# An exploratory study of co-design skills in the U.S. job postings

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**IASDR** [WITH **DESIGN**]
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**Sections**

- Background
- Co-design
- Methods
- Findings
- Discussion
- Conclusion

# Background

**Real-world Issues**

Complex Challenges

Graphic Design

Collaboration

Industries

**Participatory Design**

**CO-DESIGN**

Product Design

Experience Design

Service Design

U.S. Job Market

Social Impacts

Researchers

**Designers**

Stakeholders

Problem Solving

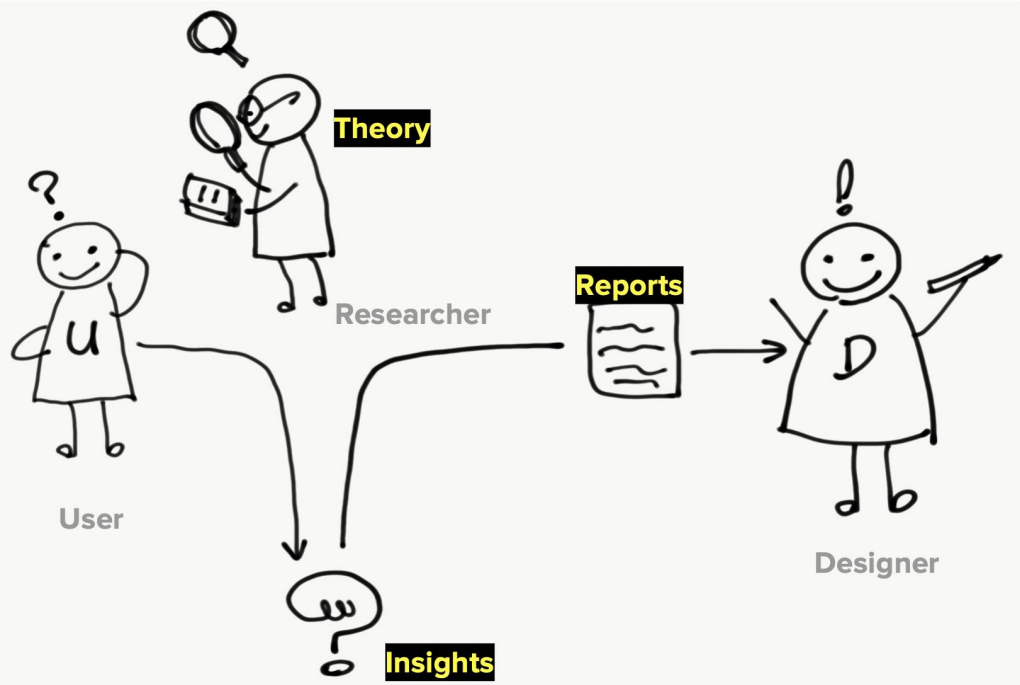
# Co-design

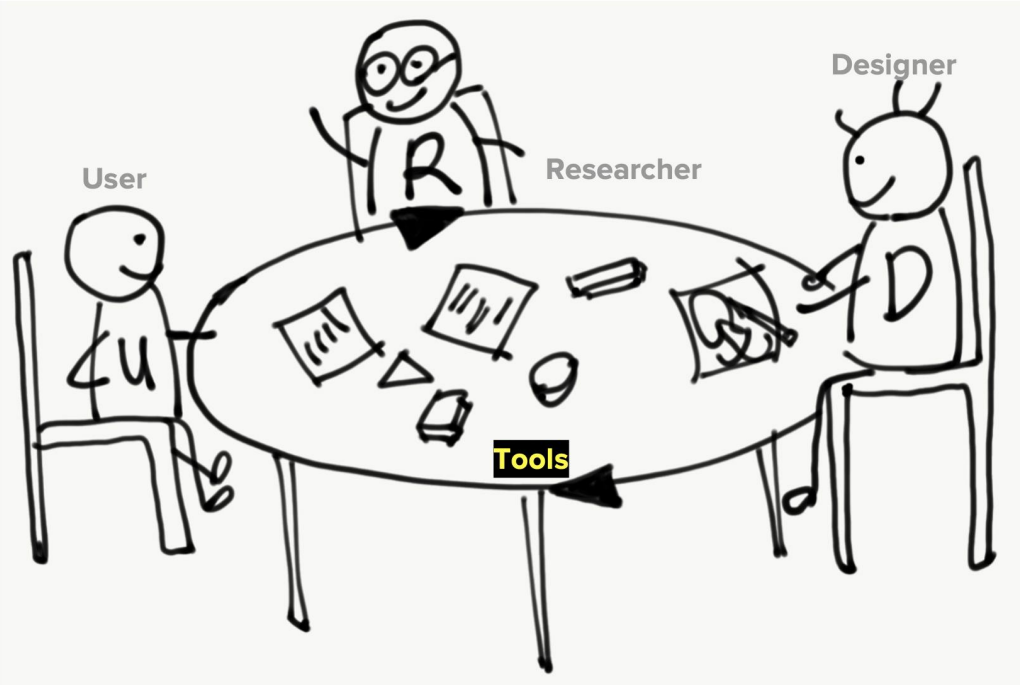
# Co-design skills

**“Co-design skills equip designers with mindset and tools, and enable them to collaborate, include and design WITH people who will use, deliver or engage with a service or product.”**

(Burkett, 2012)

# Roles




**Classical** **Co-design**

Figure 1. Classical roles of users, researchers, and designers in the design process (on the left) and how they are integrated in the co-designing process (on the right).

Adapted from Sanders and Stappers, 2008

