



# **[DC] bRight XR: How to train designers to keep on the bright side?**

Romain Rouyer, David Bourguignon, Stéphanie Fleck

## **► To cite this version:**

Romain Rouyer, David Bourguignon, Stéphanie Fleck. [DC] bRight XR: How to train designers to keep on the bright side?. 2024. hal-04548936

**HAL Id: hal-04548936**

**<https://hal.science/hal-04548936>**

Preprint submitted on 16 Apr 2024

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

# [DC] bRight XR: How to train designers to keep on the bright side?

Romain Rouyer  
Université de Lorraine  
UR7312 PErSEUs  
Metz, France  
romain.rouyer@univ-lorraine.fr

David Bourguignon  
Université de Lorraine  
UR7312 PErSEUs  
Metz, France  
david.bourguignon@univ-lorraine.fr

Stéphanie Fleck  
Université de Lorraine  
UR7312 PErSEUs  
Metz, France  
stephanie.fleck@univ-lorraine.fr

**Abstract**—This research project aims to promote ethical principles among designers engaged in adaptive-XR by providing tools for self-assessment. We introduce a Design-Based Research (DBR) methodology to build bRight-XR, a framework including a heuristic evaluation matrix and based on learning theory.

**Index Terms**—eXtended Reality, ethics, well-being, ergonomic, heuristic criteria, pedagogical framework, eudaemonia, learning theory, cognitive science.

## I. INTRODUCTION

Researchers in human-computer interactions (HCI) are concerned with ethical tensions in persuasive design practices. The boundaries between manipulative mechanisms and positive technologies are generally thin (e.g.: deceptive pattern [6]). The use of standard digital interfaces highlights designers' critical role and responsibility in ensuring users' integrity and well-being.

In a context of democratization of immersive and body-adaptive technologies (adaptive-XR), warning signals from philosophers [12], designers [16] and educators [11] insist on the need for new approaches to design practices. The associated findings aim to limit the negative consequences of embodied design [1] and urge designers to respect their users' short- and long-term well-being. They encourage a paradigm shift to a fair and virtuous user experience that benefits the user and that goes beyond the search for experiences that are merely pragmatic or hedonistic.

Knowing this and recommending this, however, does not empower designers to make these changes. Given these concerns, we aim to develop and evaluate bRight-XR, a heuristic framework that incorporates ethical dimensions, which can be used both as a design guidance tool and as a training tool for adaptive-XR designers.

In this paper, we introduce the proposed design-based research (DBR) methodology for designing such a training toolkit, mobilizing in a three-part plan: (1) Design of a heuristic recommendation grid, (2) Test of pedagogical prototypes on the ground and (3) Pre-validation of a training kit.

## II. DESIGN-BASED RESEARCH METHOD FOR bRIGHT-XR

Our research aims to bridge the gap between research and practice in adaptive-XR design. Design-based research (DBR) was heralded as a practical research methodology that

could effectively bridge this gap with the support of learning theory [2]. This paper describes how we propose to mobilize an ergonomic process and co-design activities on the ground with researchers and designers.

### A. Design a heuristic evaluation matrix

The process of creating a heuristic evaluation grid involves identifying distinct dimensions, tying them to usability standards and a scale for evaluation. There are several possible approaches (e.g.: empirical, deductive, etc.), each with different effects and scopes, as Pineau and Fabre emphasize in the construction of their captology analysis matrix [15].

In our context, we will first conduct a systematic review of the scientific literature to highlight existing theoretical frameworks [11], guidelines [8], [12], [14] and design process [18]. To complement with an empirical approach, a series of semi-directive interviews with designers, researchers and educators expert in XR will allow us to identify feedback and projections from the ground.

Then, our data analysis will enable us to identify and qualify the main dimensions currently implemented in a matrix containing, but not limited to: disciplinary fields, type of interaction (input, output), modalities of measurement (e.g.: posture, gaze, voice, facial/labial expression, gesture, EEG signal, heart rate), temporality of the effect (before, during, temporary, persistent), the reliability indicator (number of studies/observations reported), the robustness of the usage (massive, emerging, niche).

