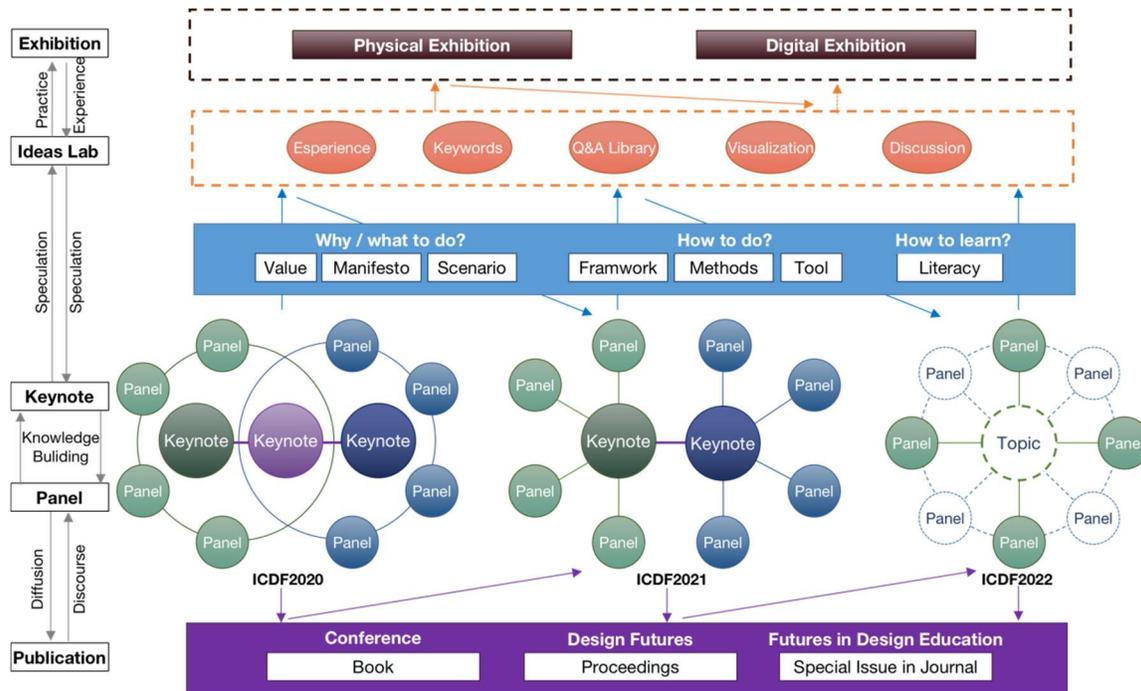


Fig. 3: Knowledge-action network of ICDF

At the beginning of ICDF in 2020, keynotes and panels which belonged to different themes were overlapped and relevant. For example, two panels' contents of Futures Studies and Speculative Design refer to value, scenarios, and methods mentioned in the keynote Futures Theory. Speakers shared their viewpoints on the topic combining their research and practical experience, which also triggered new problems and discussion in the Q&A session. The idea lab is an exchange workshop for young scholars. Each workshop started from the experience shared by guests, and then topic discussion, viewpoint analysis, thinking collision, or action planning around the theme was carried out. Finally, a visual presentation was performed at the end of this session as the inspiration for further exploration. Meanwhile, the Q&A library is also reserved as another educational resources. To expand the influence of the event and enhance citizens' awareness and attention to the future, the physical exhibition, namely "Foresight • visible — International Exhibition on Design Futures 2020" was held. In order to further extend the influence of the event and the cycle of knowledge flows, the report of the keynote, panels, workshops, exhibitions, etc., in the conference were compiled into books and published publicly.

In ICDF2021, according to the generation in the previous conference as well as potential problems in uncertain environment, the topics that need more attention focused on Futures Philosophy, Futures Creation, Futures Society and Futures Design Education. Besides, frontier ideas, methods and tools, innovative practice and design education from the fields of philosophy, aesthetics, science and sociology were discussed. Benefiting from the continuous action of events and the multi-platform dissemination of knowledge, the conference in 2022 attracted more participation and attention. Furthermore, the academic paper as a critical part of knowledge production and flows was added by launching a session on design futures at the Human-Computer Interaction International Conference 2022 (HCII 2022). Since futures thinking has been widely used in human-computer interaction (HCI), DF can be better promoted through academic networks in this relevant field.