# Co-design skills

## Research

### Insights gathering

### Empathy

(Druin, 2002; Visser et al., 2005; Sanders and Stappers, 2008; Vaajakallio, Lee and Kronqvist, 2013; Cabrero et al., 2016; Mazzurco, Leydens and Jesiek, 2018; Van Mechelen et al., 2019; Ambole, 2020)

## Knowledge transformation

### Insight analysis

### Knowledge integration

### Flexible knowledge

(Postma and Stappers, 2006; Sanders and Stappers, 2008; Feast, 2012; Vaajakallio, Lee and Kronqvist, 2013; Cabrero et al., 2016; Pirinen, 2016; Mejía et al., 2020; Xie et al., 2020)

## Collaboration

### General collaboration

### Communication

### Facilitation

(Siu, 2003; Sanders and Stappers, 2008; Vaajakallio, Lee and Kronqvist, 2013; Sangiorgi, 2015; Cabrero et al., 2016 Pirinen, 2016; Van Mechelen et al., 2019; Mejía et al., 2020; Ambole, 2020; Xie et al., 2020)

## Synthesis

### Creativity

### Decision-making

(Sanders, 2000; Postma and Stappers, 2006; Sanders and Stappers, 2008; Van Mechelen et al., 2019)

## Visualization

### Representation

### Prototyping techniques

### Stakeholders supports

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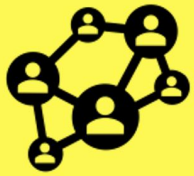

