Ethical design for digital wellbeing and mental health

Prof Corina Sas - HCI and Digital Health

Lancaster University, UK

Visiting Professor

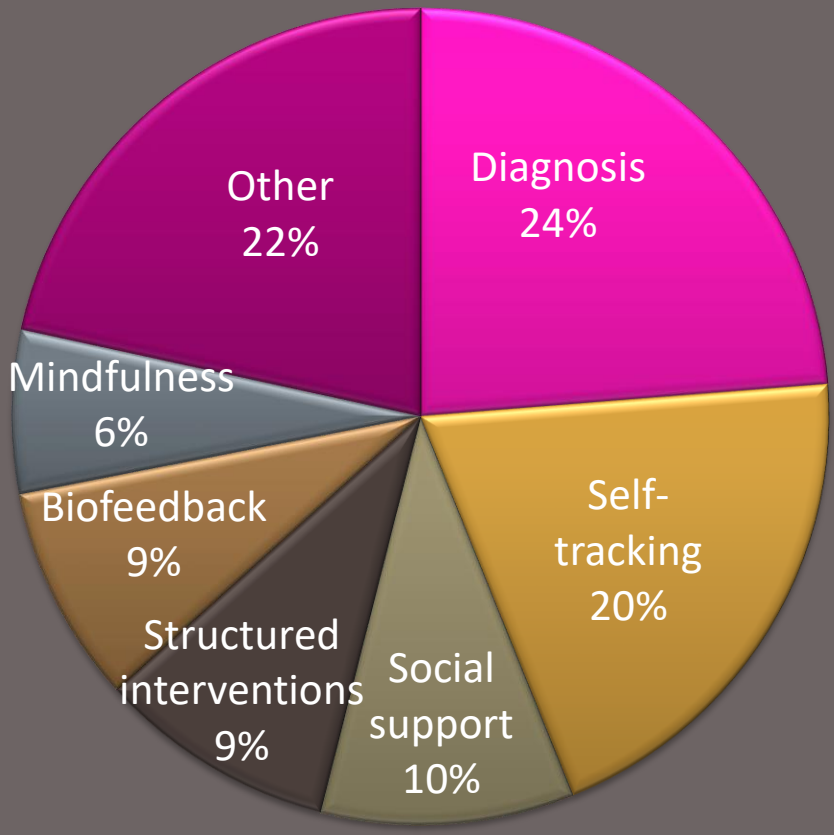
Stanford University
15 April 2022

Affective Technologies

Systematic review - 139 papers

over last 10 years of SIGCHI proceedings

- Emphasis on data production
- Limited evaluation in clinical context
- Limited engagement with emotion regulation theories

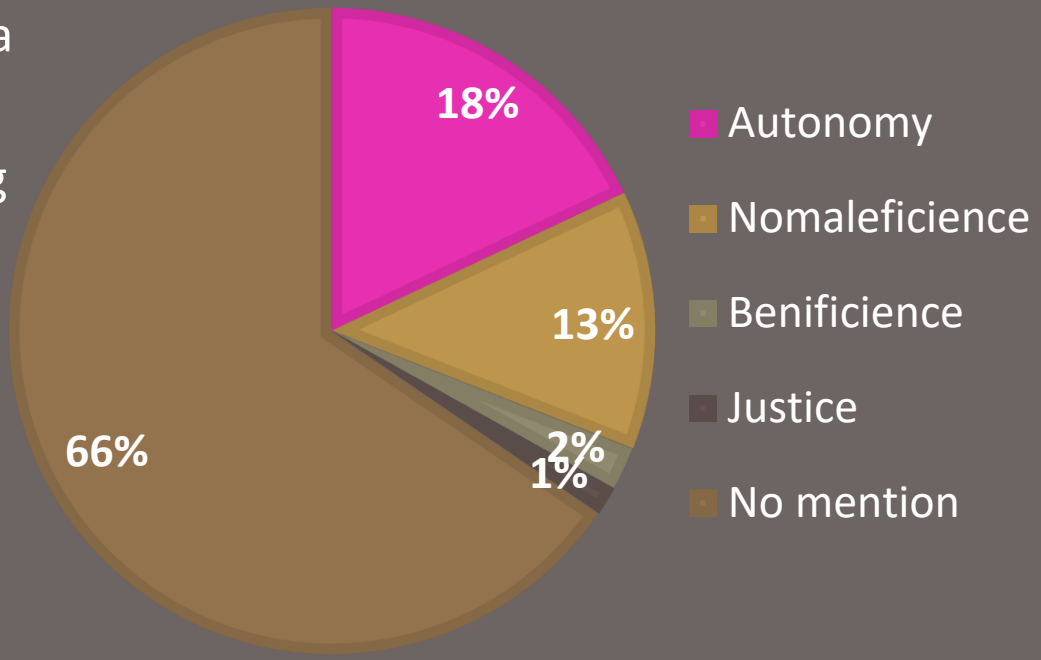


Sanches, P., Janson, A., Karpashevich, P., Nadal, C., Qu, C., Dauden Roquet, C., Umair, M., Windlin, C., Doherty, G., Höök, K., Sas, C. 2019. HCI and affective health: Taking stock of a decade of studies and charting future research directions, *CHI'19*, 17 pages [**Honorable Mention Award**]

Affective Technologies

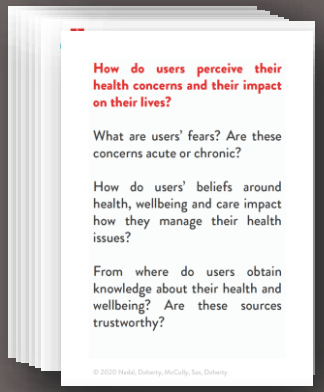
Ethics concerns and best practices

- diagnosis vs lack of support, stigma
- logging personal data vs privacy
- involving users vs careful screening
- secondary data use vs consent

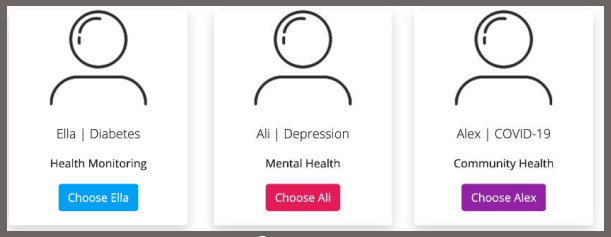


Sanches, P., Janson, A., Karpashevich, P., Nadal, C., Qu, C., Dauden Roquet, C., Umair, M., Windlin, C., Doherty, G., Höök, K., Sas, C. 2019. HCI and affective health: Taking stock of a decade of studies and charting future research directions. In *CHI'19*, 17 pages **[Honourable Mention Award]**