The way of distributed knowledge building is constantly adjusted with the change of time, context and cognition for design futures. Entering the ICDF 2022, more flexible discussion was conducted in panels on Future Scapes, Future Design Education, Future Well-being, and Future Literacy. Some potential topics emerged in the speakers' sharing and discussing step. To add "pacing" in the event, the idea lab and exhibition were postponed behind the conference. Except for the traditional physical exhibition, the digital display will also be tried to expand the breadth and durability of dissemination. Moreover, co-creation was further extended to collaborate with journals. For example, the special issue "The Future of Futures Thinking in Design Education" was launched in the Journal of

Futures Studies to call for papers. By creating a topic section in the professional academic community, more scholars with interdisciplinary background will be attracted to submit their contributions and will be the speaker of the coming ICDF 2023. In addition, new topics will also be extracted in the series of activities of knowledge building and flows and become new nodes of the distributed knowledge network.

### **Contributions for knowledge building of design futures**

Intelligence is present in people's minds, while distributed intelligence is beyond individuals, time and space. Through continuous sharing, discussion and reflection, some directions and trends of design futures gradually formed.

#### ***1. Why to do: value, highlights and trends***

When standing at a crossroad to see the impact from the past and simultaneously face great changes, shaping a new model of thinking is necessary for responding to challenges. An increasing number of scholars appeal for changes in the way of design to help us achieve a desirable future. In terms of the reason why integrating futures thinking into the design is the first part to be clarified, Riel Miller highlighted that design futures are not simply about setting a goal and achieving a better world, but really about enabling humanity, to take advantage of our underlying capability to imagine the future and to bring the future into the present through our imagination, and use that ability for different reasons in different ways. In this way can we be more able to appreciate the difference and surprises, be inspired by change, and create a relationship between us and all of the things surrounding us. Matthieu Cherubini also agreed that design futures can foresee potential problems brought by new technologies, and consider how to avoid these problems when designing products.

Futures thinking and design thinking have distinct yet interconnected aspects. Futures thinking delves into various layers of reality, examining the underlying worldviews, myths, and narratives that influence what lies ahead. It also encompasses possible, probable, preferable, and transformative futures, aiming to challenge existing assumptions, broaden horizons, and inspire present actions to achieve more desirable outcomes. Different from that, design thinking starts from the current world as the method and process of solving complex problems, and its core is the energy of thinking development, distribution and integration of design. For the design futures, Arnold Wasserman emphasized that people should never try to speculate about the future. Instead, what we can do is to understand the forces that may affect future changes. In this process, formulating your strategy and constantly looking for weak links, the power of change and the track of development are involved. In addition, Anna Barbara pointed out that the design of time is one of the most important global trends, and the future is a critical tool for designing the present. Clive van Hilden proposed that predictions should be made in politics, economy, culture, society and environment, thus more accurately describing the environmental background that can be predicted for the long term, and better making new types of product innovation. Relative to the linear development of technology, a broader perspective needs to be adopted to scan the changes in society. In this way, an early warning about some events can be acquired, and more new opportunities can be found in advance.

The design trend was analyzed by Zhiyong Fu, from taking objects and users to futures as the center to highlight the value of futures thinking to design. He advocated that foresight leads current action by integrating futures thinking into design thinking through co-creation and interdisciplinary cooperation. With the emerging stage of transition design, the value of design integration and the futures is highly valued. In Ashley Hall's opinion, if we consider design as 'knowledge for future transformation,' designers play a crucial applied and strategic role in shaping new socio-technical futures.

#### ***2. What to do: form, scenario and projects***

With design practice affected by the trend of the contemporary speculative turn, design is shaped as a rhetorical form with its advantages of visualization and mundane attributes, promoting the occurrence of action by spreading belief. This is the special mission of design under the new situation emphasized by Li Zhang. Unlike the standard design, design futures can also make the design only stay as a concept, take it as a tool of thought, and let us think about what the future will be like. The experimental results from Stuart Candy showed that after experiencing Hawaii in 2050, nearly 94% of the subjects said they had changed their view of the future and were willing to take

action. Carl Disalvo believed that the design voice exists not only in museums or expensive products, but in daily life, such as in 99 American stores in the United States. Luca Guerrini established specific project briefs, which propose alternative visions regarding the topics that emerged from the discussion. These briefs are characterized by a strong narrative component and are returned as a (scenario tale, storytelling) process.

