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Co-Design visions of public makerspaces in China

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ABSTRACT

Enhancing creativity has become of vital importance in today's modern world as creativity plays an essential role in solving complex individual, business and social issues. This paper, therefore, considers how to develop a novel and inclusive means of fostering creative citizens in a bottom-up manner, especially in China, through co-design and public makerspaces. The paper discusses the notion of creativity and its relations with co-design and makerspace, critical requirements of co-design and makerspace design, and cultural differences in co-design. A literature review and a series of co-design workshops with Chinese and non-Chinese participants were applied. The research revealed that making activities should be more 'visible' and 'inclusive' to engage more and better with both makers and non-makers. This study also identified some differences between Chinese and non-Chinese groups in terms of space management and co-design approaches. The key findings would greatly value developing user-oriented makerspaces for creativity enhancement in China.

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1. Introduction

Creativity makes a significant contribution to people's well-being, business growth and social innovation. Nurturing and retaining a creative workforce has, therefore become extremely important for sustainable economic growth and societal improvement. This argument is supported by the World Economic Forum (2016), suggesting that complex problem-solving, critical thinking and creativity are the core skills that employers will be looking for. Our society has also benefited greatly from creativity enhancement in terms of social value creation through improving social relations, tackling social problems and meeting the social needs of the community (Tremblay & Pilati, 2013). Thus it can be said that creativity plays a critical role in social innovation and socio-economic development (Sacco & Blessi, 2005). It is noticeable that creative professionals have abilities to draw upon the complex issues and apply a high level of creativity to solve the problems, in contrast, those people who are not in design or creative disciplines find it difficult. However, this does always not suggest that people outside design or creative disciplines have no creativity; but they may contribute to design decision-making without realizing that they are doing (Kotler & Rath, 1984).

Engaging people in creative activities, including co-design, is considered one of the effective ways of promoting and fostering creativity (Sanders & Stappers, 2008). Notably, engagement in co-design and co-production processes not only helps foster participants' creativity but also leads to social benefits, e.g. promoting self-help attitudes and positive behavior changes (Boyle & Harris, 2009). It has now become common knowledge that creativity, as a skill, can be learned, developed and applied (De Bono, 2007) and creative skills can be improved with the right type of input (UCLES,

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2018). Current approaches to enhance creativity, however, focus primarily on the context of school and higher rather than to the general public, despite creativity being the skill most in demand by the public (Anderson, 2020).

There are huge demands for making and makerspace with the global maker movement (Make, 2020). Making encourages participants involved in creative activities and co-design to collaboratively solve given problems (Dellot, 2015), which generates increasing pleasure, unlocking innovative capacity and building resilience in our society (Gauntlett, 2018). Makerspaces, therefore, are essential for both experienced and inexperienced makers develop their skills and creativity (DCMS, 2017), through learning about themselves and others by making and learning (Culpepper & Gauntlett, 2020). The maker movement also affects Eastern countries significantly, generating high interest and demand for makerspaces (Danning, 2015; Saunders & Kingsley, 2016) including in China – where there were 6,959 makerspaces as of 2018 with further growth expected in the near future (CHYXX.com, 2020). However, current research focuses primarily on the issues in Western culture rather than in-depth discussion or debate about makerspaces in Eastern culture. Therefore, with the key research question: *“how makerspaces can be developed and utilized to foster creative citizens and what are the perceptions of and requirements for makerspaces in different cultures?”,* this paper explores the idea of creating and using public makerspaces as a means to foster creative citizens and the application of co-design in the Eastern context of placemaking, with particular reference to the Chinese perspectives on makerspaces.

The primary discussions of the paper are the design of a co-design workshop and principal findings of literature review and a series of the co-design workshops, which together make up a critical part of the design research project titled ‘Fostering Creative Citizens through Co-design and Public Makerspaces’. The rationale of this project is that the collaborative and sharing nature of public makerspaces could enable individual and collective creativity to flourish. The literature review focused on (i) understanding meaning of creativity and its relations to co-design and makerspaces; (ii) investigating co-creation processes and tools; (iii) reviewing potential co-design tools that could be used to create strategic outputs, such as shared visions; and (iv) context where the tools are to be applied. The results of the literature review were used to inform the development of the research activities, which were combined together in a form of co-design workshop. The workshop was also designed based on the results of critical analysis of case studies with good practices, interviews with key stakeholders and field trips to public makerspaces. The main purpose of the workshop was to identify suitable activities that could help different stakeholders better understand each other and co-create shared visions of public makerspace in China, which include identifying the key design elements. This paper also discusses how Chinese people perceive making and public makerspaces by comparing their approaches and makerspace design with those from other cultures.