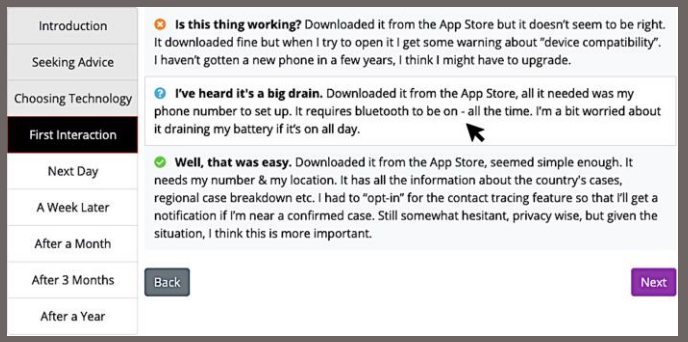
Affective Health Technologies: Acceptance



16 cards



3 personas

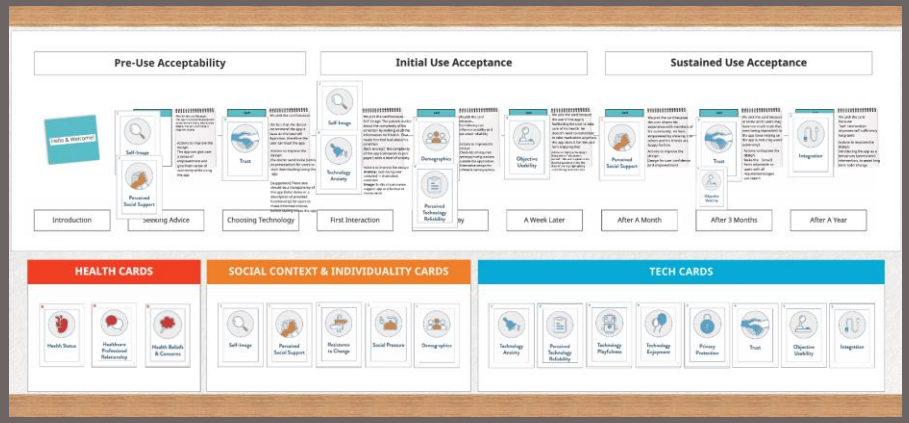


scenarios

The Technology Acceptance (TAC) Toolkit

And a website

ehealthacceptancedesign.com



A virtual think-space

Images: ©Camille Nadal

Nadal, C., McCully, S., Doherty, K., Sas, C., Doherty G., 2022. The TAC toolkit: Supporting the design for user acceptance of health technologies from a macro-temporal perspective, *CHI'22* [**Best Paper Award**]

Affective Health Technologies: Acceptance

Images: ©Camille Nadal

Nadal, C., Sas, C., & Doherty, G. (2020). Technology acceptance in mobile health: scoping review of definitions, models, and measurement. *JMIR*, *22*(7), e17256.

Nadal, C., McCully, S., Doherty, K., Sas, C., Doherty G., 2022. The TAC toolkit: Supporting the design for user acceptance of health technologies from a macro-temporal perspective, *CHI'22* [**Best Paper Award**]

Design Exemplars

Emotional awareness

- AffectiveHealth wearable system
- Smart materials interfaces
- ThermoPixels toolkit for hybrid crafting

Sas, C., Whittaker, S., Dow, S., Forlizzi, J., Zimmerman, J. 2014. Generating implications for design through design research. In *Proc. CHI '14*, 1971–1980.

Design Exemplars

Emotional awareness

- AffectiveHealth wearable system
- Smart materials interfaces
- ThermoPixels toolkit for hybrid crafting

Sas, C., Whittaker, S., Dow, S., Forlizzi, J., Zimmerman, J. 2014. Generating implications for design through design research. In *Proc. CHI '14*, 1971–1980.

AffectiveHealth System

Sanches, P., Hook, K., Sas, C. and Stahl, A., 2019. Ambiguity as a resource to inform proto-practices: The case of skin conductance. *ACM Transactions on Computer-Human Interaction (TOCHI*), 32 pages.

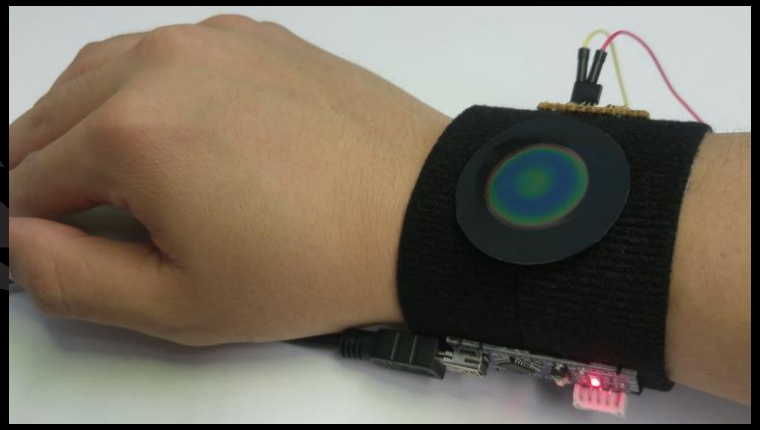
Design Exemplars

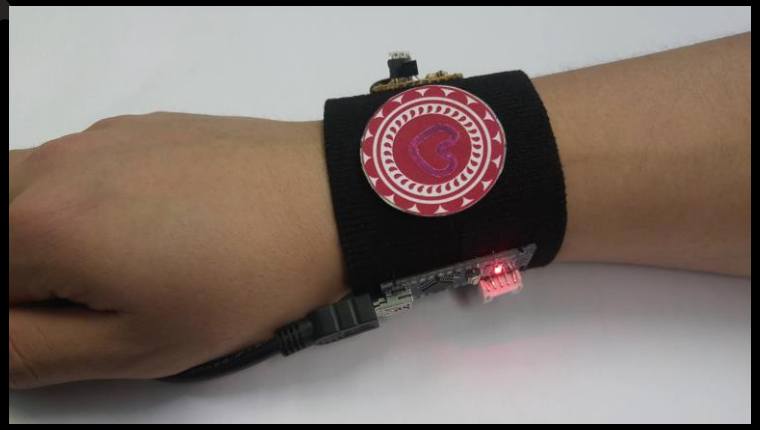
Emotional awareness

- AffectiveHealth wearable system
- Smart materials interfaces
- ThermoPixels toolkit for hybrid crafting

Sas, C., Whittaker, S., Dow, S., Forlizzi, J., Zimmerman, J. 2014. Generating implications for design through design research. In *Proc. CHI '14*, 1971–1980.