Many scholars and practitioners shared their projects of integrating futures thinking. Clive van Hilden have done a future livable city project. In the previous design concerning both engineering design and art design, their outputs and results were not specifically considered. Therefore, in the real world after 20 years, due to the doubling of the population, basic resources may be increased. His suggestion is to design an ecosystem by using customized methods to separate different processes so that the output of one object can become the input of another object. He also presented the composition and testing of micro ecological environment and applied it in different fields for creating the daily behavior of families and positively affecting society and the future. As a science fiction writer, Wu Yan explained that science fiction futurism extends the limits of imagination, hoping to surpass the existing, skip the near future and go further to the other side. The specific scenes or specific examples of science fiction futurism can be experienced from diverse creative forms, such as science fiction and art exhibition. AI 2041, the science fiction co-written by Qiufan Chen and Kai-fu Li, is an elegant method for looking back from futures and quickly juxtaposing it with a look forward from the present. A good futures work should have some space for discussion, which is indicated in Elliott P. Montgomery's presentation.

### **3. How to do: literacy, methods and tools**

How do designers interact with the world and the future? Carl Disalvo highlighted that the key is to work together with others. Although most designers are unwilling to get involved in politics, Arnold Wasserman believed that designers must participate in the management process and set the public agenda. Not only designers but also scholars, scientists, engineers and citizens of various disciplines could participate in solving various complex problems, which was mentioned by many scholars. Design for web life is put forward in Ezio Manzini's presentation, which focuses on engendering, reframing and caring. Christopher Kirwan hoped to think in a more open system and did not want to be limited by some elements, such as algorithms. In the experience share of the Designing Futures Literacy Lab, Shams Hamid introduced co-designing and co-creating with stakeholders and utilizing human capacities to sense, feel, think, and imagine.

In order to make the future better, anyone should be aware of the layer of time or pacing, in which everyone, for that matter, must operate. The word "Pathways", mentioned by both Susan Yelavich and Terry Irwin, offers options to consider the future. Susan Yelavich appealed for different opportunities within existing cultures by drawing on insights from anthropologists, sociologists, and psychologists as the word 'pace' suggests. Terry Irwin argued that the process of "visioning" is not a one-time exercise that leads to a "fixed" vision, but rather, it is part of a dynamic process of transition undertaken by stakeholders. Working in a collaborative shared values approach, Adama Sanneh said it could leverage the unique power of engaged stakeholders to experiment and create a new model that will catalyze a global call to uphold "Creativity For Social Change" as a critical element for human, social, and economic development.

In addition, many frameworks and methods proposed from diverse perspectives were explained. Stephanie Tharp and Bruce Tharp contributed their framework, which is structured around nine facets of discursive designing (Intention, Understanding, Message, Scenario, Artifact, Audience, Context, Interaction, and Impact) to help guide the design development process. A framework integrated individuals, organizations, culture and society proposed by Maree Conway to inform the design of foresight processes to ensure more inclusive, expansive and deeper conversations about futures. Giovanna Piccinno put forward a framework that redefines the emergencies on earth and human behavior's impact on nature. The six pillars (Mapping, Anticipating, Timing, Deepening, Creating Alternatives, Transforming) contributed by Sohail Inayatullah and Ivana Milojević provide a theoretical basis for the development of futures thinking from practice, and can also be used in workshops, including design futures. The four types of design, namely Post-human Design, Object-oriented Design, Feminist Speculative Design and Discursive Design based on the trend of speculative turn were shared by Li Zhang. Jörn Bühring presents a new approach (paradigm) in support of strategic decision-making in an age of uncertainty, and a rapidly advancing information environment: (1) achieving insights and alignment around current reality; (2) facilitating a productive

design conversation; (3) specifying a portfolio of desirable futures; and (4) active experimentation to gather new knowledge and learning. Alessandro Deserti held that a multi-scale and multi-focus approach should be taken to identifying the path of innovation through design practices and tools as a strategic lever to support the direction of today's complexity

As a challenge and potential opportunity, Bruce Sterling appealed that there should be different modes of cultural output. However, no one has fully considered this issue, and no one has really designed it due to the lack of a good design method for the cultural influence of peace.