2. Creativity and co-design

Creativity can be described as an active process of generating ideas in new ways by identifying and solving existing problems and exploiting opportunities, which is a critical building block for innovation (Hammershøj, 2018). This is an essential skill that contributes to both economic prosperity and social innovation with territorial development (Florida, 2005; Vitale & Membretti, 2013). Creativity, however, not only requires skills but also specific understanding of the contexts in which it is used, so that is nowadays considered as a distributed and collaborative process of communal sense-making and problem solving (UCLES, 2018). The creative process can differ depending on the context but is usually divided into four stages: (i) problem identification, (ii) preparation, (iii) response generation, and (iv) response validation (Amabile, 1996). The LinkedIn survey with 100,000 respondents suggested that the top five soft skills that respondents require are ‘Creativity’, ‘Persuasion’, ‘Collaboration, Adaptability’ and ‘Emotional intelligence’ and that ‘Creativity’ has been ranked first since 2018 (Anderson, 2020). This presents clearly how important

'creativity' is in our life; however, key questions to be explored are (i) what types and levels of creativity are required and applied to connect to diverse contexts, (ii) how it can be enhanced and (iii) what tools are available. Kaufman and Beghetto (2009) categorized creativity into four types/levels as follows.

- Big-C creativity
: Extraordinary creators producing innovative and ground-breaking work
- Pro-C creativity
: Talented people but require time (usually longer than ten years) and effort to enhance
- Little-C creativity
: Ordinary people and school children who can resolve complex problems but need practice and time (a long period) to develop
- Mini-C creativity
: Learners, including children, who can find diverse ways of approaching identified problems.

The first two, Big-C and Pro-C, should be treated as an innovative level of creativity requiring achievement of outstanding accomplishments and professional expertise respectively whilst the last two, little-C and Mini-C, should be regarded as adaptive creativity requiring everyday innovation and transformative learning respectively (UCLES, 2018). In this paper, the predominant consideration is the latter, looking at/for everyday creativity focusing on individual growth that can go up to the level of Big-C.

People might perceive that creativity cannot be taught, but it can be encouraged with a learning-oriented environment with educational practices that provides the means and opportunities for developing a creative mind (Dellot, 2015; Panagiotis & Berki, 2013). Researchers stressed that creative thinking skills and creativity could be promoted through school subjects and training, i.e. short/single training sessions, that help develop the cognitive skills required for creativity resulting in creative performance (Chamorro-Premuzic, 2015; Ritter & Mostert, 2017). With the importance of creativity, it is reasonable that school education considers creativity as fundamental to all disciplines and therefore should be nurtured across the curriculum by offering diverse educational activities including training programmes (Dellot, 2015). However, offering appropriate environments and training programmes should not be limited to schools or higher education but involve a wider public, as creativity is a necessary skill in everybody's life.

Previous research suggests that creativity can be enhanced through co-design and collaboration as they (i) help people develop the ability to think both independently and with other participants and (ii) provide opportunities to consider a broad range of perspectives during the interaction with others, which lead to increasing creativity potential (Panagiotis & Berki, 2013; Sanders & Stappers, 2008; Steen et al., 2011). They also emphasized the crucial aspect of collective creativity that considers different roles of each participant in a group, team dynamics and socio-cultural backgrounds that has become extremely important in pursuing creativity. Many organizations therefore actively promote co-design activities with different disciplines but generally focusing more on consumer participation, as consumer creativity is regarded vital in determining the value customers and pre-requisite for successful co-creation (Teichmann et al., 2016). Prahalad and Ramaswamy (2004a) advised companies to co-create value with customers, since this practice could lead to great benefits, such as enabling in-depth dialogue between companies and customers, increasing customers' inputs in the development process leading to better product quality, and enhancing transparency. The authors urged companies to think innovatively about the co-creation experience, as it has a significant impact on the quality of the process and its outputs. Creativity can be found in any design project as every design project necessitates identifying problems and finding solutions for

(Dorst & Cross, 2001). Creative co-design approaches, therefore, should be applied across the whole design process in order to define and frame design problems and develop suitable solutions for those problems.

2.1. Co-creation processes and tools for strategic development

Co-creation can be described as ‘an active, creative and social process, based on collaboration between producers and users, that is initiated by the firm to generate value for customers’ (Roser & Samson, 2009). Although the co-creation process is commonly used to create tangible outputs, it can support the development of strategic outputs because the process enables all parties to share and combine knowledge to develop a shared understanding (Steen, 2013). For instance, the Western Australian Council of Social Services recommended this process as a means of developing and delivering community services in partnership with citizens (Wasoss, 2016). Prahalad and Ramaswamy (2004b) proposed four building blocks for value co-creation, namely: *Dialogue*, *Access*, *Risk-benefits* and *Transparency* (DART). In this case, *dialogue* refers to two-ways conversations between companies and customers, while *access* and *transparency* suggest that organizations should give customers access to information they need that could help fuel honest and productive dialogs as well as realistic *risk-benefits* assessments of their collaborative work. According to Ramaswamy and Gouillart (2010), enterprises that employ a co-creative strategy could achieve advantages through the increased engagement of stakeholders, which could help them respond better in rapidly changing markets, and the firms could get higher productivity, higher creativity, higher satisfaction (from staff and customers), and lower costs and risks by continually building new interactions and experiences.