Smart Materials Interfaces

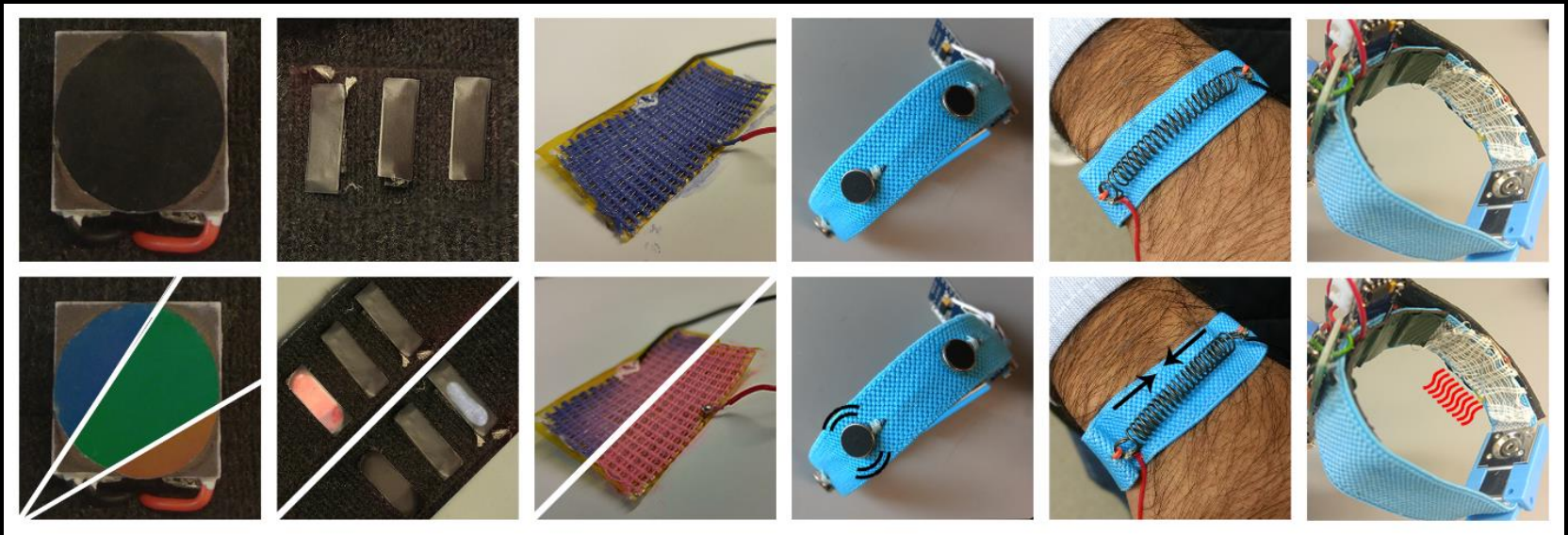




Umair, M., Hamza Latif, M., Sas, C. 2018. Dynamic displays at wrist for real time visualization of affective data, *DIS'18*, 201-205.

Images: ©Muhammad Umair

Smart Materials Interfaces



Images: ©Muhammad Umair

Umair, M., Sas, C. & Hamza Latif, M., 2019. Towards affective chronometry: Exploring smart materials and actuators for real-time representations of changes in arousal, *DIS'19,* 1479–1494

Smart Materials Interfaces

Understanding emotional responses

Increased awareness of affective chronometry

Umair, M., Sas, C. & Hamza Latif, M., 2019. Towards affective chronometry: Exploring smart materials and actuators for real-time representations of changes in arousal *DIS'19,* 1479–1494

Smart Material Interfaces: Implications

- Immediate & embodied feedback - awareness of raise time
- Gradual thermochromic feedback - awareness of decay time
- Design for slowness
- Increased expressiveness for emotional awareness

Umair, M., Sas, C. & Hamza Latif, M., 2019. Towards affective chronometry: Exploring smart materials and actuators for real-time representations of changes in arousal, *DIS'19,* 1479–1494

Design Exemplars

Emotional awareness

- AffectiveHealth wearable system
- Smart materials interfaces
- ThermoPixels toolkit for hybrid crafting

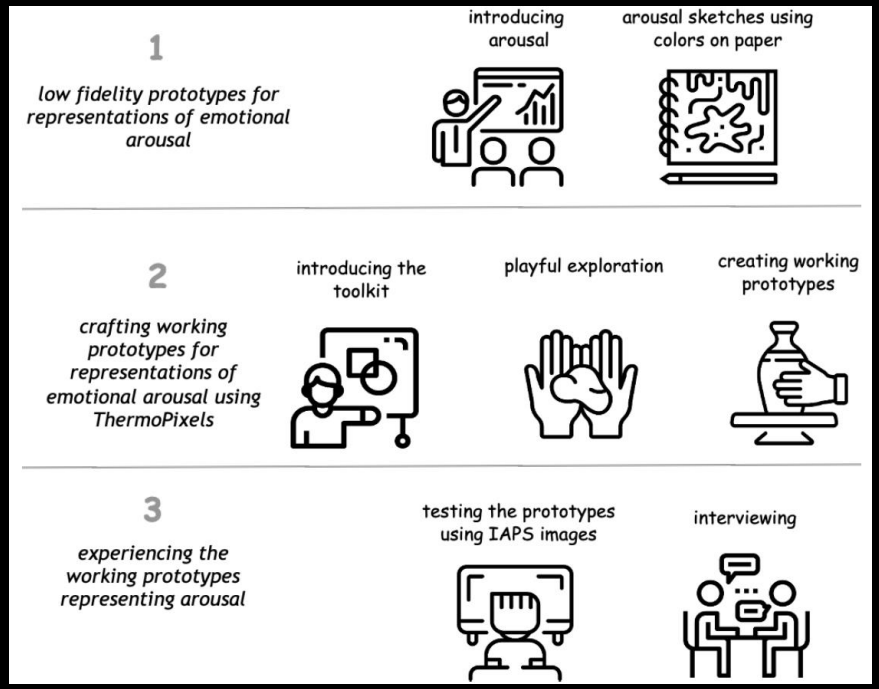
Sas, C., Whittaker, S., Dow, S., Forlizzi, J., Zimmerman, J. 2014. Generating implications for design through design research. In *Proc. CHI '14*, 1971–1980.

