Revisiting Motivated Attentional Bias: Capture or Dwelling?

Dirk Wentura[1] and Merve Boğa[2]

[1]Saarland University, Saarbrücken, Germany

[2]Bursa Uludag University, Bursa, Turkey

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Author Note

Dirk Wentura: https://orcid.org/ 0000-0001-9907-498X

Merve Boğa: https://orcid.org/0000-0001-6784-4900

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Abstract

Vogt et al. (2011) reported that a disgust induction increases attentional bias toward cleanliness-related stimuli, interpreting this effect as motivationally driven attentional capture. In a recent conceptual replication, Boğa and Wentura (2025) replicated the moderation of attentional bias by emotional state but only when a discrimination task was used instead of the location task that Vogt et al. used. Both studies used a rather long cue–target onset asynchrony (CTOA) of 350 ms. In the present follow-up experiment, we manipulated CTOA (i.e., 100 ms vs. 350 ms) in a dot-probe task in a neutral mood context and used the same stimuli as Boğa and Wentura. Whereas we were able to replicate the null effect for CTOA = 350 ms found by Boğa and Wentura as well as Vogt et al. in their control condition (no disgust), cleanliness-related stimuli elicited a significant positive attentional bias at CTOA = 100 ms. The presence of this early bias for cleanliness-related cues in the absence of a hygiene motivation, combined with the previously observed persistence of this bias under a disgust induction at the longer CTOA, suggests that motivation does not enhance initial attentional capture. Rather, it is consistent with prolonged attentional dwelling on goal-relevant stimuli. Taken together with previous findings, the present results might contribute to clarifying the mechanisms underlying motivated attentional bias and indicate that its primary effect lies in sustained attentional engagement rather than early capture.

Keywords: attentional bias, motivation, attentional dwelling, emotion regulation, disgust, dot-probe task

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Numerous studies have demonstrated that emotional stimuli are prioritized in attentional processing compared with neutral stimuli (see Yiend, 2010, for a review). While early research on attentional bias primarily focused on threat-related and negatively valenced stimuli (e.g., Öhman & Mineka, 2001; Pratto & John, 1991), subsequent research has broadened this perspective to include positive stimuli (e.g., Brosch et al., 2008; Wentura et al., 2000; Wirth & Wentura, 2020). Current theoretical frameworks suggest that attentional biases are not determined solely by the emotional characteristics of stimuli but are also shaped by the observer's motivational state, current goals, task demands, and the temporal dynamics of attention (see Pool et al., 2016, for a meta-analysis).

In a well-received study, Vogt et al. (2011) experimentally manipulated observers' motivational states to investigate the effects of current goals on attentional processes. They tested the hypothesis that aversive emotional states bias attention toward stimuli that offer a means of alleviating the emotion. Specifically, they examined whether inducing disgust (by having participants touch disgusting materials) would increase attentional bias toward cleanliness-related stimuli (e.g., a washbasin). Following the disgust induction, participants completed a dot-probe task in which pairs of images were briefly presented, one above and one below fixation: disgusting versus neutral or cleanliness-related versus neutral. After a 350 ms cue–target onset asynchrony (CTOA), a target (a small black square) appeared in the location of one of the preceding images, and participants categorized its position (above vs. below fixation). As is standard in dot-probe research, faster responses to targets replacing emotional (disgusting or cleanliness-related; the valid condition) versus neutral images (i.e., the invalid condition) were interpreted as evidence of attentional bias. Overall, participants showed an attentional bias toward disgusting images, consistent with prior findings on biases to aversive stimuli (e.g., Öhman & Mineka, 2001). Crucially, however, an attentional bias toward cleanliness-related images emerged in the disgust condition but not in the neutral control condition. The authors concluded that this shift toward cleanliness-related cues was motivationally driven, highlighting the influence of current goals and emotional states on attentional allocation.

