Online supplement

Method – additional information

Stimuli

Prototypical happy and sad composite images were generated using established techniques[7] from 20 individual male faces showing a happy facial expression, and the same 20 individuals showing an sad expression. Original images came from the Karolinska Directed Emotional Faces.[6] These prototypical images were used as end-points to generate a linear morph sequence that consisted of images that changed incrementally from unambiguously happy to unambiguously sad, with emotionally ambiguous images in the middle. We created a sequence with 15 equally spaced images for use as experimental stimuli. Online Fig. DS1 shows end-points and example intermediate stimuli.

Procedures

Each session consisted on three phases: baseline, train and test. The baseline and test phases consisted of 45 trials, in which each of the stimuli from the morph sequence was presented three times. Images were presented, in random order, for 150 ms, preceded by a fixation cross (1500–2500 ms, randomly jittered). Stimulus presentation was followed by a mask of visual noise (150 ms) and then a prompt asking the participant to respond (a judgement of happy or sad).

Within participants, classification responses to morph continua tend to shift monotonically from one expression response to the other across the continuum presented.[11] Therefore, a simple estimate of the balance points pre- and post-training can be derived by counting the number of happy responses as a proportion of the total number of trials.

Each trial in the training phase was similar to a trial in the baseline and test phases with respect to inter-trial interval and stimuli presentation, but with the addition of feedback subsequent to the participant's response. In the control condition, feedback was based on the participant's baseline balance point. Responses were classified as 'correct' if the participant identified images below the original balance point image as happy, and above it as sad, and otherwise were classified as 'incorrect'. Feedback was a message saying 'Correct/incorrect! That face was happy/sad'. In the training condition, feedback was again based on the participant's baseline balance point, but the 'correct' classification was shifted two morph steps towards the sad end of the continuum, so that the two images nearest the balance point that the participant would previously have classified as sad at baseline were considered happy when providing feedback. The structure of the training blocks was designed to present more training trials with ambiguous expression, than unambiguous expression. Thus, images 1–2 (unambiguously happy) and 14–15 (unambiguously sad) were presented once in each training block, images 3–5 and 11–13 were presented twice in each training block, and images 6–10 were presented three times in each training block, giving 31 trials per training block in total. Participants completed six blocks. Online Fig. DS2 shows the balance points before and after completion of the computer task, across each of the four sessions.

Additional analyses

We compared the baseline balance points in our sample of young adults with high levels of depressed mood with a sample ($n = 40$)
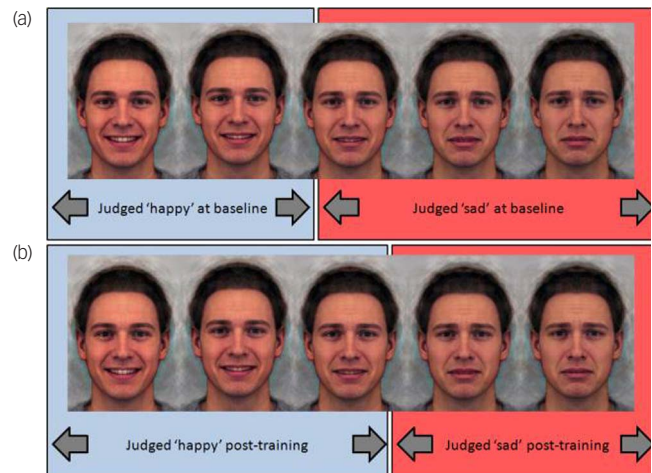

Fig. DS1 Intervention group responses to images (a) at baseline and (b) post-training.
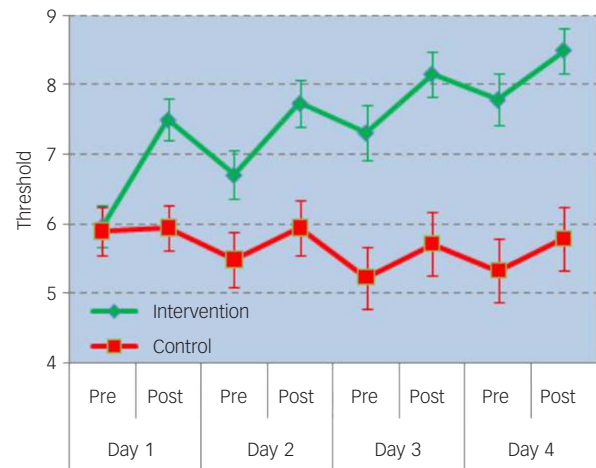

Fig. DS2 Balance points pre- and post-completion of the computer task, across each session, for the intervention and control conditions.

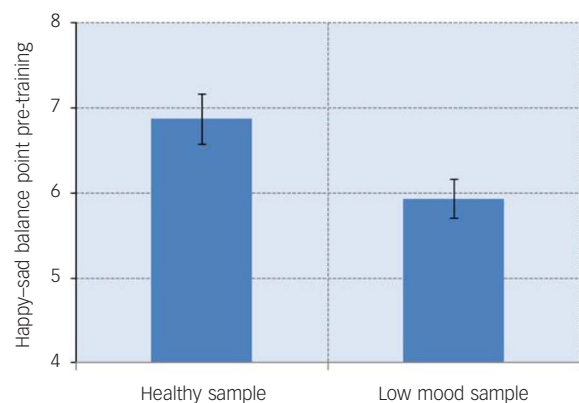Values represent the balance point. Error bars represent the standard error of the mean.

Fig. DS3 Balance points in the healthy ($n = 40$) and low mood ($n = 77$) samples.

Values represent the balance point. Error bars represent the standard error of the mean.

of young adults drawn from the same population but not selected for low mood. This indicated that those with high levels of depressed mood were significantly more likely to identify an ambiguous expression as reflecting sadness over happiness. Prior to training, the low mood sample were more likely to label ambiguous faces as 'sad' than 'happy' compared with a control group of participants from the same population who did not report low mood ($t(115) = 2.5$, $P = 0.015$). Online Fig. DS3 shows balance points in the healthy and low mood samples.

Additional reference

11 Young AW, Rowland D, Calder AJ, Etcoff NL, Seth A, Perrett DI. Facial expression megamix: tests of dimensional and category accounts of emotion recognition. *Cognition* 1997; **63**: 271–313.