Emotions in HCI: Future Research Agenda

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The significant HCI interest in emotions is reflected in a breath of technologies and design approaches. This paper offers a brief overview of my HCI work on emotions, with a reflection on the outstanding challenges that future HCI agenda in this space should focus on. The latter emphases the need for stronger theoretical framing of emotions for interaction design, multisensory interaction for capturing and representing emotions, richer set of wearable bio sensors and actuators, operationalization of emotion regulation theories, and increased sensitivity towards the ethics of working with emotions as a resource for design.

CCS CONCEPTS • Human-centered computing ~Human computer interaction (HCI)

Additional Keywords and Phrases: Emotions; design; awareness; regulation; multisensory; research agenda

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1 BACKGROUND

This paper provides on overview of our HCI work on emotions, together with a reflection on the key challenges and how they may be addressed through future research agenda. HCI scholars have had a long standing interest in emotions, although the advent of the third wave HCI has led to a renewed attention to them, from how emotions impact user experience more broadly [20] to how they can be particularly leveraged for novel emotion-based experiences and how we can better design for them. For this, we have looked at three directions prioritizing emotions as resource for design. These include exploring and designing novel interactive technologies to support emotional expression [14][15][17], emotional awareness [38][41] and emotion regulation [7][19][40] with applications to a range of domains from digital wellbeing [3], mindfulness [8][10][11] and affective health [4][5][25][26][28][31] to emotional memory support [22] in aging [16][29][32][33] or dementia [30]. Specific modalities for representing emotions are predominantly visual such as illustrated by mobile or wearable interfaces that provide mood tracking functionalities [4][5][9][27][28], large displays [30] or thermochromic materials [38][41], although we have seen emerging interest in the less explored haptic-based interfaces for both representation and regulation of bodily states [6][8][10][23][24][36]. Fostered by the increased interest in human-food-interaction and the strong link between emotions and eating experiences [12][18], novel food-based expressions of emotions based on 3D printing technologies [13][14][18] have also started to be explored. We have also looked at the ethical challenges of digital wellbeing and affective health technologies including top rated apps for depression [5][27]. Design approaches for such novel interactive systems have been inspired by somaesthetics [1][2], first-person methods [34][42], sensory turn [17] or digital fabrication [39]. Here we explored novel design tool for acceptance of mental health technologies from a macro-temporal perspective [25], emphatic design cards capturing evocative postures of depression to inspire design [31], toolkit for smart material-based fabrication of

affective interfaces [39], sensory [17] and food-based material probes [15] to support design of food-based interaction for emotional expression, regulation and recall [16].

2 FUTURE RESEARCH AGENDA

Reflecting on our body of work on emotions, we now articulate some of the main challenges of HCI research on emotions and how future research agenda could further explore them. Such challenges include limited theoretical framing of emotions for interaction design, insufficient capture and representation of multisensory aspects of emotions, limited bio sensors and actuators for materializing emotional feedback, limited use of emotion regulation theories, and focus on the ethics of emotions in HCI.

Theoretical framing of emotions in HCI has made extensive use of discrete and circumplex models of emotions, albeit with a few exceptions such as the affective loop [21] the integration of physiological, subjective, cognitive and behavioral aspects of emotions have been limited, with most research prototypes prioritizing merely one of these aspects. As the field matures, we envisage that future efforts will focus on such integration while engaging more rigorously with both psychological [35] and sociological theories of emotions [36].

Related to the limited integration of different aspects of emotions, there is also a rather restricted capture and representation of emotion. Historically, this has leveraged primarily the visual modality to capture physiological or subjective aspects, or textual modality to capture cognitive or behavioural aspects. Future work is likely to focus on richer multisensory interaction with emphasis on the distinct benefits for emotional awareness, understanding, attribution and regulation, and on how different modalities support best each of these benefits. For instance, we have seen emerging work on comparing haptic submodalities for emotion regulation [40]. For physiological aspects of emotions, current biosensors capture reliably merely the physiological arousal [43], with no robust biosensors being yet available for capturing emotional valence in everyday life. This requires interdisciplinary research with input from the sensing research community in order to develop novel sensors to capture valence as well as richer set of actuators, which together are likely to significantly push forward the HCI research on emotions [1].

Most of the current HCI research on emotions has focused on representing emotions and less on bespoke support for regulation, which is implied that happens automatically once awareness is reached. Emotion regulation however is a complex skill, significantly impaired in affective disorders, and people need tailored support to develop them. This requires solid grounding in theories of emotion regulation [19] with a wealth of findings showing the benefits of adaptive emotion regulations strategies such as cognitive reappraisal, mindfulness and biofeedback. While most commercial apps for emotion or behavior regulation have shown the benefits of the former strategies through features such as goal setting, monitoring and progress visualization [27], their focus on biofeedback has been limited. We envisage that future work should focus on how to engage with and operationalize emotion regulation theories for interaction design.

Finally, the ethics of emotion research is complex, especially when dealing with negative emotions, of both vulnerable users living with wellbeing or affective health challenges [5], but also for researchers and designers working in this space [28]. We expect that more work will focus on developing an ethical framework for HCI work on emotions, and on novel design tools to support the articulation in the form of design guidelines of often abstract ethical principles [4][5].

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