Boğa and Wentura (2025) published a conceptual replication of Vogt et al. (2011), aiming to clarify two important issues beyond mere replication: First, as acknowledged by Vogt et al., alternatively, a process of affective counter-regulation may have been responsible for the main result. This mechanism means that attentional biases respond to current motivational states in a counter-regulative way to prevent affective-motivational escalation (Rothermund et al., 2008; Rothermund, 2011; Wentura et al., 2018). That is, in a negative affective-motivational context (e.g., the disgust condition), there is a stronger bias toward (generally) positive stimuli (compared with negative ones). Evidence of a counter-regulation mechanism has been found for motivational manipulations, such as anticipating gains versus losses or failures versus successes (Rothermund et al., 2011; Wentura et al., 2018). Such a mechanism has also been found in studies that induced emotional states (Greving et al., 2015; Schwager & Rothermund, 2013, 2014; Zhang et al., 2016). As cleanliness-related stimuli might be moderately positive, counter-regulation might be responsible for the main result found by Vogt et al. To test for this possibility, Boğa and Wentura added trials with general positive (vs. neutral) content to the dot-probe task.

Second, Boğa and Wentura (2025) discussed the target-related task used by Vogt et al. (2011) in their dot-probe study. In the original experiment, participants had to categorize the location of the target. Often used in dot-probe research, this task can be criticized given the background of basic attention research because using the location task turns the dot-probe paradigm into a hybrid of exogenous cueing and response priming. Specifically, the location of the critical stimulus (e.g., the cleanliness-related stimuli) is congruent with the response required to the target in the valid condition and incongruent in the invalid condition (for elaboration on this issue, see Boğa & Wentura, 2025; Wentura et al., 2024; Wentura & Wirth, 2025). Therefore, we conducted two experiments: one with the location task and one with the discrimination task (i.e., the target stimulus was either a “p” or a “q,” and participants had to categorize accordingly).

There were two main results: First, we were able to conceptually replicate Vogt et al.’s (2011) main finding, that is, a moderating effect of the attentional bias by emotional state. However, the replication was successful only for the discrimination task but not for the task that Vogt et al. used originally (i.e., the location task). Second, the alternative explanation in terms of counter-regulation was refuted, as the attentional bias for positive stimuli was not moderated by mood manipulation.

Surprisingly, positive items produced a negatively signed effect in both mood conditions (i.e., the disgust condition and the neutral control condition). It is of course daring to carry out cueing experiments with a quasi-experimental factor in which different cue types are realized by different complex images. However, because the same neutral pictures were always used as counterparts for the cleanliness-related, disgusting, and positive images, the negatively signed effect cannot simply be attributed to some unwanted attention-catching properties of the neutral images.

The negatively signed effect for positive stimuli shed light on another of Vogt et al.’s (2011) features and the replication. Because our study was a replication study, we kept one feature of the original study that can be debated as well given the backdrop of basic attention research: the long CTOA of 350 ms. In basic attention research, it is known that positive cueing effects caused by abrupt onset cues (i.e., only a single cue appeared briefly at one of the possible cue locations) are only found with very brief cue-target asynchronies (up to approximately 200 ms; Samuel & Kat, 2003). With longer asynchronies, the effect reverses, a phenomenon known as inhibition of return (IOR; see, e.g., Klein, 2000). Although typically shown with abrupt onset cues, there are studies showing IOR for multiple cue situations (e.g., dot-probe) where a specific type of cue is believed to attract early attention (e.g., Priess et al., 2012; Theeuwes & Godijn, 2002; Theeuwes & Van der Stigchel, 2006). We acknowledge that Lupianez and Milliken (1999) found IOR with discrimination tasks only for longer CTOAs than the 350 ms used by Vogt et al. and Boğa and Wentura (2025).

Nevertheless, a CTOA of 350 ms is quite long for testing attentional capture (see, e.g., Petrova et al., 2013; Pool et al., 2016). For example, Petrova et al. (2013) showed that with a CTOA of only 400 ms—only slightly longer than the interval used here—cueing effects in reaction times were already invalidated by eye movements. Moreover, the cue images in Vogt et al. (2011) and Boğa and Wentura (2025) were presented for the full duration of 350 ms, which is another unusual feature for basic attention research. In experiments that vary CTOAs, cue duration is typically held constant. Taken together with the unexpected finding of a negatively signed effect for the positive stimuli provided sufficient reason to test the corresponding effects using the more appropriate CTOA of 100 ms (see, e.g., Wirth & Wentura, 2018, 2019, 2020).