This matrix will enable us to identify and propose a list of heuristic criteria, associated with an evaluation scale, considering the ethics of care. These criteria will be prioritized using a hybrid evaluation: a workshop for the qualitative dimension and a survey to statistically validate the results.

### B. Test pedagogical prototypes

To evaluate the analysis matrix, we will apply the scoring method to different pedagogical scenarios, using experimental prototypes in XR-adaptive. This phase will enable us to define training leverages for designers.

The scenarios and prototypes will be produced in collaboration with pedagogical engineers, designers and technologists, using the Design Fiction approach. We will partly refer to

prospective scenarios that have been developed in recently published studies [7], [9], [17].

### C. Pre-validation of a training kit

The outcomes of the Design Fiction investigation will be incorporated into a demonstration and educational toolkit. The kit will consist of a heuristic criteria evaluation grid and a set of recommendations. A concluding preliminary investigation will be conducted to evaluate its impact on designers, which will be validated through the utilization of a questionnaire.

The implementation of this questionnaire will be influenced by the previous work of Bastien and Scapin, [4], which focused on usability, and the work of Fleck et al., which focused on emerging educational technologies [3], and the consideration of long-term well-being [19].

This kit will be fully documented, published as an Open-Source project and built on open science standards to enable interoperability with other initiatives and welcome contributions.

## III. DISCUSSION

This project addresses the emerging nature of XR-adaptive technology and associated design techniques, which are evolving rapidly. It presents a unique opportunity to propose a comprehensive and ethical design framework at an early stage, yet it presents challenges in evaluating it in the absence of widespread implementation.

Furthermore, generative techniques (e.g., AI and Large Language Models) are soon to enter design arsenals, making it even more challenging for a designer to comprehend ethical aspects.

The uniqueness of this research project is derived from its multidisciplinary nature and its intention to establish a dialogue among diverse research fields that have, each in their own way, been accumulating cutting-edge knowledge and expertise for decades. These include cognitive sciences (psychology, philosophy, sociology), science and technology studies (signal processing, sensors, on-board electronics), and educational sciences.

## IV. CONCLUSION

To conclude, we anticipate demonstrating that a planned and heightened emphasis on ethics training on adaptive-XR designer, at an early stage of the democratization of this technology, could mitigate the adverse effects that digital technologies can have on individuals.

To fully exploit the performance of such a pedagogical toolkit, suitable dimensions need to be identified. The robustness of the approach appears to be attributed to its capacity to span multiple disciplinary boundaries and take into account a variety of user-risk scenarios.

