**Power Analysis**

While no previous study has been conducted examining contextual cueing changes as a result of target valence change during the course of trials, we used our previous contextual cueing study ([Szekely, Rajaram, & Mohanty, 2016](#_ENREF_9)) to conduct an *a-priori* power analysis ([Westfall, 2015](#_ENREF_11); [Westfall, Kenny, & Judd, 2014](#_ENREF_12); [Winer, Brown, & Michels, 1991](#_ENREF_13)). This analysis indicated that we would need at least 25 participants in each group to have 99% power for detecting a medium sized effect of contextual learning while employing a *p* < 0.05 criterion of statistical significance.

**Stimulus Presentation**

We adapted line drawing of faces from previous research that used schematic threatening and non-threatening faces as effective emotional and non-threatening stimuli ([Lundqvist, Esteves, & Ohman, 1999](#_ENREF_6); [Lundqvist & Ohman, 2005](#_ENREF_7)).  Target faces were drawn with dotted lines while distractor stimuli were drawn with solid lines.  Unrestrained viewing distance was approximately 50 cm.  The visual array appeared within a grid of 8 x 6 positions that subtended approximately 23.91 x 19.81 degrees of visual angle, and was limited to a 13.6 inch x 10.2 inch (17 inches diagonally) section of computer monitors (see ([Chun & Jiang, 1998](#_ENREF_2))).  The background was set to a light gray of hexadecimal value of #EDEDED, and line drawings of faces were colored blue, green, red, and purple, with hue, saturation, and brightness objectively matched across colors ([Heider, 1972](#_ENREF_5)).  The size of each face was approximately 2.3 x 3.1 degrees of visual angle.  In order to prevent collinearities with other stimuli, items were jittered from their positions in steps of 0.2 degrees of visual angle up to 0.8 degrees of visual angle in both the x and y dimensions.  The combination of grid and stimulus size prevented any stimulus from appearing within 1 degree of visual angle from any other stimulus.

Facial outline, ear position and size, nose position and size, eyebrow length, and eye position were held constant.  Eyes were ovals for non-threatening faces, and were cut in half for angry faces such that the top was removed.  Eyebrows were horizontal in non-threatening faces and were tilted at approximately a 45-degree angle in threatening faces, the mouth was a straight line in non-threatening faces, and curved by raising the central point closer to the nose and slightly increasing the length of the mouth in threatening faces.  The interior of the faces was set to background color.  Dotted lines were subjectively chosen to appear difficult but differentiable on screen.  The exact shape of the face and features were selected for their effectiveness in conveying emotion based on normative ratings of valence, arousal, and dominance ([Aronoff, Woike, & Hyman, 1992](#_ENREF_1); [Schlosberg, 1952](#_ENREF_8)) for a separate group of 18 participants.  On a scale from 1-9, compared to schematic non-threatening faces (Valence: *M* = 5.28, *SD* = 0.83; Arousal: *M* = 3.89, *SD* = 1.41; Dominance: *M* = 3.89, *SD* = 1.28) schematic threatening faces (Valence: *M* = 2.06, *SD* = 0.80; Arousal: *M* = 6.06, *SD* = 1.30; Dominance: *M* = 6.78, *SD* = 1.00) were rated significantly more unpleasant, *t*(34) = -11.87, *SE* = 0.27, *p* < 0.001, arousing, *t*(34) = 4.79, *SE* = 0.45, *p* < 0.001, and dominant, *t*(34) = 7.54, *SE* = 0.38, *p* < 0.001.  Further, in past work these threatening face targets were found to facilitate context learning compared to a target that contained the same features jumbled within the same sized oval ([Szekely et al., 2016](#_ENREF_9)), indicating that the effect is specific to faces perceived as threatening.

**Group Differences**

Fifty-one undergraduate volunteers (Mean age 22 ± 4.54 years) from Stony Brook University participated for course credit, where one group (N = 26, Mean age 21 ± 4.26 years) received a sequence with threatening targets first and non-threatening targets next and another group (N = 25, Mean age 23 ± 4.73 years) received a sequence with non-threatening targets first and threatening targets next. Groups did not significantly different in age, gender, or levels of anxiety (all *t*s < 1). We performed a χ2 goodness-of-fit test to examine if there were differences in the number of correct responses based on Sequence, Phase, Configuration, and Epoch, and found no differences (all *p*s > 0.05).