As a follow-up to Boga and Wentura (2025), we conducted an experiment in which we compared the effects of attentional bias for stimuli related to cleanliness, disgust and positivity, while manipulating CTOA (100 ms vs. 350 ms). The primary aim of the present study was to examine the negative attentional bias towards positive stimuli. Therefore, mood was not manipulated in this experiment as it did not moderate the negative bias towards positive stimuli in Boga and Wentura (2025). Although the pattern of results observed in the present experiment did not directly address our initial question, it nevertheless provided new insight into the main findings of Vogt et al. (2011) and Boğa and Wentura (2025): the moderation of attentional bias towards cleanliness stimuli induced by motivation.

Method

Transparency and Openness

We report how we determined our sample size, any data exclusions, all manipulations, and all measures in this study. The data and the program code for the experiment are available on the Open Science Framework (OSF). These files can be accessed via the following link: https://osf.io/nbjpg/overview?view_only=946e6a4f3e954a3195d6a787ee76a7b6

We preregistered the experiment on aspredicted.org (https://aspredicted.org/9g6s-h4rk.pdf). The study was approved by the Ethics Committee of the Faculty of Human and Business Sciences, Saarland University, Saarbrücken, Germany.

Participants

The final sample consisted of 278 female participants ($N_{SOA\ =\ 100ms} = 140$; $N_{SOA\ =\ 350ms} = 138$). Participants' ages ranged from 18 to 35 years (*Mdn* = 29 years). In the present study, only female participants were recruited to maintain consistency with both Vogt et al. (2011), who included only women because women tend to report stronger disgust responses than men (see also Druschel & Sherman, 1999), and our previous study (Boğa & Wentura, 2025), thereby facilitating direct comparisons across studies. The study was conducted via the online platform Prolific (www.prolific.co) with the same settings as in Boğa and Wentura. As preregistered, participants with an accuracy rate below 75% in the dot-probe paradigm were excluded ($n = 3$).

Our power analysis was based on Experiment 2 (i.e., the experiment using the discrimination task) in Boğa and Wentura (2025). We observed an overall negative bias for positive stimuli, $t(209) = 3.25$, $p = .001$, $d_Z = 0.22$. For a CTOA of 100 ms, we expected a positive attentional bias (if IOR was responsible for the negative effect at CTOA = 350 ms). Therefore, we used $d = 0.40$ for the between-participants comparison. In order to detect an effect of $d = 0.40$ with a power of $1 - \beta = .95$ (α set to .05, one-tailed), $N (= 2 \times 136) = 272$ participants were required for the experiment (G*Power; Faul et al., 2007). To account for potential outliers, we aimed to recruit a total of $N = 280$ participants. With $N = 138$, we were able to detect attentional biases in the subsamples of $d_Z = 0.21$ with a power of $1 - \beta = .80$ ($\alpha = .05$, one-tailed).

Design

The study followed a 2 (CTOA: 100 ms vs. 350 ms) × 2 (Emotional Cue: cleanliness-related vs. disgusting vs. positive) × 2 (Cue Validity: valid vs. invalid) mixed factorial design. The CTOA was a between-participants factor, whereas emotional cue and cue validity were varied within participants.

Materials and Procedure

Everything was the same as in Boğa and Wentura (2025, Experiment 2) except the variation of CTOA; therefore, we do not repeat any details here. We used the same pictures as in our earlier study: 10 pictures for disgust (e.g., a dirty toilet, vomit, and insects), 10 pictures for cleanliness (e.g., washbasin, waterfall, and soap), 10 positive pictures (e.g., cute animals, happy couples, food, and flowers), and 30 neutral pictures (e.g., a bus, a hair dryer, and mushrooms). The disgust-related as well as the cleanliness-related pictures were the same as used by Vogt et al. (2011); this holds for one third of the neutral pictures as well. The complexity, contrast, and luminance values of the images were calculated using the R Imagefluency package (Mayer, 2021) to ensure that these visual properties were matched between stimuli categories (for analyses, see Supplementary Material of Boğa & Wentura, 2025).