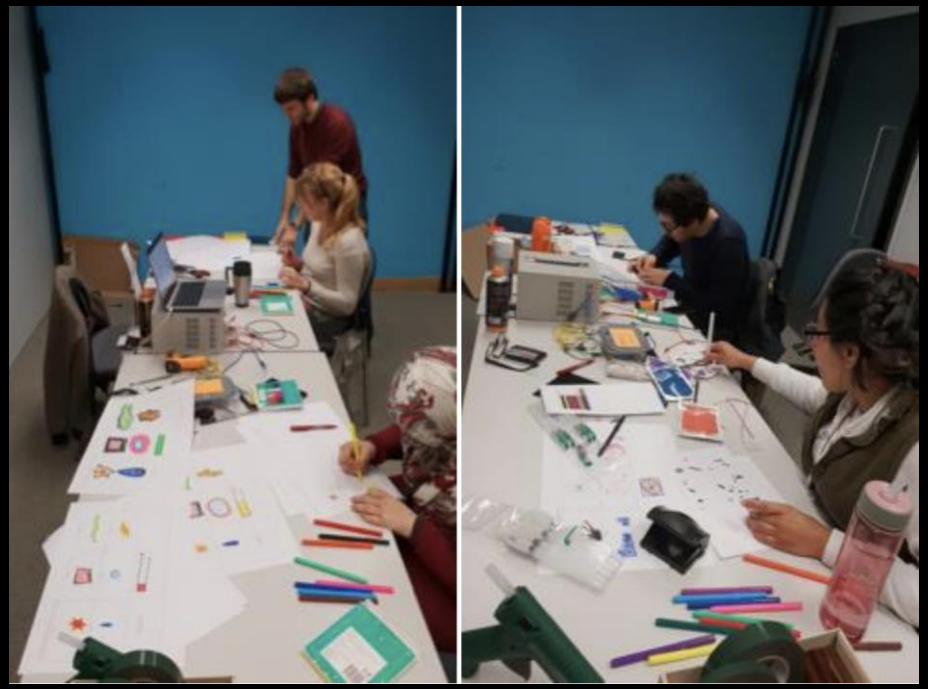
ThermoPixels Toolkit

Umair, M., Sas, C., Alfaras, M. 2020. ThermoPixels: Toolkit for personalizing arousal-based interfaces through hybrid crafting. *DIS '20 Proceedings of the 2020 Designing Interactive Systems Conference, 1017-1032.*

Image: ©Muhammad Umair

ThermoPixels: Evaluation





Images: ©Muhammad Umair

Umair, M., Sas, C., Alfaras, M. 2020. ThermoPixels: Toolkit for personalizing arousal-based interfaces through hybrid crafting. *DIS '20 Proceedings of the 2020 Designing Interactive Systems Conference, 1017-1032.*

ThermoPixels: Implications

- Embodied exploration: from assembling to creative expression

Umair, M., Sas, C., Alfaras, M. 2020. ThermoPixels: Toolkit for personalizing arousal-based interfaces through hybrid crafting. *DIS '20 Proceedings of the 2020 Designing Interactive Systems Conference, 1017-1032.*

ThermoPixels: Implications

- Embodied exploration: from assembling to creative expression
- From arousal representations to emotion regulation

Umair, M., Sas, C., Alfaras, M. 2020. ThermoPixels: Toolkit for personalizing arousal-based interfaces through hybrid crafting. *DIS '20 Proceedings of the 2020 Designing Interactive Systems Conference, 1017-1032.*

ThermoPixels: Implications

- Embodied exploration: from assembling to creative expression
- From arousal representations to emotion regulation
- Personalization of affective interfaces

Umair, M., Sas, C., Alfaras, M. 2020. ThermoPixels: Toolkit for personalizing arousal-based interfaces through hybrid crafting. *DIS '20 Proceedings of the 2020 Designing Interactive Systems Conference, 1017-1032.*

Design Exemplars

Emotion regulation

- Haptic interfaces: vibrotactile and thermal
- 3D printed flavors
- Digital wellbeing apps
- Depression apps
- Wall-sized displays for dementia care

Sas, C., Whittaker, S., Dow, S., Forlizzi, J., Zimmerman, J. 2014. Generating implications for design through design research, *CHI '14*, 1971–1980.

Design Exemplars

Emotion regulation

- Haptic interfaces: vibrotactile and thermal
- 3D printed flavors
- Digital wellbeing apps
- Depression apps
- Wall-sized displays for dementia care

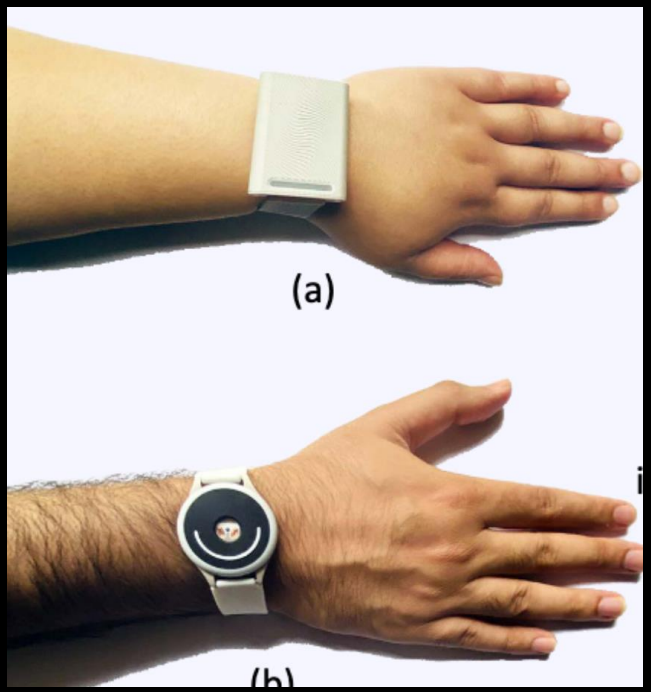
Sas, C., Whittaker, S., Dow, S., Forlizzi, J., Zimmerman, J. 2014. Generating implications for design through design research, *CHI '14*, 1971–1980.

Haptic Interfaces

Umair, M., Sas, C., Chalabianloo, N., Ersoy, C., 2021. Exploring personalized vibrotactile and thermal patterns for affect regulation, *DIS '21,* 891-906.

Haptic Interfaces: Method

- Part 1: Co-design of personalized patterns (haptic group)
- Part 2: Evaluation of patterns' impact for affect regulation (haptic and control group)



Images: ©Muhammad Umair

Umair, M., Sas, C., Chalabianloo, N., Ersoy, C., 2021. Exploring personalized vibrotactile and thermal patterns for affect regulation, *DIS '21,* 891-906.