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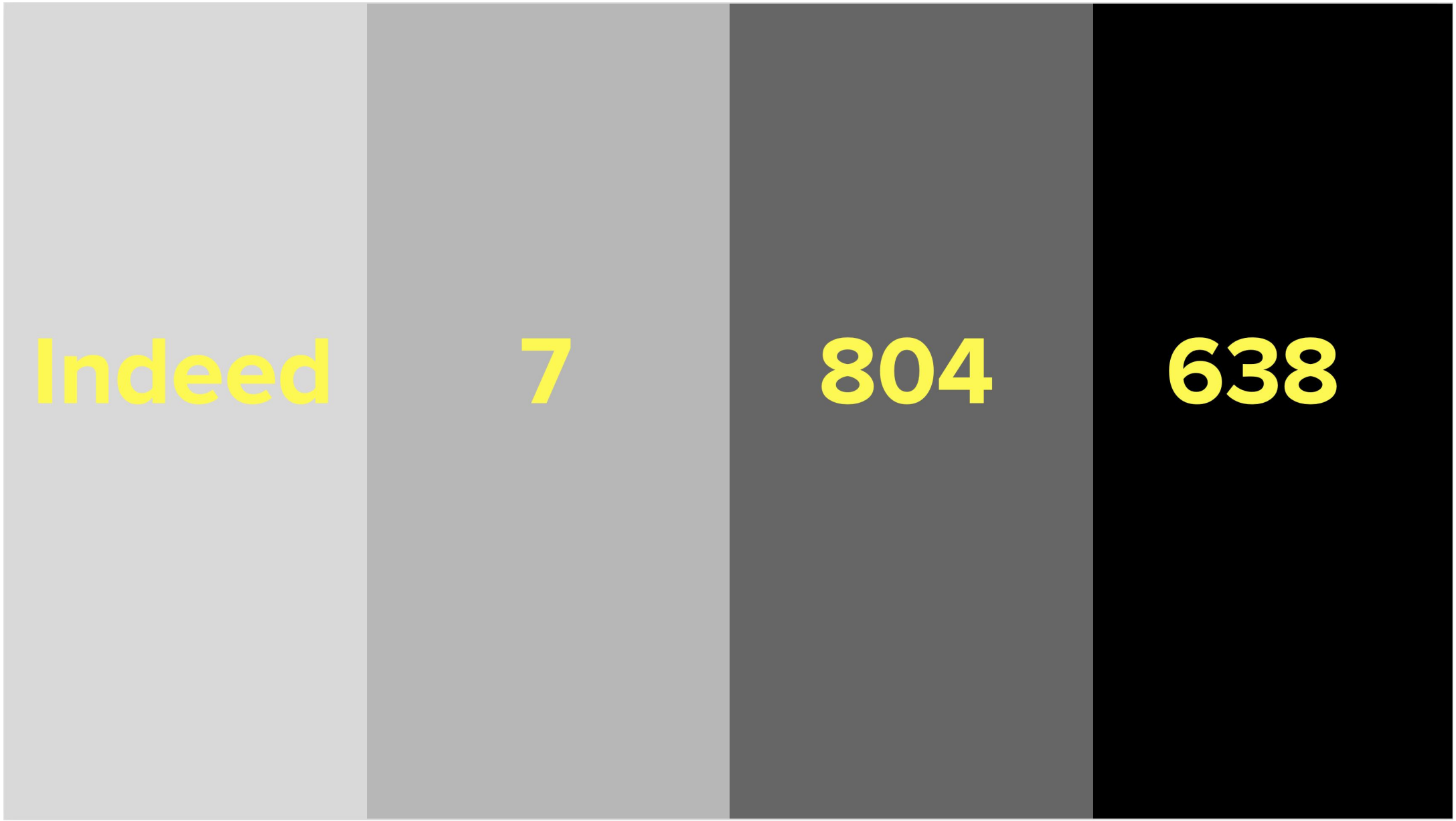
# Methods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| General discipline | Included search terms | # of search results | # of scraped posts | # of deleted posts | Total posts analyzed |
|---|---|---|---|---|---|
| **Graphic design** | graphic design, graphic designer, communication design, communication designer, visual design, visual designer | 964 | 200 | 52 | 148 |
| **Industrial design** | industrial design, industrial designer | 34 | 34 | 4 | 30 |
| **Product design** | product design, product designer | 351 | 200 | 47 | 153 |
| **Experience design** | experience design, experience designer, UX design, UX designer, interaction design, interaction designer | 524 | 200 | 34 | 166 |
| **Service design** | service design, service designer, strategic design, strategic designer, design strategy, design strategist | 49 | 49 | 14 | 35 |
| **Design research** | design research, design researcher | 15 | 15 | 0 | 15 |
| **Design management** | design lead, design leader, design manager | 149 | 149 | 58 | 91 |

Table 1. Search terms for collected and analyzed posts

# 638

200 posts per discipline

Full-time position

Published in the last 14 days (March 28, 2021)

