BIN YU

Data Designer
Data-Enabled Design,
Philips Design, Philips

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EXPERIENCE

Data Designer, 03/2019 - Now
Data-Enabled Design Group, Philips Design, Philips

My work at Philips is to design data visualisation and human-Ai collaboration for complex AI-empowered medical systems.

Since 2019, I have been applying the method of Data-Enabled Design in measuring User Experience (UX) in the field of Oncology. We combine data, visualisation, chatbot, and human-computer interaction, to better understand and improve the clinical workflow in which oncologists can work more efficiently and with less stress. We collected rich datasets about the oncologists' daily work, including qualitative data (through observation, shadowing, and interview) and quantitative data (from sensors, devices, and systems). And then we designed a set of interactive visualisations and dashboards which allow user researchers to visually explore the data and get early findings or questions for the user study. Through chatbot, we further collected the oncologists' comments on our findings which led to the final insights to inform design innovations and business decisions.

Since 2020, the majority of my work has been building a UXAI demonstrator platform, which helps designers to create, fast prototype, and evaluate visualisation, UI, and HCI concepts that facilitate AI functionality. The platform connects the back-end datasets and Ai algorithms to the front-end UIs and visualisations. The platform provides a set of modular UI components and visualisation explorables with which the designers could get hands-on experience on the work of Ai, to further create consistent UX in Ai-empowered medical imaging solutions. Besides, the platform also enables the collection of quantitative user-system interaction data for the validation of new designs.

Post-doc Researcher, 01/2018 - 02/2019
Industrial Design, Eindhoven University of Technology, Eindhoven

In the post-doc period, I developed an unobtrusive system for recognition of office workers' behaviors and quantification of personal stress. It consists of a bio-sensing seat pad with polyvinylidene fluoride (PVDF) film to measure users' ballistocardiography (BCG) signal, and a

machine learning(ML) algorithm to process the BCG into heart rate variability for behaviour recognition and stress analysis. Then, the research outcomes have been transformed into an interactive health-promoting system “LightSit” which can (1) unobtrusively sense an office worker’s sedentary work style and chronic stress and (2) provide intervention and guidance through an ambient lighting display to facilitate fitness exercises and deep-breathing relaxation at work.

Ph.D. Researcher, 10/2013 - 12/2017
Industrial Design, Eindhoven University of Technology, Eindhoven

My Ph.D. topic was "Designing Biofeedback for Managing Stress”. I explored how data visualisation and HCI can incorporate biofeedback technologies to effectively and comfortably promote respiration training against stress in a daily context. My work has focused on developing unobtrusive bio-sensing techniques to measure physiological data (e.g., heart rate variability or respiration), quantifying people’s stress accordingly, and designing real-time biofeedback user interfaces with trustable accuracy and aesthetically pleasing user experience. In this period, I have worked and tested seven novel biofeedback interfaces based on various HCI technologies including metaphorical visualisation, artistic visualisation, sonification, soundscape-based audio display, shape-changing display, tangible and haptic interfaces.

My research results have been transformed into quality publications in relevant academic venues, as well as workable applications in real-world contexts. In the past 5 years, I have published 12 journal papers (7 times first-authorship) and 11 conference papers (8 times first-authorship). *RESonance* multi-modal biofeedback system has been deployed in Philips Sport Vereniging (PSV) for professional soccer players’ relaxation training. And *Heart-Bloom* has been adopted by Dutch Heart Foundation for a charity program that raised public awareness and empathy on children’s heart health issues. The design works: BioMirror, HeartBloom, Heart Calligraphy, StressTree, LightSit, BioFidget, have been selected for several exhibitions in Dutch Design Week (2015,2017,2018), Dubai Design week(2015), Milano Design Week(2015), New York Design Week (2016), TEI (2016) and CHI conference.

Research Assistant, 07/2012 - 09/2013
Institute of Biomedical and Health Engineering, Chinese Academy of Science

My research explored the visualisation of high-density surface Electromyography (HD sEMG) signals for the early detection and rehabilitation of swallowing disorders. The HD sEMG signals were measured by 96 electrodes that were placed on the front neck and visualised by a sequence of energy maps. The HD sEMG energy maps could provide detailed spatial and temporal properties of the muscle electrical activity, and visualise the muscle contractions that are closely related to the swallowing function. Our research provides an alternative method to physiologically evaluate the dynamic characteristics of swallowing and fast screen swallowing disorders or dysphagia.