Haptic Interfaces

Umair, M., Sas, C., Chalabianloo, N., Ersoy, C., 2021. Exploring personalized vibrotactile and thermal patterns for affect regulation, *DIS ‘21,* 891-906.

Haptic Interfaces

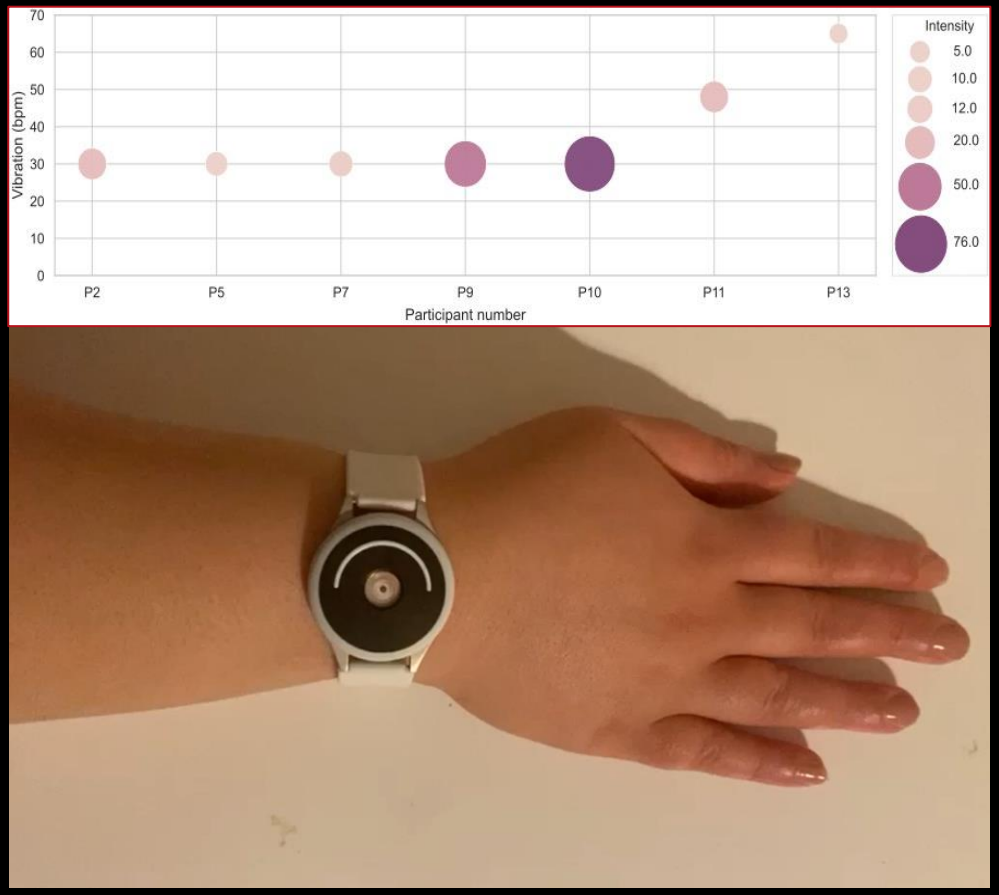


Image: ©Muhammad Umair

"I went for the lowest [30 bpm] I could get. The reason is that I felt slower. It was nicer to clam down at a slow rate, rather than when it's really high [that] it's like more panicky" [P9]

Umair, M., Sas, C., Chalabianloo, N., Ersoy, C., 2021. Exploring personalized vibrotactile and thermal patterns for affect regulation, *DIS '21,* 891-906.

Haptic Interfaces

cool warm

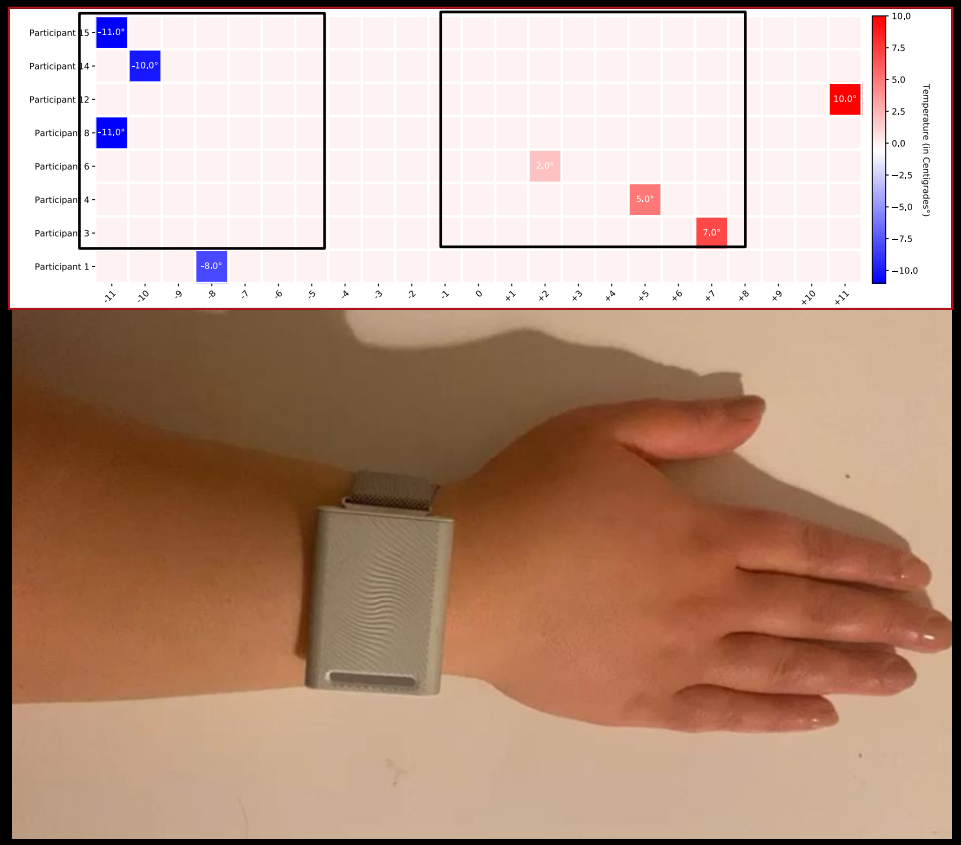


Image: ©Muhammad Umair

Warm

"It feels like someone is holding my hand" [P6]

Cool

"It's like putting the ice cubes on your wrist, which […] kind of cools you down" [P8]

Umair, M., Sas, C., Chalabianloo, N., Ersoy, C., 2021. Exploring personalized vibrotactile and thermal patterns for affect regulation, *DIS '21,* 891-906.