No part-time or internship posts

No duplicated posts

Company names

Position titles

**Position descriptions** (job responsibilities, qualifications, technology skills required and preferred, education level, experience level, etc)

**Quantitative analysis**

| Co-design skill categories to test | Thesaurus from scholarly literature references | Complementary thesaurus from qualitative analysis of 16 job postings (subsamples) |
|---|---|---|
| **Research skills** | research, observation, interview, empathy, gather insight | test, usability, contextual inquiries, mixed-method approach, quantitative, qualitative |
| **Knowledge transformation** | Knowledge transformation, translation, transfer, insight analysis, knowledge integration, flexible knowledge | persona |
| **Collaboration** | Collaborat*, facilitat*, lead*, community engagement | listen, coach, network |
| **Synthesis** | Speculation, imagination, creativity | Problem-solving, innovat*, wireframe, user flow, customer journey |
| **Visualization** | Visualization, Storyboard, Storytelling, prototype | sketch*, draw*, mockups, illustrations, models |

Table 2. Co-design skill thesaurus

# References

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# 16

**Subsamples**

**Qualitative content analysis**

**Common themes and patterns**

# Methods

**638**

**Pearson’s chi-square test**

**The null hypothesis: different design disciplines’ practices require the same proportion of co-design skills, if $p<0.05$, then the statistical results are significant to reject the null hypothesis.**

**13**

**Qualitative contend analysis**

**Co-design**

**Participatory design**

# Findings

| Skill term | P-value (*significant) | Graphic design | Industrial design | Product design | Experience design | Service design | Design research | Design Management |
|---|---|---|---|---|---|---|---|---|
| **Research skills** | | | | | | | | |
| Research | 0.0000* | 25% | 43% | 72% | 69% | 77% | 100% | 33% |
| Interview | 0.4109 | 22% | 17% | 35% | 33% | 26% | 53% | 21% |
| Empathy | 0.2614 | 2% | 3% | 9% | 9% | 11% | 20% | 3% |
| Test | 0.0009* | 24% | 37% | 67% | 65% | 46% | 53% | 39% |
| Usability | 0.0000* | 5% | 10% | 25% | 46% | 20% | 40% | 13% |
| Quantitative | 0.0082* | 0 | 0 | 10% | 8% | 11% | 40% | 4% |
| Qualitative | 0.0003* | 0 | 0 | 13% | 12% | 20% | 53% | 4% |
| **Knowledge transformation skills** | | | | | | | | |
| Persona | 0.4641 | 30% | 47% | 41% | 49% | 46% | 53% | 30% |
| **Collaboration skills** | | | | | | | | |
| Collaborat* | 0.8581 | 64% | 67% | 71% | 81% | 80% | 87% | 64% |
| Facilitat* | 0.0001* | 2% | 0 | 22% | 22% | 40% | 27% | 17% |
| Lead* | 0.0921 | 41% | 60% | 71% | 64% | 77% | 53% | 83% |
| Listen | 0.4903 | 5% | 3% | 6% | 8% | 20% | 20% | 3% |
| **Synthesis skills** | | | | | | | | |
| Creativity | 0.5574 | 16% | 30% | 12% | 11% | 9% | 13% | 7% |
| Problem-solving | 0.6734 | 14% | 17% | 20% | 20% | 20% | 0 | 15% |
| Innovat* | 0.6734 | 36% | 53% | 51% | 44% | 66% | 60% | 47% |
| Wireframe | 0.0000* | 5% | 0 | 38% | 51% | 23% | 0 | 18% |
| User flow | 0.0000* | 2% | 0% | 29% | 39% | 20% | 7% | 13% |
| Customer journey | 0.0294* | 1% | 3% | 9% | 10% | 26% | 7% | 4% |
| **Visualization skills** | | | | | | | | |
| Visualization | 0.4826 | 6% | 20% | 10% | 10% | 9% | 0 | 16% |
| Storyboard | 0.1396 | 7% | 13% | 5% | 20% | 9% | 13% | 7% |
| Storytelling | 0.4282 | 5% | 3% | 7% | 5% | 23% | 20% | 3% |
| Prototype | 0.0000* | 5% | 43% | 51% | 61% | 49% | 13% | 19% |
| Sketch* | 0.0007* | 17% | 70% | 48% | 50% | 34% | 7% | 33% |
| Draw* | 0.0021* | 1% | 37% | 10% | 4% | 9% | 0 | 18% |
| Illustration | 0.0026* | 20% | 3% | 2% | 2% | 3% | 0 | 3% |
| Models | 0.0172* | 1% | 37% | 14% | 8% | 11% | 7% | 8% |

