Introduction. Facial behavior is an important nonverbal signal that is involved in emotional expression and social communication and that is importantly influenced by culture, gender, and context (Fridlund, 1994; LaFrance, Kecht, & Paluck, 2003; Matsumoto, 2006). While facial behavior is often studied using self-report methods (i.e., by asking participants when and how often they display facial actions), there is a risk that participants may not be accurate and reliable reporters of their own behavior. As such, observational studies of participants’ actual behavior are crucial to understanding facial behavior and its connections to affective and interpersonal processes. Unfortunately, it is typically very expensive and time-consuming to collect and annotate observational data. As a result, previous observational studies of facial behavior have typically been limited to small samples and constrained settings, which may not have been adequately powered or generalizable. In the current study (McDuff, Girard, & Kaliouby, in press), we leveraged technological advances to mitigate the costs of data collection and analysis. This enabled us to conduct the first large-scale observational study of facial behavior, which included 740,984 participants from 12 countries. Using this large dataset and multilevel modeling, we examined the influence of culture, gender, and context on participants’ actual facial behavior. This analysis revealed new insights, in addition to providing much needed empirical evidence to support theories of cultural and gender display rules.

Methods. We used a web-based platform (McDuff, 2014) that walked participants through the consent process before recording video from their webcams as they viewed market research stimuli (i.e., video ads) either in their homes or in market research facilities. Participants were recruited as part of market research panels and represented a wide demographic of nationalities, genders (61% female), age groups (17–65 years old), and income levels. Over a period of four years, we collected 1,450,559 videos of facial responses from 740,984 participants in the US, UK, Germany, India, Japan, Argentina, Russia, Brazil, Mexico, China, Peru, and Colombia. To mitigate the costs of manually coding behavior in all of the participant videos, algorithms were developed to automatically measure smiling and brow furrowing (i.e., AU 12 and AU 4 in the Facial Action Coding System, respectively). We then used multilevel regression models to predict each participant’s smiling and brow furrowing base rates from his or her self-reported gender, his or her setting/context (i.e., at home or in facility), and his or her country’s score on Hofstede’s (2001) individualism–collectivism scale. The main effects of these three variables, as well as each pairwise interaction effect, were examined for each facial action.

Results. The main effect of individualism was significant for brow furrowing (p=.004) but not for smiling (p=.140); thus, participants from more individualist countries displayed more brow furrowing than participants from more collectivist countries. The main effect of setting was significant for brow furrowing (p=.021) but not for smiling (p=.821); thus, participants displayed more brow furrowing in the facility setting than in the home setting. The main effect of gender was significant for smiling (p<.001) and for brow furrowing (p<.001); thus, female participants displayed more smiling and less brow furrowing than male participants. The interaction between individualism and setting was significant for smiling (p<.001) but not for brow furrowing (p=.543); thus, participants in more individualist countries displayed more smiling in the facility setting while participants in more collectivist countries displayed more smiling in the home setting. The interaction between individualism and gender was significant for
brow furrowing \((p=.049)\) but not for smiling \((p=.450)\); thus, the gender difference in brow furrowing was more pronounced in more individualist countries and less pronounced in more collectivist countries. The interaction between setting and gender was not significant for smiling \((p=.360)\) or brow furrowing \((p=.591)\).

**Conclusions.** Our study demonstrates the feasibility and promise of using “affective computing” techniques, and technology more generally, to advance psychological science. In our study, these tools provided the opportunity to test several hypotheses inspired by theory and to replicate the findings of previous studies in a new experimental context \(\text{e.g., LaFrance et al., 2003; Matsumoto, Willingham, \\
& Olide, 2009; Oyserman, Coon, \\
& Kemmelmeier, 2002.}\) We interpret smiling as generally (albeit imperfectly) indicative of positive affect and brow furrowing as generally (albeit imperfectly) indicative of negative affect. Given these interpretations, a number of interesting conclusions can be drawn about the expression of emotion across cultures, genders, and settings. Positive affect was more displayed by female participants than male participants and the influence of culture depended on the setting: more individualist cultures displayed positive affect in the facility setting, whereas more collectivist cultures displayed positive affect in the home setting. Negative affect was more displayed by male participants than female participants (especially in more individualist cultures), more in the facility setting than in the home setting, and more in more individualist cultures than in more collectivist cultures. These results suggest that culture, gender, and setting combine in fascinating and complex ways to influence facial behavior as a signal of affective and interpersonal information.

**References**


McDuff, D., Girard, J., & Kaliouby, R. \(\text{\text{(in press).}}\) *Large-scale observational evidence of cross-cultural differences in facial behavior.* *Journal of Nonverbal Behavior.*