Haptic Interfaces: Implications

- Design for implicit regulation: entrainment of slow bodily rhythms
- Entrainment of slow bodily rhythms: beyond vibrotactile modality
- Design for thermal biofeedback
- Support personalized and dynamically adaptive patterns

Umair, M., Sas, C., Chalabianloo, N., Ersoy, C., 2021. Exploring personalized vibrotactile and thermal patterns for affect regulation, *DIS '21,* 891-906.

Design Exemplars

Emotion regulation

- Haptic interfaces: vibrotactile and thermal
- 3D printed flavors
- Digital wellbeing apps
- Depression apps
- Wall-sized displays for dementia care

Sas, C., Whittaker, S., Dow, S., Forlizzi, J., Zimmerman, J. 2014. Generating implications for design through design research, *CHI '14*, 1971–1980.

3D Printed Flavors

- From taste stimulation towards multisensory flavor experiences
- From external sensory stimulation to external and internal ones

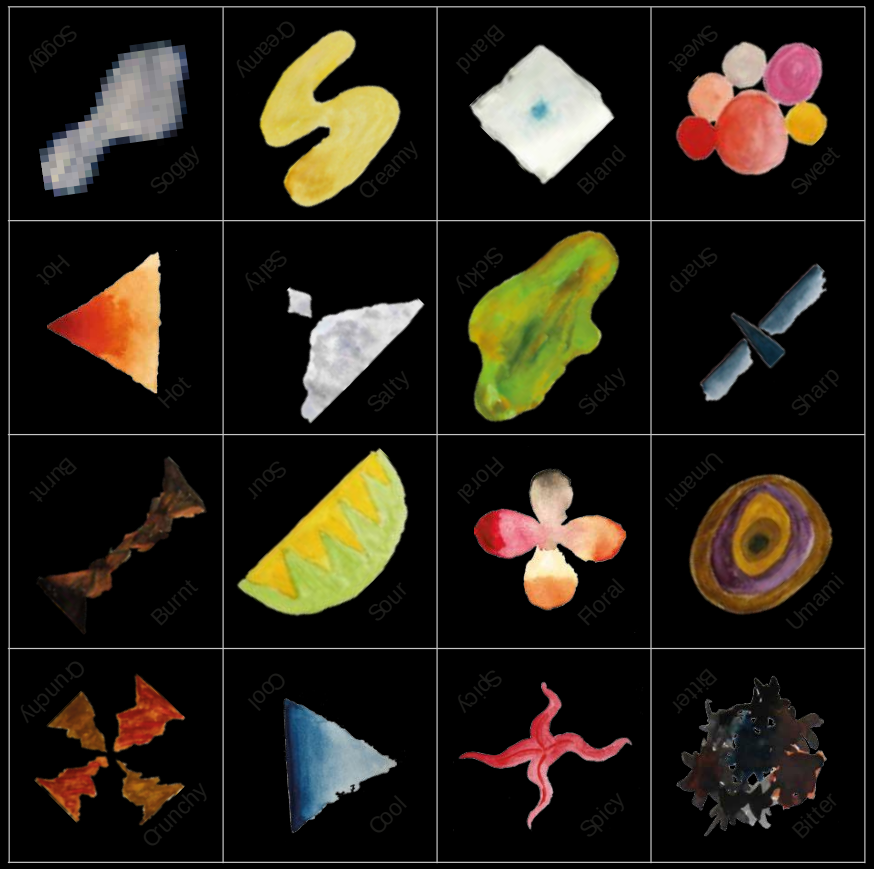
The mouth as site for HFI

The gut as site for HFI

Images: ©Tom Gayler

Gayler, T., Sas, C., & Kalnikaitė, V. 2022. Exploring the design space for human-food-technology interaction: An approach from the lens of eating experiences. *ACM Transactions on Computer-Human Interaction (TOCHI)*, *24*(2), 29 pages

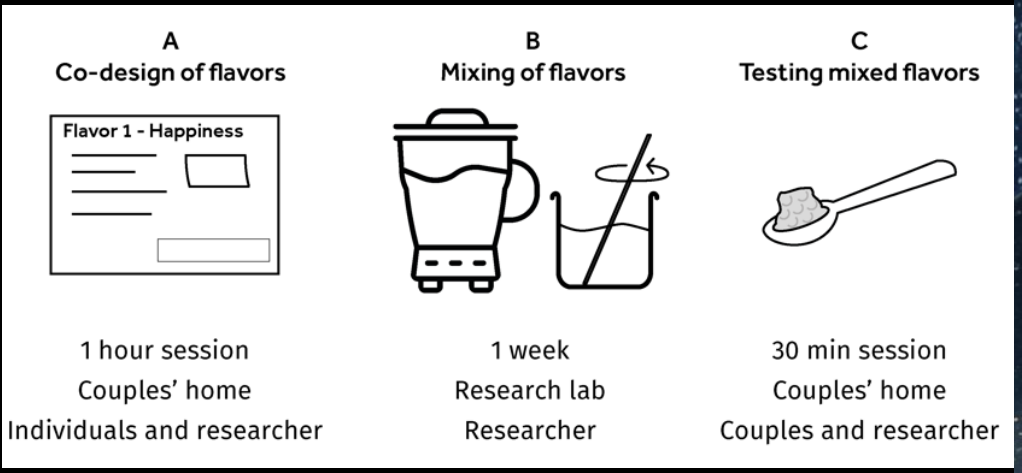
Sensory Food Probes



Images: ©Tom Gayler

Gayler, T., Sas, C., & Kalnikaitė, V. 2021. Sensory Probes: An Exploratory Design Research Method for Human-Food Interaction. *DIS'21,* 666-682.

3D Printed Flavors



Images: ©Tom Gayler

Gayler. T., Sas, C., Kalnikaitė, V. 2020. Material food probes: Personalized 3D printed flavors for intimate communication, *DIS '20,* 965-978.

3D Printed Flavors

Gayler. T., Sas, C., Kalnikaitė, V. 2020. Material food probes: Personalized 3D printed flavors for intimate communication, *DIS '20,* 965-978.

Design Exemplars

Emotion regulation

- Haptic interfaces: vibrotactile and thermal
- 3D printed flavors
- Digital wellbeing apps
- Depression apps
- Wall-sized displays for dementia care

Sas, C., Whittaker, S., Dow, S., Forlizzi, J., Zimmerman, J. 2014. Generating implications for design through design research, *CHI '14*, 1971–1980.