**Design and Procedure**

The procedure in the present study was the same as in our previous work (Szekely et al., 2016) where it was reported as follows. “Each trial began with a small fixation cross appearing in the middle of the screen for 500 ms, followed by an array of faces (Figure 1). Participants were asked to indicate presence or absence of a face drawn with a dotted line in the array of faces drawn in solid line by pressing the “.” key if the target was present, and the “/” key if it was absent.   Hence, we asked participants to discriminate the presence versus absence of a target in dotted lines in the array. We chose this task to minimize the potential for “pop-out” effects for targets of interest (Geyer, Zehetleitner, & Muller, 2010) because our ultimate aim was to measure the emergence of contextual learning rather than stimulus-driven responses to threatening stimuli. Each trial ended either after participant response or 6 sec.

The visuospatial context consisted of an array of faces where the spatial configurations of the faces in the search display were manipulated. In the old condition, the array of faces repeatedly appeared in consistent locations across blocks of trials such that the visuospatial context predicted the location of face targets. In the new condition, the locations of the array of faces varied from trial to trial. The old configurations consisted of 12 randomly generated arrays of face stimuli, each corresponding to 12 of the 48 possible locations, and were repeated once per block.  The new configurations consisted of a random arrangement of all possible other locations, of which 12 were randomly selected for each block; each new configuration was presented only once throughout the experiment. For old configurations, targets and nontargets were first placed randomly within the array, and then remained in the same set of positions after being jittered across blocks of the experiment.  To remove location probability effects, target stimuli appeared equally often in each of the 48 possible locations throughout the experiment; 12 locations were used in old configurations, and the other 36 were used in new configurations.  All arrays were generated separately for each participant.  Participants received old arrays after either one or two new arrays and new arrays after either one or two old arrays. Target quadrant and color were counterbalanced to ensure an even distribution of all possible combinations within each block and across all blocks."

"Since implicit memory of visual context is hypothesized to guide contextual learning, we confirmed whether this was the case by conducting an explicit recognition memory test. After performing the contextual cueing task participants were given a recognition test, also on the computer.   The procedure for the explicit recognition test was similar to prior contextual cueing studies (Chun & Jiang, 1998; Chun & Phelps, 1999) such that participants were asked to indicate whether they noticed repetition of arrays.  Next, all participants were given 12 old displays and randomly selected 12 of 36 new displays presented in a random, interspersed order to indicate whether they recognized each array as having been repeated or not.”

In the present study, a total of 960 trials were presented in 20 blocks, with each block consisting of 48 trials with breaks of 10 sec between blocks.  This resulted in 24 target-present and 24 target-absent trials per block, divided into 12 old and 12 new trials. Each trial began with a small fixation cross appearing in the middle of the screen for 500 ms, followed by an array of faces (Figure 1).  Participants were asked to indicate presence or absence of a face drawn with a dotted line in the array of faces drawn in solid line by pressing the “.” key if the target was present, and the “/” key if it was absent.  Each trial ended either after participant response or 6 sec.  Before the experiment began, participants performed a practice session of a separate set of 24 trials with a non-threatening target to familiarize themselves with the task and procedure.

**Recognition Results**

Data analyses were performed using SPSS ([Corp., Released 2013](#_ENREF_4)).  For the recognition task, we report data from 50 out of 51 participants.  One participant did not complete the recognition task.  When asked, 42 out of the 51 participants reported seeing some form of repetition across blocks.  However, when tested on recognition of the actual arrays, hit rates were not particularly high either for those who reported recognizing (*M* = 0.66, *SD =* 0.25) or those who reported not recognizing (*M* = 0.56, *SD* = 0.18) the repetition.  The false alarm rates were fairly high both for those who reported recognizing (*M* = 0.52, *SD* = 0.30) and not recognizing (*M* = 0.49, *SD* = 0.28) the repetition.  Consistent with these patterns, the *d*’ measure (of discriminability) was low both for those who reported recognizing (*M* = 0.49, *SD* = 1.02) and not recognizing (*M* = 0.18, *SD* = 0.78) the repetition, and did not differ between the two groups, *t*(48) = 0.83, *SE* = 0.38, *p* = 0.41.  This result is more suggestive of guessing than recollected memory ([Chun & Jiang, 1998](#_ENREF_2), [2003](#_ENREF_3); [Wagner, Gabrieli, & Verfaellie, 1997](#_ENREF_10)).  These findings suggest that participants who indicated that they had observed some form of repetition may have become aware of some consistency in the potential arrays, but that this information was not explicitly or reliably available to them compared to participants who did not notice any repetition.

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