Physiological measures as indices of moods during human-computer interaction

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Emotions are an important factor in human-computer interaction. One of the challenges in building emotionally intelligent systems is the automatic recognition of affective states. We are developing and evaluating a method for measuring user affect that incorporates psychological, behavioral, and physiological measures. During affective stimulation, breathing parameters, skin conductance level (SCL) and corrugator EMG activity correlate with self-reported levels of valence and arousal. Valence, at the level of subjective experience, summarizes how well one is doing, whereas arousal refers to a sense of energy. A stimulus activates appetitive or defensive motivation (the valence dimension) with some degree of energy mobilization (the arousal dimension). In the laboratory, moods are induced using different procedures. Only few studies have investigated the critical question of how long induced moods actually last. Further, knowledge concerning the persistence of physiological responding, when the stimuli are withdrawn, remains spare. The goals of this study were first, to assess the somato-physiological activity during affective stimulation (film clip viewing) and its relation to valence and arousal, and second, to determine if the response patterns persist, dissipate or otherwise change when the stimuli are withdrawn and the subjects perform a computer task. Seventy-six participants viewed a neutral film clip (an educational program) and completed immediately afterward the task (control condition). Then, they viewed either a positive high-arousal clip (sport scenes), a positive low-arousal clip (takes from landscapes), a negative high-arousal clip (scene depicting captives forced to play Russian roulette) or a negative low-arousal clip (a documentary about a slum in Belgium) and completed the task a second time (experimental condition). The task required participants to shop on an e-commerce website for office supplies. After each clip and each task, the participants rated their current mood. We tested valence and arousal effects during the last 90 s of the films, the first and last 90 s of the task of the experimental condition. Viewing of the selected film clips resulted in increasing defensive and appetitive activation in the expected ways both subjectively and physiologically. Corrugator EMG activity was higher at the end of the negative clips than the positive clips, and minute ventilation and SCL were higher for the arousing clips than for the less arousing clips. After the approximately 9-minute task, people who viewed the negative clips still reported more negative valence than those who viewed the positive clips. On the contrary, there were no differences in the arousal ratings. The valence effect in the mood state was paralleled by valence effects in the somato-physiological measures during the task. Increased facial frowning at the end of the negative clips was maintained during the task indicating persistence of defensive activation. SCL was lower for the negative film groups, especially at the end of the task, suggesting that sympathetic activation was lowered in subjects in the negative mood as compared with subjects in the positive mood.
The findings of this study have several implications. First, they enrich our knowledge concerning the relationships between subjective feelings and their physiological correlates. Second, they inform us about the effectiveness of film clips as a mood induction instrument. Third, they suggest that induced changes in arousal are quickly overridden by the degree of activation “imposed” by the cognitive task, whereas induced changes in valence are more resistant and thus likely to impact the execution of the task. Finally, they show which physiological measures may be useful in tracking mood states during human-computer interaction (i.e., corrugator EMG activity and SCL). Feedback from these parameters could be used by computers to recognize mood states in the user.

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