## REFERENCES

- [1] D. Abrahamson, "Embodied Design," Embodied Design Research Laboratory, Berkeley, CA, Jun., 2019. <https://edrl.berkeley.edu/glossary/embodied-design/>
- [2] T. Anderson and J. Shattuck, "Design-Based Research: A Decade of Progress in Education Research?," *Educational Researcher*, vol. 41, no. 1, pp. 16–25, Jan. 2012, doi: 10.3102/0013189X11428813.
- [3] C. Baraudon, J.-B. Lanfranchi, C. J. M. Bastien, and S. Fleck, "Conception d'une échelle française d'évaluation de l'utilisabilité des nouvelles technologies éducatives par l'enfant," *Médiations et médiatisations - Revue internationale sur le numérique en éducation et communication*, no. 5, pp. 44–67, Jan. 2021. <https://hal.science/hal-03127419>
- [4] C. Bastien and D. Scapin, "Evaluating a user interface with ergonomic criteria," INRIA, Research Report RR-2326, 1994. <https://hal.inria.fr/inria-00074348>
- [5] B. Beams, "Teaching Conscientious Design: How Learning VR Development Can Lead to Greater Understanding of Sustainability," in *Ethical Considerations of Virtual Reality in the College Classroom*, 1st ed., New York: Routledge, 2023, pp. 51–69. doi: 10.4324/9781003329718-5.
- [6] H. Brignull, M. Leiser, C. Santos, and K. Doshi, "Deceptive patterns – user interfaces designed to trick you." Accessed: Dec. 21, 2023. <https://www.deceptive.design/>
- [7] C. Eghtebas, G. Klinker, S. Boll, and M. Koelle, "Co-Speculating on Dark Scenarios and Unintended Consequences of a Ubiquitous(ly) Augmented Reality," in *Proceedings of the 2023 ACM Designing Interactive Systems Conference*, in DIS '23. New York, NY, USA: Association for Computing Machinery, juillet 2023, pp. 2392–2407. doi: 10.1145/3563657.3596073.
- [8] P. Fuchs, Y. Toullec, B. Ajang, and A. Chiriach, "Charte de recommandations sur l'usage de la Réalité Virtuelle," *GIE VR Connection*, Oct. 2019. <https://vr-connection.com/comite-dethique-vr/charte-de-recommandations/>
- [9] D. P. Green et al., "Using Design Fiction to Explore the Ethics of VR 'In the Wild,'" in *Proceedings of the 2019 ACM International Conference on Interactive Experiences for TV and Online Video*, in TVX '19. New York, NY, USA: Association for Computing Machinery, juin 2019, pp. 293–299. doi: 10.1145/3317697.3323346.
- [10] V. Krauß, M. Nebeling, F. Jasche, and A. Boden, "Elements of XR Prototyping: Characterizing the Role and Use of Prototypes in Augmented and Virtual Reality Design," in *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems*, in CHI '22. New York, NY, USA: Association for Computing Machinery, avril 2022, pp. 1–18. doi: 10.1145/3491102.3517714.
- [11] J. J. Lee and E. Hu-Au, "E3XR: An Analytical Framework for Ethical, Educational and Eudaimonic XR Design," *Frontiers in Virtual Reality*, vol. 2, 2021. Available: <https://www.frontiersin.org/article/10.3389/frvir.2021.697667>.
- [12] M. Madran and T. K. Metzinger, "Real Virtuality: A Code of Ethical Conduct. Recommendations for Good Scientific Practice and the Consumers of VR-Technology," *Front. Robot. AI*, vol. 3, 2016, doi: 10.3389/frobot.2016.00003.
- [13] N. Mandran, E. Prior, E. Sanchez, and M. Vermeulen, "Reorienting Learning Game Design in Design-Based Research: a Case Study," *arXiv*, Jan. 09, 2024. Available: <http://arxiv.org/abs/2401.05450>
- [14] D. Meacham and D. Shanley, "Guidelines for ethics by design," *Guest XR: A Machine Learning Agent for Social Harmony in eXtended Reality*, Dec. 2022. Available: <https://guestxr.eu/download/d1-1-guidelines-for-ethics-by-design/>
- [15] K. Pineau and A. Fabre, "Évaluer la captologie et le design persuasif des services numériques. Approche empirique de mesure de la persuasion et proposition d'une matrice d'évaluation," *I2D - Information, données et documents*, vol. 2, no. 2, pp. 151–173, 2021, doi: 10.3917/i2d.212.0151.
- [16] W.-J. Tseng et al., "The Dark Side of Perceptual Manipulations in Virtual Reality," in *CHI Conference on Human Factors in Computing Systems*, New Orleans LA USA: ACM, Apr. 2022, pp. 1–15. doi: 10.1145/3491102.3517728.
- [17] X. Wang, L.-H. Lee, C. B. Fernandez, and P. Hui, "The Dark Side of Augmented Reality: Exploring Manipulative Designs in AR," Mar. 2023, doi: 10.1080/10447318.2023.2188799.
- [18] P. Wang, M. R. Miller, E. Han, C. DeVeaux, and J. N. Bailenson, "Understanding virtual design behaviors: A large-scale analysis of the design process in Virtual Reality," *Design Studies*, vol. 90, p. 101237, Jan. 2024, doi: 10.1016/j.destud.2023.101237.
- [19] A. S. Waterman et al., "The Questionnaire for Eudaimonic Well-Being: Psychometric properties, demographic comparisons, and evidence of validity," *J Posit Psychol*, vol. 5, no. 1, pp. 41–61, 2010, doi: 10.1080/17439760903435208.