Table 3. Co-design skill terms frequencies in the U.S. job postings descriptions

# Findings

## Co-design

**Experience design [1]**

**Service design [2]**

## Participatory design

**Product design [1]**

**Experience design [4]**

**Service design [2]**

**Design research [1]**

**Design management [1]**

# Discussion

## Research skills

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**New** > **Design management** > **Traditional**

- Product design
- Experience design
- Design research

- Graphic design
- Industrial design

## Knowledge transformation skills

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Low frequencies

# Collaboration

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## New

Product design
Experience design
Design research
Design management

>

## Traditional

Graphic design
Industrial design

## Synthesis

## Visualization

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**Low frequencies**

**Discipline - specific**

# Conclusion

Qualitative analysis?

Interview designers and employers?

# References


Ambole, A. (2020) 'Embedding Design in Transdisciplinary Research: Perspectives from Urban Africa', *Design Issues*, 36(2), pp. 28–40. doi: 10.1162/desi_a_00588.

Burkett, I. (2012) *An introduction to co-design*. Knode: Sydney, Australia.

Cabrero, D. G., Winschiers-Theophilus, H., Abdelnour-Nocera, J. and Kapuire, G. K. (2016) 'A hermeneutic inquiry into user-created personas in different Namibian locales', in *Proceedings of the 14th Participatory Design Conference: Full papers - Volume 1*. New York, NY, USA: Association for Computing Machinery (PDC '16), pp. 101–110. doi: 10.1145/2940299.2940310.

Dodero, G., Gennari, R., Melonio, A. and Torello, S. (2014) 'Gamified co-design with cooperative learning', in *CHI'14 Extended Abstracts on Human Factors in Computing Systems*, pp. 707–718. Available at: https://dl.acm.org/doi/10.1145/2559206.2578870 (Accessed: 28 May 2021).

Druin, A. (2002) 'The Role of Children in the Design of New Technology', *Behaviour and Information Technology*, p. 38.

Dziobczenski, P.R.N. and Person, O. (2017) 'Graphic Designer Wanted: A Document Analysis of the Described Skill Set of Graphic Designers in Job Advertisements from the United Kingdom', *International Journal of Design*, 11(2), pp. 41–55.

Feast, L. (2012) 'Professional perspectives on collaborative design work', *CoDesign*, 8(4), pp. 215–230. doi: 10.1080/15710882.2012.734828.

Frascara, J. (2004) *Communication design : principles, methods, and practice*. New York : Allworth Press.

Lang, S. Y. T., Dickinson, J. and Buchal, R. O. (2002) 'Cognitive factors in distributed design', *Computers in Industry*, 48(1), pp. 89–98. doi: 10.1016/S0166-3615(02)00012-X.

Luck, R. (2018) '[Editorial] What is it that makes participation in design participatory design?', *Design Studies*, 59, pp. 1–8.

Mazzurco, A., Leydens, J. A. and Jesiek, B. K. (2018) 'Passive, Consultative, and Coconstructive Methods: A Framework to Facilitate Community Participation in Design for Development', *Journal of Mechanical Design*, 140(121401). doi: 10.1115/1.4041171.

Mejía, G.M., Malina, R.F., Xie, Y. and García, A.T. (2020) 'Translating disciplinary practices for trans-sentient collaboration', in *26th International Symposium on Electronic Arts ISEA2020*.