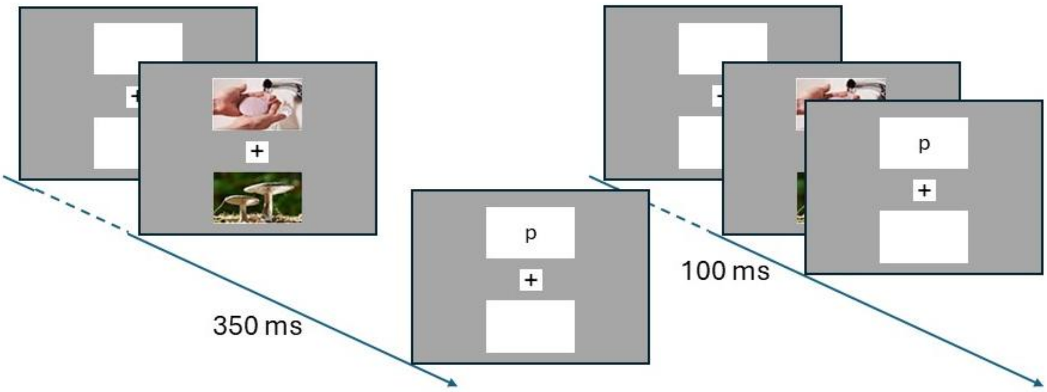
Each trial began with a fixation point presented for 500 ms. The fixation point remained at the center of the screen throughout the trial. An emotional cue (disgusting, cleanliness-related, or positive) and a neutral cue were presented above and below the fixation point. Pictures had a size of 9.3 cm × 7.1 cm. Cues were presented for either 100 ms (SOA = 100 ms sample) or for 350 ms (SOA = 350 ms sample); thus, CTOA (and presentation duration)[1] varied between 100 ms and 350 ms (see Figure 1). Subsequently, the target—either

[1] We acknowledge that CTOA is confounded with presentation duration because the 350 ms condition was a replication of a condition with CTOA = presentation duration = 350 ms (Boğa & Wentura, 2025; Vogt et al., 2011). We already mentioned this in the introduction.

a “p” or a “q”—was presented at the top or bottom location until a response was given. Participants were asked to categorize the target identity as “p” (by pressing the S key) or as “q” (by pressing the L key). The intertrial interval was 200 ms. Participants were instructed to look at the fixation cross throughout all trials.

Figure 1

Schematic illustration of a typical trial with either CTOA=350 ms or 100 ms (cue presentation duration = CTOA). Note: Presented stimuli in Figure 1 are placeholder examples (due to copyrights on the original stimuli; proportions are not true to scale).



The task consisted of 240 trials (80 disgusting-neutral trials, 80 cleanliness-neutral trials, and 80 positive-neutral trials). There were equal numbers of valid and invalid trials for each stimulus category. Additionally, each emotional picture was presented just as often in the top and bottom positions and in the valid and invalid positions. The variation of “p” or “q” was orthogonal to all other variations (i.e., validity, location of emotional picture, type of emotional picture).

Results

Average dot-probe accuracy was M = 96.2% (SD = 2.8%). For the response time (RT) analysis, RTs below 150 ms were excluded, as were RTs more than 1.5 interquartile ranges above the third quartile of the individual participant’s distribution (Tukey, 1977). This approach led to the exclusion of 4.25% of all trials with correct responses.

We conducted a series of planned analyses ; dependent variables are always attentional bias (AB) scores, computed as $RT_{invalid}$ minus RT_{valid}. Following our preregistered analysis plan, (1) we conducted one-sample t-tests to examine whether the AB score for each emotion picture category differs from zero for each time group. (2) t-tests for independent groups were conducted to examine the differences in AB scores for each emotion picture category in the 100 ms vs. 350 ms condition. (3) If the AB scores do not differ significantly between the time groups for a given emotional stimulus, one-sample *t*-tests will be conducted on the pooled sample to examine whether the overall mean bias score for that stimulus differs from zero. In line with our preregistration, one-tailed tests were used for hypothesis-congruent directional predictions.

Analyses conducted for the 350-ms condition were of particular interest because they allowed us to determine whether the current findings replicate those of our previous study (Experiment 2, neutral condition). In contrast, analyses focusing on the 100-ms condition and comparisons between the 100-ms and 350-ms conditions were intended to examine whether the observed attentional bias for the stimulus categories (particularly positive stimuli) could be explained by inhibition of return. Table 1 presents the mean RTs for each condition as well as the mean ABs.