EDUCATION

Ph.D. 2013-2018 Industrial Design, Eindhoven University of Technology, Eindhoven
M.A., 2010-2012 Biomedical Engineering, Northeastern University, Shenyang
B.A., 2008-2010 Industrial Design, Chongqing University, Chongqing
B.A., 2006-2010 Biomedical Engineering, Chongqing University, Chongqing

TECHNICAL SKILLS

- Proficient with ***Javascript*** and ***React*** to build interactive UIs and data-driven web applications for field study in a real-world context.
- Proficient with the design tools like ***Sketch*** and ***Illustrator*** in ideation and creating low-fidelity design prototypes for early iteration.

- Proficient with ***D3*** to design meaningful visualisations supporting sense-making and story-telling with a specific dataset and for different user groups.
- Skilled with ***Cross-filter***, ***Dc***, and ***Chart*** libraries to build an interactive dashboard with large multivariate business datasets for insight generation.
- Skilled with ***Python*** or ***Matlab*** for data cleansing, processing, and analysis.
- Rich experience with rapid prototyping tools like ***Processing*** and ***Arduino*** to build human-computer interaction demos.
- Rich experience with ***bio-sensors*** for measuring user's ***ECG***, ***heart rate***, ***respiration***, and ***skin conductance*** as the bio-metrics to quantify emotion and UX.

RESEARCH& DESIGN SKILLS

- Expertise in designing ***human-computer interaction*** to shape the desired user experience and meaningful information flow.
- Proficient in designing ***multi-model interface*** (visual, audio, tangible, ambient light) to improve usability and user experience.
- Proficient in applying a ***comprehensive approach*** that combines quantitative and qualitative data in the usability test and UX study of new interfaces and solutions.
- Skilled with ***statistical methods*** and software SPSS for ***quantitative analysis*** and the approach of Conventional Qualitative Content Analysis for ***qualitative analysis.***
- Good knowledge in ***Design Methods*** including User-Centred Design, Research through Design and, Data-Enabled Design.
- Good ***writing*** and ***storytelling skills*** to transform research findings into understandable insights through visualisation.

HONOURS & AWARDS

- Best Poster Award, 7th International Conference on Automotive User Interface
- BioMirror has been featured by CNN as one of “the most innovative projects from the world’s leading design schools”.
- IBM University program, Advance level academic Qualification (2011)
- Northeastern University First Class academic scholarship (2010)
- Northeastern University Excellent Student Award (2011)
- Chongqing University First Class academic scholarship (2006 - 2010)

GRANT

- Creative Industrial Knowledge-Innovation-Mapping grant from NWO (22K €), 2018
- Postdoctoral grant from International Smart-Health Lab and Hangzhou Bobo Technology Co., Ltd to support post-doc research, (60K €), 2017
- The project BioMirror has been granted by Design United (4TU federation) for “Dutch Research for Design” (5K €), 2015
- The project HeartBloom has been granted by Design United (4TU federation) for “Dutch Research for Design” (5K €), 2016.

EXHIBITIONS

- “LightSit”, Mind the Step, Dutch Design Week, Eindhoven, the NL, 2018
- “Zen-Light", World Industrial Design Conference, Hangzhou, China, 2018
- “BioFidget”, Mind the Step, Dutch Design Week, Eindhoven, the NL 2018

- “HeartBloom”, Mind the Step, Dutch Design Week, Eindhoven, the NL, 2017
- “Heart Bloom”, the WantedDesign, New York Design Week, New York, USA, 2016
- “Heart Calligraphy”, TEI Art Track exhibition, Eindhoven, the NL, 2016
- “BioMirror”, Global Grad Show, Dubai Design Week, Dubai, UAE, 2015
- “Heart Bloom”, Global Grad Show, Dubai Design Week, Dubai, UAE, 2015
- “BioMirror”, Mind the Step, Dutch Design Week, Eindhoven, the NL, 2015
- “Dialogue”, Dutch invertuals, SALONE DEL MOBILE MILAN, Milan, Italy, 2015

PUBLICATIONS

Thesis

Yu, B. (2018). Designing biofeedback for managing stress. Technische Universiteit Eindhoven.