Moreno, L. A. and Villalba, E. R. (2018) 'Transdisciplinary Design: Tamed complexity through new collaboration', *Strategic Design Research Journal*, 11(1). doi: 10.4013/sdrj.2018.111.07.

Piller, F. T. and Tseng, M. M. (2003) 'New Directions for Mass Customization', in *The Customer Centric Enterprise: Advances in Mass Customization and Personalization*. Berlin, Heidelberg: Springer, pp. 519–535. doi: 10.1007/978-3-642-55460-5_30.

Pirinen, A. (2016) 'The Barriers and Enablers of Co-design for Services', *International Journal of Design, 10(3), pp.27-42*.

Postma, C. E. and Stappers, P. J. (2006) 'A vision on social interactions as the basis for design', *CoDesign*, 2(3), pp. 139–155. doi: 10.1080/15710880600888527.

Prahalad, C. K. and Ramaswamy, V. (2004) 'Co-creation experiences: The next practice in value creation', *Journal of Interactive Marketing*, 18(3), pp. 5–14. doi: 10.1002/dir.20015.

Rodgers, P. A., Mazzarella, F. and Conerney, L. (2019) 'The Evolving Landscape of Design Research in the UK', in *International Association of Societies of Design Research Conference 2019*, p. 16.

Sanders, E. B.-N. (2000) 'Generative Tools for Co-designing', *Collaborative Design*. London: Springer, pp. 3–12. doi: 10.1007/978-1-4471-0779-8_1.

Sanders, E. B.-N. and Stappers, P. J. (2008) 'Co-creation and the new landscapes of design', *CoDesign*, 4(1), pp. 5–18. doi: 10.1080/15710880701875068.

Sangiorgi, D. (2015) 'Designing for public sector innovation in the UK: design strategies for paradigm shifts', *Foresight*. Edited by Ms. Deborah Cox, Dr. Lawrence Green, and Dr. Krzysztof Borodako, 17(4), pp. 332–348. doi: 10.1108/FS-08-2013-0041.

Simonsen, J. and Robertson, T. (2012) *Routledge International Handbook of Participatory Design*. Routledge.

Siu, K. W. M. (2003) 'Users' Creative Responses and Designers' Roles', *Design Issues*, 19(2), pp. 64–73. doi: 10.1162/074793603765201424.

Taffe, S. (2015) 'The hybrid designer/end-user: Revealing paradoxes in co-design', *Design Studies*, 40, pp. 39–59. doi: 10.1016/j.destud.2015.06.003.

Vaajakallio, K., Lee, J.-J. and Kronqvist, J. (2013) 'Service co-design with the public sector – Challenges and opportunities in a healthcare context', In *Include Asia 2013 proceedings*. Helen Hamlyn Center RCA.

Van Mechelen, M., Schut, A., Gielen, M. and Södergren, A. C. (2019) 'Children's Assessment of Co-design Skills: Creativity, Empathy and Collaboration', in *Proceedings of the 18th ACM International Conference on Interaction Design and Children*. New York, NY, USA: Association for Computing Machinery (IDC '19), pp. 520–526. doi: 10.1145/3311927.3325334.

Visser, F. S., Stappers, P. J., Lugt, R. van der and Sanders, E. B.-N. (2005) 'Contextmapping: experiences from practice', *CoDesign*, 1(2), pp. 119–149. doi: 10.1080/15710880500135987.

Wu, J., Kang, J.-Y. M., Damminga, C., Kim, H.-Y. and Johnson, K. K. P. (2015) 'MC 2.0: testing an apparel co-design experience model', *Journal of Fashion Marketing and Management*, 19(1), pp. 69–86. doi: 10.1108/JFMM-07-2013-0092.

Xie, Y., Mejía, G.M., Coseo, P. and Cheng, C. (2020) 'A Participatory Design Case Study in Environmental Design Education', in *Proceedings of the 16th Participatory Design Conference 2020 - Participation(s) Otherwise - Volume 2*. New York, NY, USA: Association for Computing Machinery (PDC '20), pp. 87–94. doi:10.1145/3384772.3385152.


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# Thanks!

Questions?