For the positive stimuli, a significant negative bias score was observed in the 350 ms condition, replicating our previous study, $t(137) = -2.07$, $p = .040$, $d_z = 0.18$. In the 100 ms condition, a numerically negative AB was still observed, but it was not significantly different from zero, $t(139) = -1.50$, $p = .137$, $d_z = 0.13$. The AB for the 100 ms condition was not significantly different from the 350 ms condition, $|t| < 1$. Overall, the (negative) AB for positive stimuli was significant, $t(277) = -2.56$, $p = .011$, $d_z = 0.15$.

For the disgusting stimuli, similar to our previous study, the AB effect in the 350 ms condition was not significantly different from zero, $|t| < 1$. For the 100 ms condition, there was no significant result either, $|t| < 1$. There was no effect of time on the AB, $|t| < 1$. Overall, the (negative) AB for disgusting stimuli was not significant, $|t| < 1$.

Table 1

Mean RTs as a Function of Cue Validity, Cue Type, and CTOA as Well as AB Scores

		Cue validity			
Condition	**Cue type**	**Valid**	**Invalid**	**AB [SE]**	**95%-CI**
100 ms	Cleanliness	639 (3.07)	643 (3.18)	5 [2]	[.5, 8.6]
	Disgusting	648 (2.93)	647 (3.50)	-1 [2]	[-5.0, 2.6]
	Positive	645 (3.43)	642 (3.61)	-3 [2]	[-6.9, 1.0]
350 ms	Cleanliness	659 (4.80)	660 (3.97)	1 [2]	[-3.6, 5.0]
	Disgusting	675 (4.53)	675 (4.28)	0 [3]	[-5.4, 6.3]
	Positive	665 (4.26)	659 (3.66)	-6 [3]	[-11.3, 0.3]
Boga and Wentura (2025; Experiment 2)					
350 ms (Neutral state)	Cleanliness	637 (3.71)	635 (3.83)	-1 [3]	[-6.7, 3.8]
	Disgusting	650 (4.43)	649 (4.12)	-1 [3]	[-6.7, 3.9]
	Positive	640 (3.69)	634 (3.67)	-7 [3]	[-12.0, -1.4]
350 ms (Disgust state)	Cleanliness	624 (4.12)	629 (4.52)	5 [2]	[0.1, 9.4]
	Disgusting	639 (4.88)	641 (4.50)	3 [3]	[-2.8, 8.1]
	Positive	633 (4.81)	627 (4.71)	-6 [3]	[-11.1, -0.3]

Note. Error rates are given in parentheses. AB = attentional bias scores with standard errors given in brackets. For reasons of comparison, we added the results from Boga and Wentura's (2025) Experiment 2; the neutral state condition is directly comparable to the present 350 ms CTOA condition.

For the cleanliness-related stimuli, in line with our previous study (Experiment 2, neutral condition), the AB was not significantly different from zero in the 350 ms condition, $|t| < 1$. However, surprisingly, the AB in the 100 ms condition was significantly different from zero, $t(139) = 2.22$, $p = .028$, $dz = 0.19$. To compare the scores between the two groups, we conducted a robust independent samples t test (Yuen's test) with a trimming of $\gamma = .20$

because the AB score for the 350 ms condition was particularly burdened by outliers at both tails. The AB was significantly larger in the 100 ms condition than in the 350 ms condition, $t(165.54) = 1.80$, $p = .037$ (one-tailed),[2] $d = 0.16$.

In addition to the planned analyses, readers might be interested in whether the differences in stimulus types would show up in an overall analysis. Therefore, we computed a 2 (CTOA: 100 ms vs. 350 ms) × 3 (Cue Type: cleanliness-related vs. disgusting vs. positive) repeated-measures MANOVA (O'Brien & Kaiser, 1985) with CTOA as a between-participants factor, cue type as a within-participants factor, Helmert contrasts, and ABs as the dependent variable. It yielded a main effect of cue type, $F(2, 275) = 4.10$, $p = .018$, $\eta_p^2 = .029$, all other Fs < 1.01. The AB (collapsed over time conditions) for cleanliness-related cues was significantly larger than the remaining ABs (collapsed over disgusting and positive cues and time conditions; i.e., the first Helmert contrast), $F(1, 276) = 7.39$, $p = .007$, $\eta_p^2 = .026$, whereas the ABs for disgusting versus positive cues (collapsed over time conditions, i.e., the second Helmert contrast) did not diverge significantly, $F(1, 276) = 2.02$, $p = .156$, $\eta_p^2 = .007$.