#### **4. How to learn: pathway, course and program**

Various challenges require a broader version of design than design thinking. In this case, design educators around the world are trying to prepare designers for such challenges. In the opinion of Anan Barbara, educators should go out of the reflection of knowledge, and teach students how to ask correct questions rather than simply give answers. Xiabo Lu shared a new-typed concept of the educational theory for integrating value shaping, ability training and knowledge transfer. David J. Staley combined his works to lead us to imagine the university anew, including the configuration of knowledge, the epistemological organization of the university and novel institutional forms. From the perspective of educators' actions, Manuela Celi summarized five aspects: (1) practice-based pedagogic scapes; (2) developing knowledge, resources and methods; (3) helping young designers design for complex tomorrows; (4) building on an extensive research program; (5) supporting pedagogic practices through designing. Susanna Sancassani introduced the concept of hybrid thinking, which includes the space as a teacher, dimmable proximity, frictionless hyper content, and education. Based on the four values of Love, Life, Wisdom and Voice, Jennifer M Gidley expanded them with educational approaches that include "contemplative love and critical reverence", "life cultivation through imaginal thinking", "creative wisdom or waking up to multiplicity", and "voice consciousness or language reflexivity".

Tsinghua University and Milan Polytechnic University have a master's program of smart city integration and innovation named "Living Lab" by carrying out hybrid design to amplify human wisdom in such as industrial design or urban development design. In the talk of Peter Scupelli, he shared the Dexign Futures course and the related open-source project. Dexign Futures started as an undergraduate course in the School of Design at Carnegie Mellon University, and now it also has been a MOOC course cooperated with the Academy of Arts and Design at Tsinghua University. Moreover, it aims to guide the young designers participating into imagining a sustainable future through the combination of design thinking and futures studies, anthropology and sociology research, in the perceptive of multi-disciplinary integration.

By a series of experiments conducted within a Danish master's program geared towards design futures, Rike Neuhooff thought the education should focus on cultivating mindsets that are passionate about otherness, as they hold the potential to challenge self-centeredness and accompanying notions of narrow-mindedness and short-termism.

#### **Activities for design futures knowledge flows**

It is expected that design thinking integrated with futures thinking through co-creation and interdisciplinary cooperation to guide relevant practice. A series of activities, such as sharing platforms, workshops, exhibitions, and publications, are beneficial to accelerating the design futures knowledge flows.

##### **1. Platform: persistent knowledge sharing**

With the emergence of the Metaverse and its application in the website, ICDF 2022 has shifted from traditional live broadcasts (e.g., Youtube LIVE, WIZ LIVE, etc.) to VR digital space (Figure 4). Furthermore, the recording video can be permanently watched on Facebook or other educational platforms. The total number of viewers of the ICDF 2021 return has reached about 114,400 on the website. Even though the conference has been over for more than a year, learners can still gain knowledge from those resources. It is enough to see the crucial of sharing platforms for knowledge dissemination and flows.



Fig. 4: ICDF2022 in Metaverse

## 2. Workshop: reflection and action around theme

The Idea Lab is an exchange workshop for young scholars. It will consist of topic discussion guests and moderators. After the guests share their views, they will carry out a topic discussion, viewpoint analysis, thinking collision or action planning around the theme, and present a visual presentation. For example, the topic of Futures Literacy was hosted by Xia Qing (Ph.D. in Information Art Design of Tsinghua University) and Sally/Yuyang Lin (Futures Literacy Facmtator of UNESCO), and four young scholars were invited to share their viewpoints following the order below at first:

**Manjiang He** - “Youth Perspective: Futuring Peace of Northeast Asia in 2060”

**John A. Sweeney** - “How can we imagine more participatory futures?”

**Sebastian Plate** - “Are we forced to become Future Literate? The acceleration of the capability in a changing world”

**Klara Rehm** - “Reframing DRR Futures Thinking in 2045 from the Perspective of Youth and Young Professionals (YYPs)”

Based on the experience shared by the speakers, a keyword map is visualized, as shown in Figure 5. Then, a total of sixteen questions were summarized for further discussion and interaction between scholars and audiences. Finally, the questions were permanently saved in the Q&A library and will be reused in other educational activities.