An increase of interest in co-creating strategic outputs generates opportunities for co-design, as it can assist different stakeholders in sharing ideas and working collectively to achieve mutual goals (Kleinsmann, 2006). Moreover, the sharing of skills and experience of various participants could lead to novel solutions (Moilanen, 2012) as well as improvements in many areas, e.g. processes of idea generation, decision-making, customer satisfaction and loyalty over the long-term (Steen, 2013). The co-design process comprises of three key activities: *Telling*, *Making* and *Enacting* (Brandt et al., 2012). Although these three activities do not directly match the building blocks of value co-creation, they share some common principles, e.g. ‘*telling*’, focusing on sharing stories, is described as a critical driver of active participation in the same way that ‘*dialogue*’ is considered a starting point of value co-creation. While DART model emphasizes on access and transparency of information, the co-design process concentrates on how information shared among different partners can be used to generate useful results, since the co-design process is outcome-based with a practical focus (Bradwell & Marr, 2008). The act of ‘*making*’ is used to visualize ideas whilst ‘*enacting*’ is employed to demonstrate how their ideas would work. These activities enable all parties to exchange information, thoughts and ideas effectively – in other words, enable in-depth dialogue and support them in investigating potential *risk-benefits*. These principles and building blocks were used to inform the development of the research methodology in this study.

2.2. Creativity and makerspaces

Creativity, as a crucial soft skill applicable to nearly every role, can be learned and developed through creative activities such as co-design and making. Making helps people to develop their ability to develop personal and contextually relevant artifacts which enable them to enhance self-fulfillment and creativity (Tanenbaum et al., 2013). To a certain extent, making can be regarded as play or a task that people would love to do with or without realizing the enhancement of creativity (Chamorro-Premuzic, 2015). Makerspaces, therefore, has become the core platform to support people in developing necessary skills and creativity by providing diverse making experiences and co-design opportunities with multipurpose spaces, tools and relevant programmes. The impacts of

makerspaces can be (i) individual's creativity enhancement by making and learning (Florida, 2005), (ii) cultivating a collaborative culture, encouraging interactions with participants and promoting peer-learning (Moilanen,) and (iii) creating social value through societal engagement and positive behavior changes (Dellot, 2015).

School education all over the world nowadays reflects the global maker movement well by establishing makerspaces within the schools, with the belief that creativity can be promoted outside of class and 'making' can contribute significantly to creativity through design (Gauntlett, 2018). In this setting, students become less teacher-dependent but more engaged in discussions, interactions and activities that enable increasing creative thinking and skills.

3. Concept of making and makerspaces in China

Since visions of public makerspace are based on how Chinese people perceive making and makerspaces, it was critical to investigate the making culture in Chinese society. The most discourse of making in China is often related to two ideas of 'Crafting' and 'Manufacturing'. The former concept can be described as nostalgia for craft culture organized in a bottom-up manner. However, it appeals to specific groups only, e.g. the middle-class urban dwellers, who would like to escape from their busy reality. Through handcrafting activities, people feel as if they could return to a time where working with one's hands was a necessity. This sentiment is expressed in the makerspace literature of both the US and China (Irie et al., 2019). In this sense, public makerspaces are perceived as a leisure place, where people pay for crafting activities.

In contrast, the manufacturing aspect of making is advocated in a top-down manner. The Chinese government considers making as a way of promoting 'mass innovation' and 'entrepreneurship'. This reflects a shift of economic mode from 'Made in China' to 'Designed in China'. In 2015, Chinese Premier Li Keqiang visited Chaihuo Makerspace in Shenzhen and praised the innovation generated by makers and considered makerspaces to be a driving force for China's economic growth (Xie, 2018). In an attempt to spread the ideas of mass innovation, the Chinese government also promotes creative spaces for entrepreneurs to prototype and build their businesses (Saunders & Kingsley, 2016). As a result, makerspaces in China combine the hacker culture with factories for start-ups, where people can work with technology on real problems such as air/water pollution (Saunders & Kingsley, 2016). These types of makerspaces attract the younger generation, who need spaces for co-working/-creating in STEAM, and establishing their businesses, responding to the government's policy goals and market needs. However, they missed the advantages of bottom-up approaches that help engage a broader range of citizens in creative making and co-design activities resulting in social value creation through societal engagements, self-fulfillment and positive attitude and behavior changes. Therefore, it is timely and important to understand users' perceptions of requirements toward public makerspaces.

4. Research methodology

This study employed a co-design research methodology to learn the perceptions and requirements toward 'public' makerspaces in China. Co-design workshops can help users and stakeholders to share valuable insights and feedback for projects through their active contribution to the design process (Bratteteig & Wagner, 2012). The participants were expected to exchange information, value and ideas, and negotiate and agree on the final decision. With the advantage of the observation method that enables researchers to understand and capture the context within which people interact (Gillham, 2008), semi-structured observations were applied to learn the participants' perspectives, key considerations and patterns of interaction, including the underlying reasons and rationales, in the workshops.

4.1. Co-Design workshop

Within the context of this research, the *Design by Consensus (DbC)*, originated by The Glass-House Community Led Design in 2006, was considered as the most appropriate tool to explore the co-design of public makerspaces, and therefore adapted it in collaboration with The Glass-House. The DbC workshop addresses the majority of the building blocks of strategic co-creation and co-design activities, aiming at creating a session bringing together different disciplines across different sectors to explore challenges and opportunities of co-creating a place. While the DbC workshop might share common activities with other co-design tools, e.g. Serious Play or 2D collage, it focused on empathy development by encouraging provocative conversations, sparking discussions, and providing immersive, interactive and collaborative experiences with and for their creativity. Although the DbC workshop was not underpinned by a theory, it encompasses components found in widely adopted co-creation frameworks, such as the four building blocks (DART) proposed by Prahalad and Ramaswamy and the three key activities: (Telling, Making and Enacting) proposed by Brandt et al (Figure 1). The workshop in this project required the participants two main activities: role-playing and co-creation, working together to create a mutual vision for an imagined site and the design of such space.