A corresponding analysis for the ABs based on error rates (see Table 1) yielded nothing but a main effect of CTOA, $F(1, 276) = 9.28$, $p = .003$, $\eta_p^2 = .033$, all other Fs < 1. For CTOA = 350 ms, the AB collapsed over cue types was significantly below zero, $t(137) = -2.72$, $p = .007$, $d_z = 0.23$, whereas for CTOA = 100 ms, the AB was numerically positive, $t(139) = 1.53$, $p = .128$, $d_z = 0.13$.

Discussion

[2] Because we expected to replicate a null effect in the 350 ms condition, the most plausible outcome for the 100 ms condition was also a null effect (i.e., no difference between CTOAs). A negatively signed effect at 100 ms was considered implausible a priori; therefore, we used a one-tailed test to examine whether a positive effect at 100 ms exceeded the effect at 350 ms. But note, our main argument in this text—that is, that the present 100 ms condition would produce exactly the effect that Boğa and Wentura (2025) found for the disgust mood condition—did not depend on the significance of this test (which, of course, is not statistically significant under a two-tailed test, $p = .074$).

For the 350 ms conditions, we almost exactly replicated the results of our previous study (Boga & Wentura, 2025; Experiment 2, neutral condition). For disgusting and cleanliness-related stimuli, the bias score did not differ from zero, whereas for positive stimuli, a negative bias score was observed.

We wondered whether the negative AB for positive stimuli could be explained by IOR (Klein, 2000). If so, we would have expected a positive AB for the 100 ms condition. However, no positive bias score was observed for positive pictures. In fact, the AB was not different from zero, although numerically it remained negative. These results argue against an interpretation of the negative AB in the 350 ms condition as IOR.

Ironically, a clue to the results was provided by the cleanliness-related pictures. For these stimuli, we found a positive AB at 100 ms CTOA, which significantly decreased to a null effect at 350 ms CTOA. Thus, our procedure was able to produce AB effects at 100 ms CTOA. Given that the same neutral pictures served as the counterpart in all three cue type conditions, the effect can be clearly interpreted as a capture effect caused by the cleanliness-related stimuli. What follows? First, the absence of effects for positive and disgusting pictures at 100 ms CTOA is really an absence of attentional capture processes for these stimuli (not a failure of our procedure to cause capture effects).

Second, we do not intend to claim that the effect for cleanliness-related pictures at 100 ms CTOA must have anything to do with a general hygiene motivation. It might have to do with subtle perceptual features of these pictures. However, the effect sheds new light on Vogt et al. (2011) and Boğa and Wentura (2025). The premise of these experiments was that an increase in the AB for cleanliness-related pictures in the disgust mood condition compared with the neutral mood condition can plausibly be related only to hygiene motivations but not to subtle perceptual features of these pictures. This premise is certainly true. Luckily for both author groups, the cleanliness AB in the neutral mood condition was null. Thus, there did not appear to be attentional capture by these pictures when the hygiene motivation was absent, such that the positive AB in the disgust mood condition reflected attentional capture caused by a hygiene motivation. With our present results, the picture changed: For the 100 ms CTOA—the CTOA condition that can be most clearly interpreted as reflecting capture effects—there was an AB for cleanliness-related pictures even in the absence of a hygiene motivation. This effect already disappeared at 350 ms CTOA, but only in the absence of a hygiene motivation. It was still there if a hygiene motivation was induced (Boğa & Wentura, 2025). This finding speaks in favor of the most plausible interpretation, namely, an attentional dwelling interpretation (in contrast to a capture interpretation; see, e.g., Fox et al., 2001; Grafton & MacLeod, 2014) induced by the motivation: Attention may have —for whatever reason—initially been focused on the cleanliness-related picture. It may have returned to fixation within a short delay in the neutral condition but may have remained on the picture when a hygiene motivation was present.