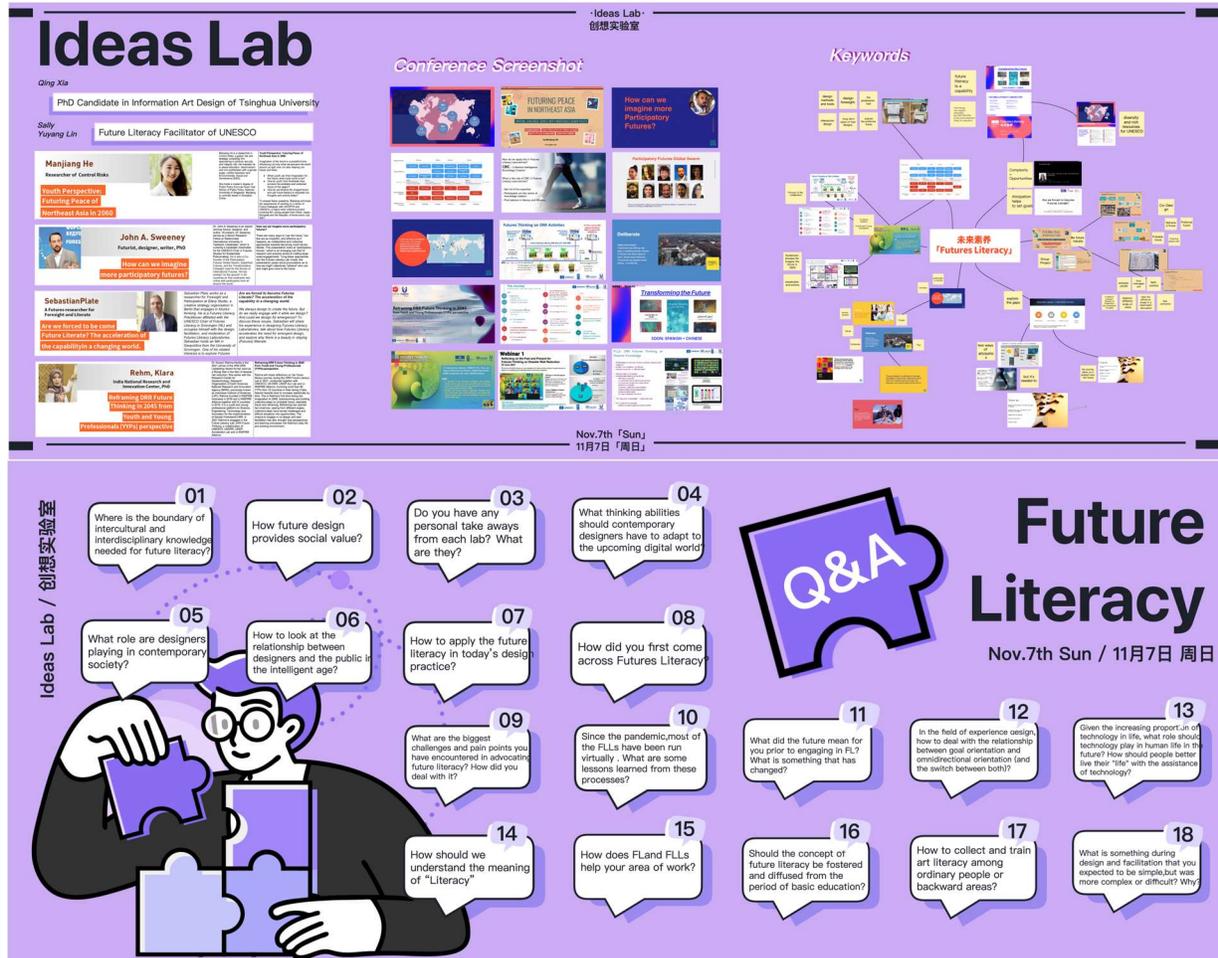


Fig. 5: co-creation board

3. Exhibition: innovation activity

The International Exhibition on Design Futures 2020 (Figure 6), as an extension of the theme forum of ICDF2020, was held in Chengdu, a city in China. It is presented in four parts: future chronicles, future empowerment, future evolution and future outlook. The exhibition brings the audience a multidimensional perspective and presents an unknown and exploratory future field in the form of literature arrangement and creative works. In the interaction and experience section, citizens are able to participate in the co-creation process of future cities, collect materials and materials for the construction of future life scenes in Chengdu, and also try to implement the concept of the city as a service. Beyond that, this exhibition presents the most cutting-edge academic theories, literature achievements and art design work in the field of scientific research and innovation to the international conference guests, and leads the visitors to new thinking.



Fig. 6: Foresight • visible - International Exhibition on design futures 2020

#### 4. Publication: academic ecology

The traces generated at each conference are so valuable that they should be compiled and published as books for a longer spreading cycle. Collaborated with the publisher named postmedia books, the book *Online International Conference on Design Futures 2020* has been published and sold online (e.g., amazon.com). Starting in 2021, ICDF strengthened academic orientation that the accepted papers were presented at the conference and then published in the proceedings of HCII 2022.

To further foster an academic ecology, ICDF 2022 cooperated with the journal to launch a special issue, such as “The Future of Futures Thinking in Design Education” in the *Journal of Futures Studies*. The aim of this special issue is to develop the knowledge system and design methodology and to integrate futures studies into design education and practice for cultivating compound talents much more with futures literacy. Through various pathways of academic publishing, the knowledge of design futures is gradually settling, and absorbing more designers, strategists, engineers, scientists, artists and futurists from around the world to join the sustainable community.