The DbC workshop was designed to help people come together to discuss how they could shape a building to cater for multiple different makers and to be a space that could help engage the community in creative making activities. The workshops were conducted three times in the UK and China (the first and third workshops were conducted at Brunel University London in the UK, and the second one was at Tongji University in China) for about two hours. The participants came from various backgrounds: university students, academics, artists, residents, designers and business persons. Across these workshops, eight groups of participants (8–13 per group) took part: Groups 1–6 contained Chinese participants only and Groups 7–8 had participants from other Asian countries and Western countries, respectively (see the details of the participants in each session in Table 1). Although the project focused primarily on findings out requirements of Chinese people regarding public makerspaces, requirements suggested by participants from other cultures were considered useful, as they helped highlight unique requirements made by Chinese participants. As the workshop would be conducted with Chinese participants and those from different backgrounds, it was essential that the props should be as visual and accessible as possible, and not rely heavily on written text. A series of roles were created to represent potential stakeholders of public makerspaces, such as start-up businesses, knitting groups, digital makers, and facility managers, who can be categorized into groups of building staff, experienced/professional makers, and occasional/aspiring makers with varying degrees of experience. Role cards, describing the requirements of different stakeholders, were given to the participants for their understanding of the roles.

The workshop consisted of three sessions. Firstly, during the role-playing stage, participants were given 5–10 minutes to read and understand their roles and requirements. Next, they were asked to participate in the group discussion where everyone shared their thoughts and requirements according to their assigned roles. After that, they were requested to create a mutual vision based on the shared information, which served as a foundation for their co-

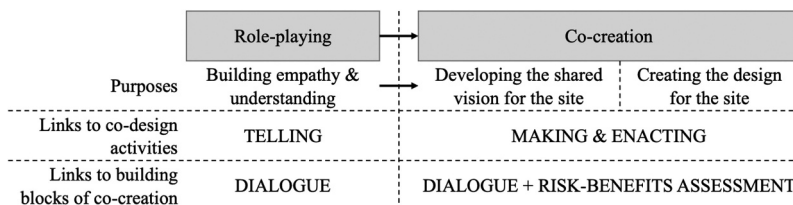


Figure 1. The co-design workshop structure.

Table 1. Participants in each session.

	1 st Workshop, UK		1 st Workshop, China		3 rd Workshop, UK			
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8
Numbers	8	8	13	12	9	8	8	9
Age	20–30		20–60		22–30		22–35	
Background	University students		University students Residents, Designers Business Persons, Academics		University students with various work experience in the fields of design, branding, architecture, business, marketing and sociology			
Nationality	Chinese						Thailand, India, South Korea	UK, Greece, Brazil

creation task. The process helped emphasize that, despite conflicting interests, all stakeholders share some fundamental values and aspirations, and build empathy and understanding for each other.

Secondly, in the co-creation task, participants were given a floorplan of an imagined building, as well as a series of props to help them explore various types of the space (Figure 2). The props included some standard building features, such as kitchens, toilets, doors, windows and corridors. In the second session, the participants worked on the co-creation task to (i) map their shared and conflicting interests, concerns and aspirations, and (ii) negotiate a shared vision for the site. The co-creation task required participants to draw simple design ideas and consider (i) how and when people would use the space; (ii) what materials might be used; and (iii) how the space would be enlivened, managed and maintained. The participants were also encouraged to explore the ‘*design*’ with and for multiple and diverse users.

Finally, they were asked to present their vision statements and the design of makerspace (Figure 3). The researchers developed a set of notes for each presentation.

4.2. Observation

Observations were made on the workshops with a semi-structured observation template considering the participants’ (i) overall approach to the workshop discussions and activities, (ii) ways of interaction and communications and (iii) main considerations in designing public makerspaces. Researchers played the role of facilitator and one facilitator was assigned to each group to lead activities and instruction to help the group work collaboratively and objectively. Each workshop had 2–3 observers to ensure that key points were captured. All the workshops were photographed with permission and used as evidence to support the observation notes taken.



Figure 2. An imagined building with props for different types of space.

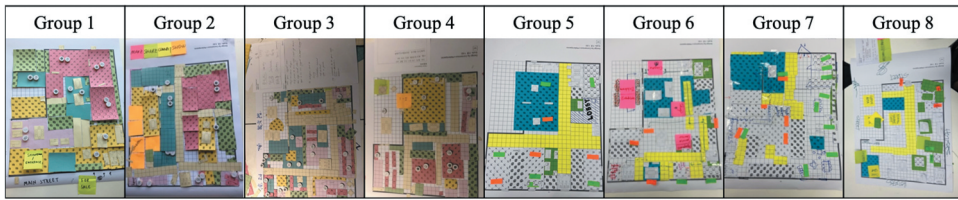


Figure 3. The outputs from three workshops created by eight groups of participants.