Journals

1. **Yu,B.**, An,P.,Hendriks,S., Zhang, N., Feijs, L., Li, M., Hu, J., (2021). ViBreathe: Heart Rate Variability Enhanced Respiration Training for Workaday Stress Management via an Eyes-free Tangible Interface, *International Journal of Human–Computer Interaction* (2021): 1-20.

2. Xue, M., Liang, R. H., **Yu, B**., Funk, M., Hu, J., & Feijs, L. (2019). AffectiveWall: Designing Collective Stress-Related Physiological Data Visualization for Reflection. *IEEE Access*, 7, 131289-131303.

3. Ren, X., **Yu, B**., Lu, Y., Chen, Y., & Pu, P. (2019). HealthSit: designing posture-based interaction to promote exercise during fitness breaks. *International Journal of Human–Computer Interaction*, 35(10), 870-885.

4. **Yu, B.**, & Arents, R. (2019). Biofeedback Painting: Let the Heart Lead the Brush. *Leonardo*, 1-10.

5. Ren, X., **Yu, B**., Lu, Y., Zhang, B., Hu, J., & Brombacher, A. (2019). LightSit: An unobtrusive health-promoting system for relaxation and fitness microbreaks at work. *Sensors*, *19*(9), 2162.

6. **Yu, B**., Funk, M., Hu, J. Wang,Q and Feijs, L. (2018). Biofeedback for Everyday Stress Management: A Systematic Review. *Frontiers in ICT,* 5(23).

7. **Yu, B**., Hu, J., Funk, M., Liang, R. H., Xue, M., & Feijs, L. (2018). RESonance: Lightweight, Room-Scale Audio-Visual Biofeedback for Immersive Relaxation Training. *IEEE Access*, 6, 38336-38347.

8. **Yu, B**., Hu, J., Funk, M., & Feijs, L. (2018). DeLight: biofeedback through ambient light for stress intervention and relaxation assistance. *Personal and Ubiquitous Computing*, 22 (4), 787–805.

9. **Yu, B**., Funk, M., Hu, J. and Feijs, L., (2018). UnWind: Musical Biofeedback Interfaces for Relaxation Training, *Behaviour & Information Technology,* 37(8), 800-814

10. **Yu, B.**, Hu, J., Funk, M. and Feijs, L., 2017. A Model of Nature Soundscape for Calm Information Display. *Interacting with Computers,* 29(6), pp.813-823.

11. Zhu, M., **Yu, B**., Yang, W., Jiang, Y., Lu, L., Huang, Z., Chen, S. and Li, G., 2017. Evaluation of normal swallowing functions by using dynamic high-density surface electromyography maps. *Biomedical engineering online*, 16(1), p.133.

12. Wang, Q., Markopoulos, P., **Yu, B**., Chen, W., & Timmermans, A. (2017). Interactive wearable systems for upper body rehabilitation: a systematic review. *Journal of NeuroEngineering and Rehabilitation*, 14(1), 20.

Conference

1. **Yu, B**., Zhang, B., An, P., Xu, L., Xue, M., & Hu, J. (2019, July). An Unobtrusive Stress Recognition System for the Smart Office. In 2019 41st *Annual International Conference of the IEEE Engineering in Medicine and Biology Society* (EMBC) (pp. 1326-1329). IEEE.

2. **Yu, B**., Zhang, B., Xu, L., Fang, P., & Hu, J. (2019, July). Automatic Detection of Atrial Fibrillation from Ballistocardiogram (BCG) Using Wavelet Features and Machine Learning. In 2019 41st *Annual International Conference of the IEEE Engineering in Medicine and Biology Society* (EMBC) (pp. 4322-4325). IEEE.

3. Ren, X., **Yu, B**., Lu, Y., Brombacher, A.C. (2018), Exploring Cooperative Fitness Tracking to Encourage Physical Activity for Office Workers, *2*(CSCW), 1-20.