#### Conclusion

Based on the analysis of ICDF in this article, the critical role of distributed knowledge building and flows in the transition to a more sustainable community and the need for the conference as the knowledge-action network to fill the knowledge gap defined collaboratively by broad actors within and outside of academia are identified. The co-production in multi-stakeholders ensures that the activities deliver the knowledge of design and futures that transformation needs.

In the future, policymakers, city planners, and organizational leaders should actively engage with action networks to integrate design thinking and futures thinking, enabling them to address the challenges of sustainable development more effectively.

#### References

- Barbara, A., & Scupelli, P. (2021). Teaching to design futures in cities. *Techne*, 112-116. <https://doi.org/10.13128/techne-10693>
- Belliappa, J. L. (2020). Extending feminist pedagogy in conferences: Inspiration from theatre of the oppressed. *Gender and Education*, 32(1), 101-114. <https://doi.org/10.1080/09540253.2019.1646412>
- Candy, S., & Potter, C. (2019). Introduction to the special issue: Design and futures (Vol. I). *Journal of Futures*

- Studies*, 23(3), 1-2. [https://doi.org/10.6531/JFS.201903\\_23\(3\).0001](https://doi.org/10.6531/JFS.201903_23(3).0001)
- Dunne, A., & Raby, F. (2013). *Speculative everything: design, fiction, and social dreaming*. MIT press.
- Fu, Z., Barbara, A., & Scupelli, P. (2022). *Online International Conference on Design Futures 2020*. Postmedia Books.
- Hawkes, J. (2001). *The fourth pillar of sustainability: Culture's essential role in public planning*. Common Ground Publishing.
- Hewitt, J., & Scardamalia, M. (1998). Design principles for distributed knowledge building processes. *Educational psychology review*, 10(1), 75-96. <https://doi.org/10.1023/A:1022810231840>
- Mendonça, S., Cardoso, G., & Caraça, J. (2012). The strategic strength of weak signal analysis. *Futures*, 44(3), 218-228. <https://doi.org/10.1016/j.futures.2011.10.004>
- Mendonça, S., e Cunha, M. P., Kaivo-oja, J., & Ruff, F. (2004). Wild cards, weak signals and organisational improvisation. *Futures*, 36(2), 201-218. [https://doi.org/10.1016/S0016-3287\(03\)00148-4](https://doi.org/10.1016/S0016-3287(03)00148-4)
- Moeliono, M., Gallemore, C., Santoso, L., Brockhaus, M., & Di Gregorio, M. (2014). Information networks and power: confronting the "wicked problem" of REDD+ in Indonesia. *Ecology and Society*, 19(2), 9. <https://doi.org/10.5751/ES-06300-190209>
- Muñoz-Erickson, T. A., & Cutts, B. B. (2016). Structural dimensions of knowledge-action networks for sustainability. *Current Opinion in Environmental Sustainability*, 18, 56-64. <https://doi.org/10.1016/j.cosust.2015.08.013>
- Raby, C. L., & Madden, J. R. (2021). Moving academic conferences online: Aids and barriers to delegate participation. *Ecology and Evolution*, 11(8), 3646-3655. <https://doi.org/10.1002/ece3.7376>
- Sabatini, F. (2019). Culture as fourth pillar of sustainable development: Perspectives for integration, paradigms of action. *European Journal of Sustainable Development*, 8(3), 31-31. <https://doi.org/10.14207/ejsd.2019.v8n3p31>
- Scupelli, P. (2022). Does When and How Design Students Learn Causal Layered Analysis Matter? *Journal of Futures Studies*, 27(2), 28-41. [https://doi.org/10.6531/JFS.202003.24\(3\).0002](https://doi.org/10.6531/JFS.202003.24(3).0002)
- United Nations. (2012). *The future we want*. Outcome document of the United Nations Conference on Sustainable Development. <https://sustainabledevelopment.un.org/content/documents/733FutureWeWant.pdf>.
- Viglione, G. (2020). A year without conferences? How the coronavirus pandemic could change research. *Nature*, 579(7798), 327-329. <https://doi.org/10.1038/d41586-020-00786-y>
- Walker, K. (2003). Applying distributed learning theory in online business communication courses. *Business Communication Quarterly*, 66(2), 55-67. <https://doi.org/10.1177/108056990306600205>