4.3. Data analysis

The study ran a data analysis session with all researchers and observers after each workshop. This study employed thematic analysis to identify and cluster critical issues raised in the co-design workshops and offer insight into the underlying themes: the participants' approaches to and interaction ways in the workshop and their key consideration in makerspace design, across the data collected (Gibbs, 2007). The research obtained two types of data to analyze: workshop outputs (eight presentations of groups discussion with the visual makerspace design) and observation notes. Firstly, the workshop outputs were compared and analyzed in terms of the (i) vision statement, (ii) spatial strategy (layout, social space, workspace and external space), and (iii) context (role and purpose of makerspaces). The workshop outputs are illustrated in Figure 3 and the comparison results are presented in Table 2. Secondly, all the observation notes were analyzed, compared and integrated in order to draw a unified view of the data. The observers debriefed the results of each workshop with sharing the observation notes. The research team captured the core ideas and created a set of codes on sticky notes, e.g. perceptions, requirements, communication, behaviors, inclusivity, social interaction, and economic value, and collated them on a sheet for each group. They were then grouped by the codes and analyzed with affinity mapping technique in order to categorize them into the relevant themes mentioned above, and discuss them in details.

4.4. Key findings and discussions

All participants in the co-design workshops agreed that makerspaces should be inclusive, interactive (not only between makers but also with non-makers), accessible and flexible to fulfil the requirements of different activities. This research, however, found some noticeable similarities and differences between Chinese and non-Chinese groups in terms of (i) their approaches to the workshops and (ii) co-design results on the vision statements and space design.

4.5. Approaches to the creative co-design workshops

The Chinese participants' methods, attitudes and behavior toward communication in the co-design process was very distinctive from the non-Chinese groups. The Chinese groups preferred consensus-based collaborations and an efficient problem-solving attitude with more hands-on activities but fewer discussions whilst the non-Chinese groups tended to have difference-based approaches with lots of discussions to explore more possibilities and alternatives. When devising their vision statements, it was observed that all Chinese groups spent a relatively small amount of time (5–10 minutes) on that strategic task (the development of shared vision). They quickly brainstormed and efficiently agreed on the common ideas. They spent a more considerable amount of time on a practical task (the design of makerspace). On the contrary, the non-Chinese groups had a long open discussion on the development of shared vision (15–20 minutes), believing that the vision will guide them for the design of the

Table 2. Comparison of the co-design workshop outputs.

Location	Workshop 1, UK			Workshop 2, China			Workshop 3, UK		
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	
Vision Statement	Quick Discussion (5–10 minutes) Key words Theme park of making	Making, sharing, connecting N/A	Cosy, variety, inclusive Separated private and public zones	Relaxing for professional making N/A	Welcoming space	Entertaining & sustainable	Quick Discussion(15–20 minutes) Detailed sentences Boundless space to collaborate & share experience	Inclusive space for skill developing & socializing	
Spatial Strategy	Organized around noise level and messy versus clean areas Separated private and public zones Extended to the external space Shop	N/A	Separated private and public zones	N/A	One large internal area	N/A	N/A	N/A	
Social Space	Several small internal areas	Extended to the external space	Shop	One large internal area	N/A	Shop	N/A	N/A	
Work space	Shared space and storage for connection and working together. Based on the nature of different making activities, e.g. the handcrafting and digital works should be separated.	Positive and productive working environment	Mainly social space. Some storage and exhibition area. Makers and the public	Makers and the public	Makers and the public	Makers and the public	Some prefer to work in social areas Work space Makers only	Access from outside of the building N/A	
External space	Access only through the building	Access from outside of the building	Access only through the building	Access from outside of the building	Access only through the building	Access from outside of the building	Access only through the building	Access from outside of the building	
Role of Makerspace in the community	To welcome and engage the public in creative making activities	To welcome and engage the public in creative making activities	To focus on those already doing it	To welcome and engage the public in creative making activities	To welcome and engage the public in creative making activities	To welcome and engage the public in creative making activities	To welcome and engage the public in creative making activities	To welcome and engage the public in creative making activities	
Purpose of Makerspace	A space for connection both for the makers and the public	A space for connection both for the makers and the public	To support professional makers	To support professional makers	N/A	Multi-function	N/A	To support professional makers	

space. The participants' primary considerations in designing the space also differ. The Chinese participants showed good skills in negotiating the requirements of each stakeholder. They did not try to satisfy everyone's needs but considered more benefits to the future of makerspaces with particular focus on the economic aspects. The non-Chinese groups, however, attempted to address all members' requirements with an emphasis on social value creation. They appeared to be more flexible with the design of the space, e.g. most participants did not mind if some of their requirements were unmet in the space design.