Digital Wellbeing Apps

Functionality review digital wellbeing apps

- 39 commercial apps
- 17 from academia

Almoallim, S., Sas, C. 2022. Functionalities review of digital wellbeing apps: Towards research-informed design implications for interventions limiting smartphone use. *JMIR Formative Research.*

Digital Wellbeing Apps

Behavior regulation:

- limiting use time
- interventions for limiting use

Almoallim, S., Sas, C. 2022. Functionalities review of digital wellbeing apps: Towards research-informed design implications for interventions limiting smartphone use. *JMIR Formative Research.*

Digital Wellbeing Apps

Behavior regulation:

- limiting use time
- interventions for limiting use

Design implication:

- from limiting meaningless use towards meaningful use

Image used under license from Shutterstock.com

Almoallim, S., Sas, C. 2022. Functionalities review of digital wellbeing apps: Towards research-informed design implications for interventions limiting smartphone use. *JMIR Formative Research.*

Design Exemplars

Emotion regulation

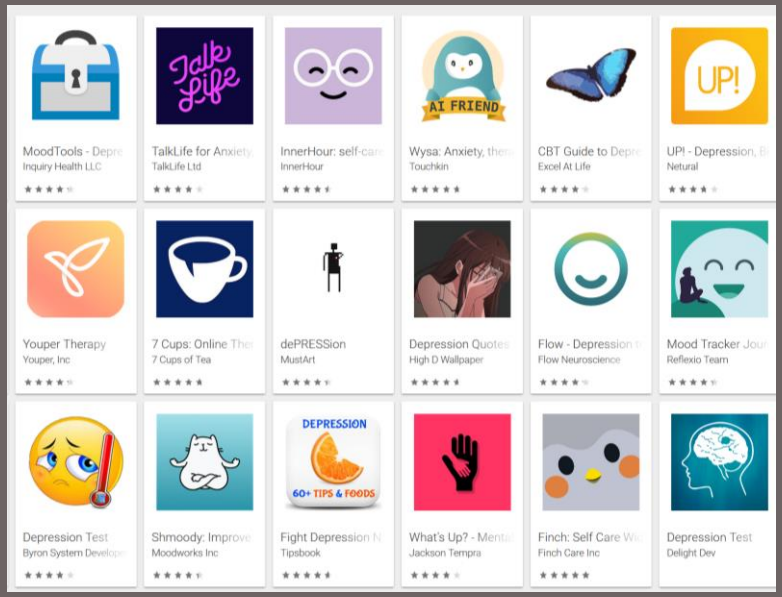
- Haptic interfaces: vibrotactile and thermal
- 3D printed flavors
- Digital wellbeing apps
- Depression apps
- Wall-sized displays for dementia care

Sas, C., Whittaker, S., Dow, S., Forlizzi, J., Zimmerman, J. 2014. Generating implications for design through design research, *CHI '14*, 1971–1980.

Depression Apps

Content analysis of 353 apps' descriptions

- transdiagnostic & multi-theoretical interventions
- evidence-informed interventions
- clinical validity & safety

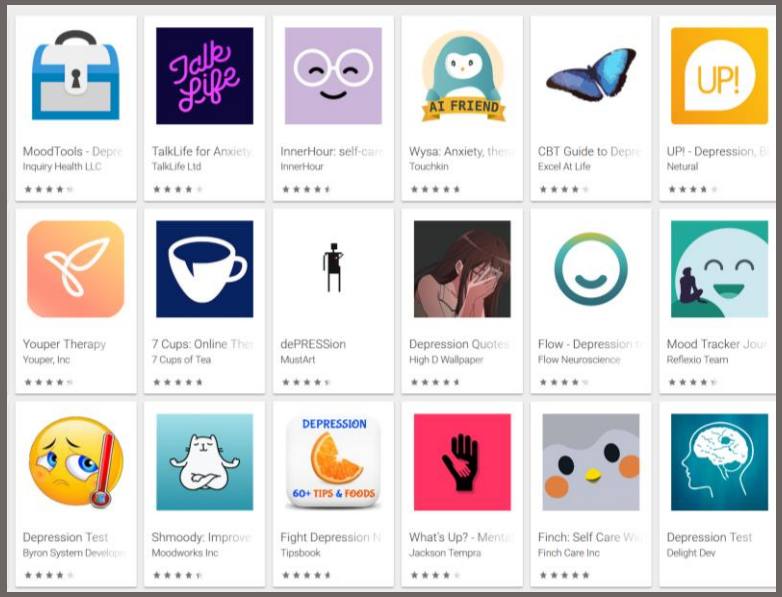


Bowie-DaBreo, D., Sünram-Lea, S., Sas, C., C., Iles-Smith, H. 2020. Evaluation of depression app store treatment descriptions and alignment with clinical guidance: Systematic search and content analysis. *JMIR Formative Research,* 4(11), 18 pages

Depression Apps

Content analysis of 353 apps' descriptions

- transdiagnostic & multi-theoretical interventions
- evidence-informed interventions
- clinical validity & safety



Reflective questions:

- skills and expertise
- treatment design
- safety and duty of care

Bowie-DaBreo, D., Sünram-Lea, S., Sas, C., C., Iles-Smith, H. 2020. Evaluation of depression app store treatment descriptions and alignment with clinical guidance: Systematic search and content analysis. *JMIR Formative Research,* 4(11), 18 pages

Depression Apps

Content analysis of 2,217 user reviews from 40 depression apps

- negative impact: misdiagnosis, harmful advice
- usability issues
- data validity, safety, accuracy

Bowie-DaBreo, D., Sas, C., Iles-Smith, H., Sunram-Lea, S. 2022. User perspectives and ethical experiences of apps for depression: A qualitative analysis of user reviews. *CHI'22.*

Depression Apps

Content analysis of 2,217 user reviews from 40 depression apps

Ethical issues:

- Autonomy - choice
- Access - barriers
- Commerce – costing
- Privacy, respect – limitedly mentioned

Bowie-DaBreo, D., Sas, C., Iles-Smith, H., Sunram-Lea, S. 2022. User perspectives and ethical experiences of apps for depression: A qualitative analysis of user reviews. *CHI'22.*

Depression Apps

Content analysis of 2,217 user reviews from 40 depression apps

Ethical issues:

- Autonomy - choice
- Access - barriers
- Commerce – costing
- Privacy, respect – limitedly mentioned

Virtutes:

