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## Designing a Digital Interactive Emotion Measure (DIEM) for Digital Media: Theoretical Foundations and Validation Protocols


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## Designing a Digital Interactive Emotion Measure (DIEM) for Digital Media: Theoretical Foundations and Validation Protocols

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### I. DIGITAL MEASURES OF EMOTION

Awareness of emotions is often a treatment target in psychotherapy, but it is difficult to assess emotions due to ambiguity in measurement or scale design. Lack of clarity in scale design may increase risk that participant interpretations of scale items may not align with emotion constructs those scales were designed to capture. Furthermore, emphasis on verbal or written cues leads to low scientific representation of patients who cannot read emotion scales (e.g., low literacy). Touch-screen applications provide a unique opportunity to create a visual emotion measure which has low barriers but can be used to assess a high level of generalizability across cultures and psychology subdisciplines

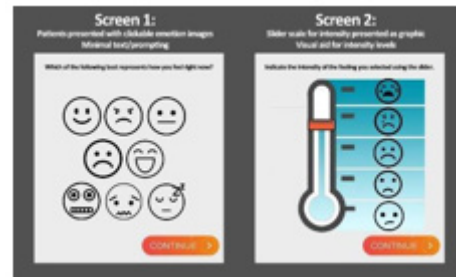


Fig 1. First mock-up of DIEM

### II. AN INTERACTIVE VISUAL MEASURE: DIEM

The Digital Interactive Emotion Measure (DIEM) is a brief, fully visual measure that is designed for administration on virtual interfaces. It was developed using Unity Software so that it may be intergrated into any existing mental health application, website, or platform.

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Fig. 2. Reference image from Paul Ekman's work and 2D illustration design direction

### A. Development: Content and Construction

Construction of DIEM included a literature review broadly organized into three categories: user interface design, emotion representation, and color science. Interface and icon design studies were used to determine visual cues to communicate scale prompts (e.g., instructions, clear or confirm selection, proceed to next screen); these studies included basic design principles (Ma et al., 2009; Zender, 2006), interpretation of icons across cultures (Shen et al., 2020; Stinson et al., 2006), and use of visual icons among individuals who cannot speak (van der Merwe & Alant, 2004). Existing pain and distress thermometers were used to determine the content and screen progression (Hawker et al., 2011; Mitchell et al., 2010).

Emotion representation studies on the universality of basic emotions and stimulus images were used to design 2-dimensional (2D) illustrations of emotions (Ekman, 1999). The color of the 2D illustrations were determined through systemic review of emotion-color perceptions across cultures (Hanada, 2018; Lin et al., 2018; Ou et al., 2018; Thorstenson et al., 2018).

### B. Validity Testing

The next phase of testing involves confirmatory and discriminatory validity testing. Participants will give assessments of DIEM's emotion icons and compare DIEM icons to existing sadness, fear, anger, happiness, and disgust scales.

**Keywords**— digital healthcare, eHealth, mental health, psychotherapy, assessment, visual tools, interactive tools

### III. REFERENCES

- Ekman, Paul. 1999. "Basic Emotions." *Handbook of Cognition and Emotion* 98 (45–60): 16.
- Hanada, Mitsuhiro. 2018. "Correspondence Analysis of Color–Emotion Associations." *Color Research & Application* 43 (2): 224–37. <https://doi.org/10.1002/col.22171>.
- Hawker, Gillian A., Samra Mian, Tetyana Kendzerska, and Melissa French. 2011. "Measures of Adult Pain: Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale for Pain (NRS Pain), McGill Pain Questionnaire (MPQ), Short-Form McGill Pain Questionnaire (SF- MPQ), Chronic Pain Grade Scale (CPGS), Short Form- 36 Bodily Pain Scale (SF-36 BPS), and Measure of Intermittent and Constant Osteoarthritis Pain (ICOAP)." *Arthritis Care & Research* 63 (S11): S240– 52. <https://doi.org/10.1002/acr.20543>.
- Lin, Rebecca, Muhammad "Tuan" Amith, Chen Liang, Rui Duan, Yong Chen, and Cui Tao. 2018. "Visualized Emotion Ontology: A Model for Representing Visual Cues of Emotions." *BMC Medical Informatics and Decision Making* 18 (2): 64. <https://doi.org/10.1186/s12911-018-0634-6>.
- Ma, Xiaojuan, Jordan Boyd-Graber, Sonya Nikolova, and Perry R. Cook. 2009. "Speaking through Pictures: Images vs. Icons." In *Proceedings of the 11th International ACM SIGACCESS Conference on Computers and Accessibility*, 163–70. Assets '09. New York, NY, USA: Association for Computing Machinery. <https://doi.org/10.1145/1639642.1639672>.
- Ma, Xuelei, Jing Zhang, Wuning Zhong, Chi Shu, Fengtian Wang, Jianing Wen, Min Zhou, Yaxiong Sang, Yu
- Jiang, and Lei Liu. 2014. "The Diagnostic Role of a Short Screening Tool—the Distress Thermometer: A Meta-Analysis." *Supportive Care in Cancer* 22 (7): 1741–55. <https://doi.org/10.1007/s00520-014-2143-1>.
- Merwe, Elmarie van der, and Erna Alant. 2004. "Associations with Minspeak™ Icons." *Journal of Communication Disorders* 37 (3): 255–74. <https://doi.org/10.1016/j.jcomdis.2003.10.002>.
- Mitchell, Alex J., Elena A. Baker-Glenn, Bert Park, Lorraine Granger, and Paul Symonds. 2010. "Can the Distress Thermometer Be Improved by Additional Mood Domains? Part II. What Is the Optimal Combination of Emotion Thermometers?" *Psycho- Oncology* 19 (2): 134–40. <https://doi.org/10.1002/pon.1557>.
- Ou, Li-Chen, Yinqiu Yuan, Tetsuya Sato, Wen-Yuan Lee, Ferenc Szabó, Suchitra Sueeprasan, and Rafael Huertas. 2018. "Universal Models of Colour Emotion and Colour Harmony." *Color Research & Application* 43 (5): 736–48. <https://doi.org/10.1002/col.22243>.

Punchoojit, Lumpapun, and Nuttanont  
Hongwarittorn. 2017. "Usability Studies  
on Mobile User Interface Design Patterns:  
A Systematic Literature Review."  
Edited by Thomas Mandl. *Advances  
in Human- Computer Interaction 2017*  
(November): 6787504. [https://doi.  
org/10.1155/2017/6787504](https://doi.org/10.1155/2017/6787504).

Thorstenson, Christopher A., Andrew J.  
Elliot, Adam D. Pazda, David I. Perrett,  
and Dengke Xiao. 2018. "Emotion-Color  
Associations in the Context of the Face."  
*Emotion* 18 (7): 1032–42. [https://doi.  
org/10.1037/emo0000358](https://doi.org/10.1037/emo0000358).

Zender, Mike. 2006. "Advancing Icon Design  
for Global Nonverbal Communication:  
Or What Does the Wordbow'mean?"  
*Visible Language* 40 (2): 177. [https://www.  
chicagomanualofstyle.org/tools\\_citationgu  
ide/citation-guide-2.html](https://www.chicagomanualofstyle.org/tools_citationguide/citation-guide-2.html)