4.6. Results of the creative co-design workshops

The workshop results demonstrated that all participants believed that interactions between makers and makers and non-makers, e.g. residents, were crucial when designing public makerspaces. Thus, they decided to make the making activities 'visible' to the general public through windows, which can generate a sense of welcome. They all agreed to have exhibition space inside and/or outside of the building, where the items made in the makerspace can be displayed (or sold with expectations of economic value creation). Moreover, most participants believed that making should be perceived as an 'inclusive' activity that is 'accessible' for everyone. Hence, they want to place their makerspaces in a residential area in order to maximize opportunities for interacting with local people. In this way, non-makers could develop interests in making and become makers in the future. All groups preferred separated the workspaces based on the functionality and organized the areas according to the level of noise – e.g. placing a noisy handcraft workspace in a large shared space in one corner of the building, and locating a quiet digital work zone in an opposite corner. Having a garden (e.g. a green space) appeared to be necessary to all groups. Generally, most participants wanted to maintain a reasonable level of privacy. Hence, a wooden fence was used to block the garden area from the public. Interestingly, there was no distinct difference between other Asian and Western participants, except the space management. The non-Chinese Asian group believed that the external space should be used only by makers and accessible through the building, same as the Chinese group. This indicates that most Asians might prefer to have well-defined private and public zones, while others were willing to keep boundaries relatively blurred.

The differences of space management can be summarized as follows. Firstly, some aspects of control were observed in the spatial planning strategy of some Chinese participants. For instance, four out of six Chinese groups decided to keep the outdoor space mainly for the makers, which makes it easier to control and manage. The Chinese participants were quite optimistic about future growth and anticipated that there would be an increasing number of makers. Hence, they prepared a relatively large workspace for more members. In contrary, the non-Chinese participants did not envision a notable increase of makers and would be satisfied with a relatively small workspace. Creating a productive working environment was also the primary concern of Chinese teams. Two Chinese groups emphasized the importance of separating workspace into the private and public zones as they preferred to work in their private areas without disruptions from visitors. The productivity concern was not observed in non-Chinese groups.

Secondly, their perceptions toward making and socializing seemed slightly different. In western culture, making and socializing are interconnected, however, socialization might not be seen as part of 'making' from Chinese participants' perspectives. Although having a proper socializing space for makers were essential to all groups in the workshop, the Chinese groups preferred to separate a socializing space from a making space. In contrast, the non-Chinese group combined making with socializing areas, as they believed that it would be a more enjoyable and meaningful way of making. It was observed that all Chinese groups tended to use the outdoor space for socialization, which created a clear separation between socializing and making.

Finally, most Chinese participants demonstrated strong business awareness by considering

the economic sustainability of the makerspace. Five out of six Chinese groups introduced a shop in order to sell the artifacts produced by the makers, although generating incomes was not included in the requirements of the workshops. In contrast, the non-Chinese group introduced a café in the building, mainly for relaxing and socializing – not for a commercial purpose. Further details of each group's main considerations on the physical environments are summarized in Table 2.

Through the series of co-design workshops, it was able to identify the Chinese participants' primary considerations for makerspace design that were rarely discussed in western literature, such as productivity, the element of control, and separation between socializing and making. The visions, expectations and key design elements defined by Chinese participants were slightly different from non-Chinese. The workshop results revealed that participants from different cultures approached public makerspaces differently. The Chinese participants appeared to be more pragmatic in a way that they co-created the makerspace design. They focused more on 'efficiency', which helped them come to the agreed decisions quickly. On the other hand, non-Chinese participants paid more attention to shared visions. They attempted to listen to each member and tried to reflect them into the design, which at times was less effective in reaching conclusions.

The difference echoes the argument of Shao et al. (2019) that creativity is culture-sensitive, so their preferred creative processes and modes are dissimilar. The workshop findings in terms of the methods of communication and attitudes/behaviors do not suggest that creativity is in any approach, less valued. However, the efficiency approach might limit the participants' creativity while more discussions might help enhance creative thinking. Beghetto (2007) stressed that group discussions support people to develop their creative thinking skills. It does not mean that long discussions are encouraged in co-design. However, discussions generally help improve the quality of ideas through sharing their ideas and building on it, focusing on defining problems and finding well-established solutions. They also provide participants with opportunities to work with a more collaborative mind-set. It is apparent that discussion outcomes should be more creative than an individual proposal. Thus, when planning co-design workshops with participants from different cultures, developing a strategy for better engagement of all participants would be essential.

5. Conclusion

With the vital role of creativity in our daily life, industrial development and societal improvement, fostering creative citizens has become a critical issue in most countries. There are various ways to promote and enhance creativity and co-design and making as creative activities are considered a means of designing together, using each member's creativity to design more user-centered makerspaces where creativity can be fostered. Therefore, this paper discussed the meaning of creativity; creativity in and for co-design and makerspaces; key considerations for co-design and makerspace design; and cultural aspects on co-design activities and makerspace design. The key research findings would be of great value to develop more user-oriented makerspaces for creativity enhancement, especially in China. The relatively small sample size of non-Chinese participants, therefore, could be an issue in generalizing the findings of cultural differences. The application of the Design by Consensus approach in this project suggested that the co-design workshops were effective at supporting value co-creation, as they excel at engaging participants and enable them to collaborate as equal partners. While a few cultural differences emerged in the outputs, it supported an accessible and inclusive way to introduce participants to the co-design of their makerspaces and to explore and articulate their shared values and design ambitions. However, better engagement of all participants in discussions throughout the whole co-design process could be studied further as discussions help enhance creativity at both individual and team levels. For future study, therefore, it is recommend (i) recruiting more samples of participants (from both in and outside China) and (ii)

designing and running co-design workshops in particular reference to participants' attributes and cultural perspectives.