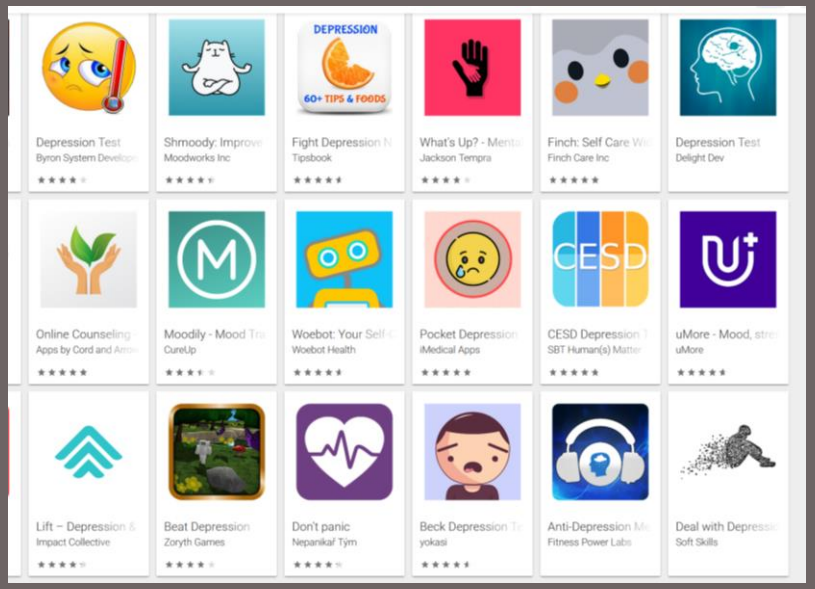
- Transparency, trust
- Social impact

Bowie-DaBreo, D., Sas, C., Iles-Smith, H., Sunram-Lea, S. 2022. User perspectives and ethical experiences of apps for depression: A qualitative analysis of user reviews. *CHI'22.*

Depression Apps

Functionalities review of 29 top rated apps

- depression – lack of wellbeing
- science/evidence base
- children - users

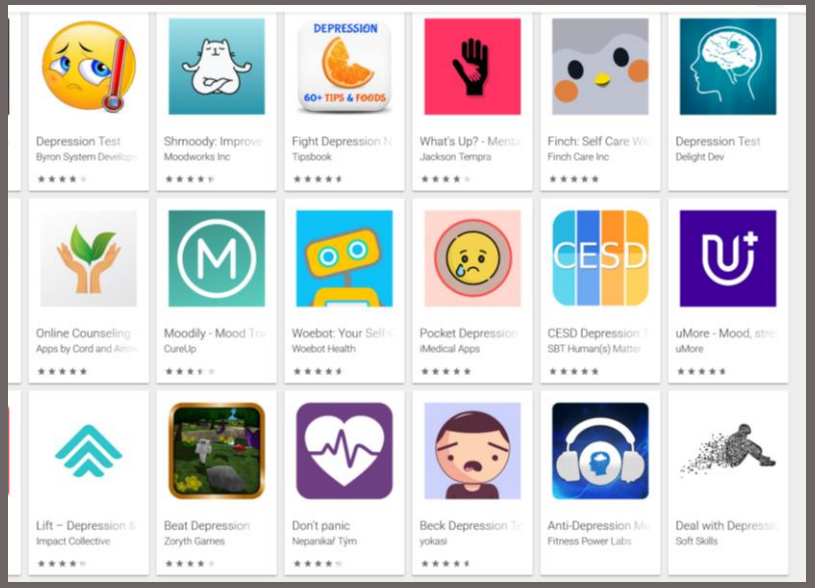


Qu, C., Sas, C., Dauden Roquet, C., Doherty, G. 2020. Reviewing and evaluating the functionalities of top-rated mobile apps for depression. *JMIR Mental Health* 7(1), 13 pages

Depression Apps

Functionalities review of 29 top rated apps

- depression – lack of wellbeing
- science/evidence base
- children - users



Design implications

- safeguarding
- tracking emotions & thoughts
- integrate tracked data with intervention progress

Qu, C., Sas, C., Dauden Roquet, C., Doherty, G. 2020. Reviewing and evaluating the functionalities of top-rated mobile apps for depression. *JMIR Mental Health* 7(1), 13 pages

Design Exemplars

Emotion regulation

- Haptic interfaces: vibrotactile and thermal
- 3D printed flavors
- Digital wellbeing apps
- Depression apps
- Wall-sized displays for dementia care

Sas, C., Whittaker, S., Dow, S., Forlizzi, J., Zimmerman, J. 2014. Generating implications for design through design research, *CHI '14*, 1971–1980.

Dementia Care

Dementia: need for cognitive and sensory stimulation

DementiaWall:

- wall-sized display
- 1 year deployment in residential care home
- strong attachment, engagement & adoption

Image: ©Paul Rowley

Sas, C., Davies, N., Clinch, S., Shaw, P., Mikusz, M., Steeds, M., Nohrer, L 2020. Supporting stimulation needs in dementia care through wall-sized displays, *CHI'20,* 16 pages [**Honorable Mention Award**]

Dementia Care

Mediated staged experiences for sensory & social stimulation

Image: ©Paul Rowley

Sas, C., Davies, N., Clinch, S., Shaw, P., Mikusz, M., Steeds, M., Nohrer, L 2020. Supporting stimulation needs in dementia care through wall-sized displays. *CHI'20,* 16 pages [**Honorable Mention Award**]

Dementia Care

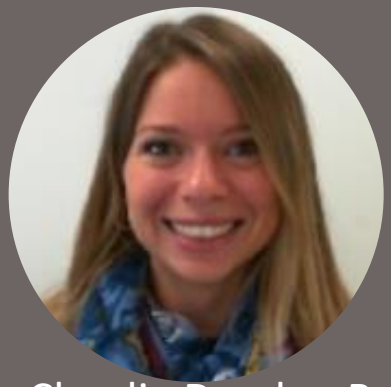
Nature-inspired media for mood and behavior regulation

"with severe dementia, there is a lot of walking, so that [one resident] almost exhausts herself, [but with] the right image she would relax [almost instantaneously]: shoulders would drop and she would sit and look at the screen"

Sas, C., Davies, N., Clinch, S., Shaw, P., Mikusz, M., Steeds, M., Nohrer, L 2020. Supporting stimulation needs in dementia care through wall-sized displays. *CHI'20,* 16 pages [**Honorable Mention Award**]

Acknowledgement


Muhammad Umair


Claudia Dauden Roquet


Tom Gayler


Camille Nadal


Dionne Bowie-DaBreo


Pedro Sanches


Kia Hook


Gavin Doherty


Nigel Davies

AffecTech: Personal Technologies for Affective Health, a Marie Sklodowska-Curie Innovative Training Network. European Commission.

AffecTech

Thank you

Prof Corina Sas
School of Computing and Communications
Lancaster University, UK
Email: corina@comp.lancs.ac.uk