4. Liang, R. H., **Yu, B**., Xue, M., Hu, J., & Feijs, L. M. (2018, April). BioFidget: Biofeedback for respiration training using an augmented fidget spinner. In *Proceedings of the 2018 CHI conference on human factors in computing systems* (pp. 1-12).

5. Liang, R. H., **Yu, B**., Xue, M., Hu, J., & Feijs, L. M. (2018, April). Biofidget demo: biofeedback for respiration training using an augmented fidget spinner. In *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems* (pp. 1-4).

6. **Yu, B**., Hu, J., Funk, M., & Feijs, L. (2017, June). StressTree: a Meterphorical Visualization of Heart Rate Variability for Stress Management. In *Proceedings of DIS 2017* ACM.

7. **Yu, B**., Hu, J., Funk, M., & Feijs, L. (2016, October). A study on user acceptance of different auditory content for relaxation. In *Proceedings of the Audio Mostly* 2016 (pp. 69-76). ACM.

8. **Yu, B**. (2016, May). Adaptive biofeedback for mind-body practices. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems* (pp. 260-264). ACM.

9. **Yu, B.**, Arents, R., Funk, M., Hu, J., & Feijs, L. M. (2016, May). HeartPlotter: visualizing bio-data by drawing on paper. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems* (pp. 1794-1799). ACM.

10. **Yu, B.**, Bongers, N., Van Asseldonk, A., Hu, J., Funk, M., & Feijs, L. (2016, February). LivingSurface: Biofeedback through Shape-changing Display. In *Proceedings of the TEI'16: Tenth International Conference on Tangible, Embedded, and Embodied Interaction* (pp. 168-175). ACM.

11. **Yu, B**., Arents, R., Hu, J., Funk, M., & Feijs, L. (2016, February). Heart Calligraphy: an Abstract Portrait Inside the Body. In *Proceedings of the TEI'16: Tenth International Conference on Tangible, Embedded, and Embodied Interaction* (pp. 675-680). ACM.

12. **Yu, B.**, Feijs, L., Funk, M., & Hu, J. (2015, September). Breathe with touch: a tactile interface for breathing assistance system. In *Human-Computer Interactio, INTERACT*, (pp. 45-52).

13. **Yu, B**., Feijs, L., Funk, M., & Hu, J. (2015). Designing auditory display of heart rate variability in biofeedback context. In *Proceedings of of 21th International Conference on Auditory Displays* (ICAD 2015).

14. **Yu, B**., Song, Y., & Feijs, L. (2015). Light Bird: An Animated Biofeedback Interface for Coherent Breathing. In *9th International Conference on Design and Semantics of Form and Movement* (DesForm) (pp. 356-364).

15. **Yu, B.**, Hu, J., & Feijs, L. M. (2014, November). Design and Evaluation of an Ambient Lighting Interface of HRV Biofeedback System in Home Setting. In *Proceeding of the Conference on Ubiquitous Computing and Ambient Intelligence.* (UCAmI), (pp. 88-91).

16. Wang, C., Terken, J., **Yu, B**., & Hu, J. (2015, September). Reducing driving violations by receiving feedback from other drivers. In Adjunct Proceedings of the 7th International Conference on Automotive User Interfaces and Interactive Vehicular Applications (pp. 62-67). ACM.

17. Lin, X., Tao, L., **Yu, B.**, Guo, Y., & Hu, J. (2015, August). Interact Through Your Data: Collective Immersive Experience Design for Indoor Exercises. In International Conference on Cross-Cultural Design (pp. 328-337). Springer International Publishing.

18. **Yu, B.**, Zhu, M., Xu, L., & Li, G. (2013, July). A pilot study of high-density electromyographic maps of muscle activity in normal deglutition. In Engineering in Medicine and Biology Society (EMBC), 2013 35th Annual International Conference of the IEEE (pp. 6635-6638). IEEE.

19. **Yu, B.**, Xu, L., & Li, Y. (2012, June). Bluetooth low energy (BLE) based mobile electrocardiogram monitoring system. In Information and Automation (ICIA), 2012 International Conference on (pp. 763-767). IEEE.