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References

- Amabile, T. (1996). *Creativity in context: Update to the social psychology of creativity*. Routledge.
- Anderson, B. (2020). *The most in-demand hard and soft skills of 2020*. LinkedIn. Retrieved December 05, 2020, from <https://business.linkedin.com/talent-solutions/blog/trends-and-research/2020/most-in-demand-hard-and-soft-skills>
- Beghetto, R. A. (2007). Does creativity have a place in classroom discussions? Prospective teachers' response preferences. *Thinking Skills and Creativity*, 2(1), 1–9. <https://doi.org/10.1016/j.tsc.2006.09.002>
- Boyle, D., & Harris, M. (2009). *The challenge of co-production*. NESTA.
- Bradwell, P., & Marr, S. (2008). *Making the most of collaboration: An international survey of public service co-design*. Demos.
- Brandt, E., Binder, T., & Sanders, E. (2012). Tools and techniques: Ways to engage telling, making and enacting. In J. Simonsen & T. Robertson (Eds.), *Routledge International Handbook of Participatory Design* (pp. 145–181). Routledge International Handbooks.
- Bratteteig, T., & Wagner, I. (2012). Spaces for participatory creativity. *Co-Design*, 4(2–3), 105–126 doi:10.1145/1900441.1900449.
- Chamorro-Premuzic, T., (2015). *You can teach someone to be more creative*. Harvard Business Review. 23 February. Retrieved October 10, 2020, from <https://hbr.org/2015/02/you-can-teach-someone-to-be-more-creative>
- CHYXX.com. (2020). *Analysis on the operation of mass innovation makerspace in China in 2020 (2020年中国众创空间运营情况分析)*. CHYXX.com. the 2nd of May. Retrieved November 08, 2020, from <http://www.chyxx.com/industry/202005/858262.html>
- Culpepper, M., & Gauntlett, D. (2020). Making making and learning together: Where the makerspace mindset meets platforms for creativity. *Global Studies of Childhood*, 10(3), 264–274. <https://doi.org/10.1177/2043610620941868>
- Danning, M. (2015). *How makerspaces are nurturing the next wave of Chinese innovators*. [online] Chinadaily. Retrieved November 28, 2020, from https://www.chinadaily.com.cn/china/2015-06/29/content_21127750_2.htm
- DCMS. (2017). *Guidance: libraries and makerspaces*. Department for Digital, Culture, Media and Sport. Retrieved November 01, 2020, from <https://www.gov.uk/government/publications/libraries-and-makerspaces/libraries-and-makerspaces>
- De Bono, E. (2007). *How to have creative ideas: 62 exercises to develop the mind*. Vermilion.
- Dellot, B. (2015). *Ours to master: How makerspaces can help us master technology for a more human end* (London: RSA Action and Research Centre) Retrieved 05 10 2020 https://www.thersa.org/globalassets/pdfs/reports/rsaj3881_ours_to_master_report_11.15_web.pdf.
- Dorst, K., & Cross, N. (2001). Creativity in the design process: Co-evolution of problem-solution. *Design Studies*, 22 (5), 425–437. [https://doi.org/10.1016/S0142-694X\(01\)00009-6](https://doi.org/10.1016/S0142-694X(01)00009-6)

- Florida, R. (2005). *The flight of the creative class. the new global competition for talent*. harper business.
- Gauntlett, D. (2018). *Making is connecting: The social power of creativity, from craft and knitting to digital everything* (2nd ed.). Polity Press.
- Gibbs, G. R. (2007). *Analysing qualitative data*. SAGE Publications.
- Gillham, B. (2008). *Observation techniques: Structured to unstructured*. Continuum International Publishing.
- Hammershøj, L. G. (2018). Conceptualizing creativity and innovation as affective processes: Steve Jobs, Lars von Trier, and responsible innovation. *Philosophy of Management*, 2018(17), 115–131. <https://doi.org/10.1007/s40926-017-0053-2>
- Irie, R. N., Hsu, Y., & Ching, Y. (2019). Makerspaces in diverse places: A comparative analysis of distinctive national discourses surrounding the maker movement and education in four countries. *Tech Trends*, 63(4), 397–407. <https://doi.org/10.1007/s11528-018-0355-9>
- Kaufman, J. C., & Beghetto, R. A. (2009). Beyond big and little: The four C model of creativity. *Review of General Psychology*, 13(1), 1–12. <https://doi.org/10.1037/a0013688>
- Kleinsmann, M. S. (2006). *Understanding collaborative design* [Thesis], Delft University of Technology.
- Kotler, P., & Rath, G. A. (1984). Design: A powerful but neglect tool. In M. Bruce & R. Cooper (Eds.), *Marketing and design management* (1997). International Thomson Business Press 16–21 .
- Make. (2020). *Makerspace directory*. Make. Retrieved November 11, 2020, from <https://makerspaces.make.co>
- Moilanen, J. (2012). Emerging Hackerspaces – Peer-Production Generation International Conference on Open Source Systems 10 - 13 September 2012 Hammamet, Tunisia. , 4 (Springer), 65–78 05 12 2012 doi:10.1007/978-3-642-33442-9_7.
- Panagiotis, K., & Berki, E. (2013). *Nurturing creative thinking*. International Bureau of Education.
- Prahalad, C. K., & Ramaswamy, V. (2004a). Co-creating unique value with customers. *Strategy and Leadership*, 32(3), 4–9. <https://doi.org/10.1108/10878570410699249>
- Prahalad, C. K., & Ramaswamy, V. (2004b). Co-creation experiences: The next practice in value creation. *Journal of Interactive Marketing*, 18(3), 5–14. <https://doi.org/10.1002/dir.20015>
- Ramaswamy, V., & Gouillart, F. (2010). Building the co-creative enterprise. *Harvard Business Review*, 88(10), 100–109 <https://hbr.org/2010/10/building-the-co-creative-enterprise> .
- Ritter, S. M., & Mostert, N. (2017). Enhancement of creative thinking skills using a cognitive-based creativity training. *Journal of Cognitive Enhancement*, 1(3), 243–253. <https://doi.org/10.1007/s41465-016-0002-3>
- Roser, T., & Samson, A. (2009). *Co-creation: New pathways to value: An overview*. *Promise/LSE Enterprise*. Retrieved December 10, 2020, from https://www.researchgate.net/publication/272566751_Co-creation_New_Pathways_to_Value_An_Overview
- Sacco, P. L., & Blessi, G. T. (2005). Distretto culturale e aree urbane. *Economia della cultura*, 2 , 153–165. <https://doi.org/10.1446/19933>
- Sanders, E., Brandt, E., & Binder, T. (2010). A framework for organizing the tools and techniques of participatory design, In *Proceedings of PDC 2010/11th Biennial Participatory Design Conference*, Sydney, Australia (Association for Computing Machinery (ACM)), November 29 – December 3, 2010, November 29 – December 3, 2010, pp. 195–198.
- Sanders, E., & Stappers, P. (2008). Co-creation and the new landscapes of design. *Co-Design*, 4(1), 5–18 doi:10.1080/15710880701875068.
- Saunders, T., & Kingsley, J. (2016). *Made in China: Makerspaces and the search for mass innovation*. NESTA.
- Shao, Y., Zhang, C., Zhou, J., Gu, T., & Yuan, Y. (2019). How does culture shape creativity? A mini-review. *Frontiers in Psychology*, 10. Retrieved December 07, 2020, from, <https://www.frontiersin.org/articles/10.3389/fpsyg.2019.01219/full>
- Steen, M. (2013). Co-Design as a Process of Joint Inquiry and Imagination. *Design Issues*, 29(2), 16–28. https://doi.org/10.1162/DESI_a_00207
- Steen, M., Manschot, M., & Koning, N. (2011). Benefits of co-design in service design projects. *International Journal of Design*, 5(2), 53–60 doi:10.1145/2470654.2481360.
- Tanenbaum, J., Williams, A., Desjardins, A., & Tanenbaum, K. (2013). Democratizing technology: Pleasure, utility and expressiveness in DIY and maker practice CHI '13: CHI Conference on Human Factors in Computing Systems 27 April - 2 May, 2013 Paris, France. , 13 (New York: Association for Computing Machinery), 2603–2612 doi:10.1145/2470654.2481360.
- Teichmann, K., Scholl-Grisseemann, U., & Stokburger-Sauer, N. (2016). The power of codesign to bond customers to products and companies: The role of toolkit support and creativity. *Journal of Interactive Marketing*, 36(2016), 15–30. <https://doi.org/10.1016/j.intmar.2016.03.006>
- Tremblay, D., & Pilati, T. (2013). Social Innovation through arts and creativity. In F. Moulaert, D. MacCallum, A. Mehmood, & A. Hamdouch (Eds.), *The International Handbook on social innovation: Collective action, social learning and transdisciplinary research* (pp. 67–79). Edward Elgar.
- UCLES. (2018). *Developing the Cambridge learner attributes* . University of Cambridge Local Examinations

- Syndicate. Retrieved November 16, 2020, from <https://www.cambridgeinternational.org/Images/417069-developing-the-cambridge-learner-attributes-.pdf>
- Vitale, T., & Membretti, A. (2013). Just another roll of the dice: A socially creative initiative to assure Roma housing in North Western Italy. Maccallum Diana, Mehmood Abid, Moulaert Frank, Hamdouch Abdel. In F. Moulaert, D. MacCallum, A. Mehmood, & A. Hamdouch (Eds.), *The International Handbook on social innovation: Collective action, social learning and transdisciplinary research* (pp. 186–196). Edward Elgar.
- Wasoss. (2016). *Co-design Principles to deliver community services in partnership in WA*. WA Council of Social Service. World Economic Forum.
- World Economic Forum. (2016). *The Future of Jobs Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution*. World Economic Forum.
- Xie, Y. (2018). *Made in China: The boom and bust of makerspaces*. [online] *SIXTH TONE*. Retrieved November 28, 2020, from <https://www.sixthtone.com/news/1003171/made-in-china-the-boom-and-bust-of-makerspaces>