We should note that, in our experiment, CTOA and cue duration were completely confounded. This was because the present CTOA = 350 ms condition was designed to replicate the procedures used in previous studies (Boğa & Wentura, 2025; Vogt et al., 2011), in which the entire CTOA was occupied by cue presentation. From a methodological perspective, this confound is a limitation because it remains unclear whether the observed difference between the CTOA conditions was driven by CTOA itself, cue duration, or their combination. Future studies should manipulate cue duration and CTOA independently to disentangle their respective contributions.

At the same time, however, this confound makes our tentative interpretation in terms of attentional dwelling more plausible in light of the seminal study by Fox et al. (2001). Fox and colleagues hypothesized that individuals with high state anxiety would dwell longer on threat cues (angry faces) than individuals with low state anxiety.[3] In their Experiment 2, cue

[3] Fox et al. (2001) used a design intended to isolate attentional dwelling processes. Specifically, they presented (a) a single cue (an *abrupt-onset cue*) that (b) was predictive of

duration was manipulated (100 vs. 250 ms), whereas CTOA was held constant at 300 ms (i.e., roughly corresponding to the present 350 ms CTOA). The predicted pattern emerged only for the 250-ms cue duration, not for the 100-ms duration. This finding suggests that prolonged cue exposure, rather than CTOA per se, may be critical for the emergence of state-dependent attentional dwelling effects. Accordingly, it is conceivable that the dependency of the cleanliness cueing effect on motivational state (Boğa & Wentura, 2025; Vogt et al., 2011) likewise reflect the longer availability of the cue rather than the longer CTOA itself.

When interpreting the positive AB for cleanliness-related pictures at CTOA = 100 ms, we should bear in mind the initial motivation behind Boğa and Wentura's (2025) study: to test the counter-regulation hypothesis (see *Introduction*). The basis of this hypothesis was the assumption that cleanliness-related images are moderately positive stimuli. In this regard, our present pattern for CTOA = 100 ms—a positive AB for cleanliness-related stimuli, but a null effect for general positive images—aligns with previous research on ABs toward positive stimuli (for a meta-analysis, see Pool et al., 2016). First, these biases tend to emerge at earlier (≤ 250 ms) rather than later processing stages (> 250 ms). Second, these effects are observed more reliably when the stimuli are relevant to a common concern (e.g., self-relevant, erotic/attractive, baby/child, food) than to general mixed positive stimuli. From this perspective, cleanliness-related stimuli may represent a functionally more relevant category than our general positive stimuli (which were not related to a common concern).

Although this might be an explanation why cleanliness pictures cause a positive effect at CTOA = 100 ms whereas general positive stimuli do not, it does not make clear why we reliably found a negative attentional bias for CTOA = 350 ms. As mentioned earlier, this finding is unlikely to be explained by inhibition of return. Previous studies have often

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the target location. Together, these features ensured that attention was initially directed to the cue. Consequently, differences in the cueing effect (i.e., $RT_{invalid} - RT_{valid}$) between cue types or participant samples can be interpreted as reflecting differences in attentional dwelling, with prolonged dwelling leading to increased RTs on invalid trials.

interpreted negative attentional biases toward positive stimuli as reflecting attentional avoidance, particularly in clinical populations (Mingtian et al., 2011; Shane & Peterson, 2007; see also Winer & Salem, 2016). Although this explanation appears less applicable to the present findings since we recruited from a general population, it is notable that negative attentional biases for positive stimuli were found at all.

More important, however, is the question of how what appears to be *avoidance* can be realized at the level of basic attentional processes. We think the conceptually cleanest account is to assume that the positive/neutral trials are not characterized by an initial attentional capture process, as the CTOA = 100 ms condition, considered on its own, did not reveal an attentional bias. Nevertheless, this finding is fully compatible with the assumption that, during a CTOA of 350 ms, attention shifts (in a substantial portion of trials) accidentally to either the positive or the neutral cue with equal probability, thus still producing no systematic attentional *capture* bias. Within this framework, *avoidance* means that attentional disengagement from positive stimuli (when the target appears at the location of the neutral cue) is faster than disengagement from neutral stimuli (when the target appears at the location of the positive cue). Across trials, this asymmetry would produce a negative cueing effect.

This interpretation also reframes the functional question. Rather than asking *why positive pictures are avoided*—a question that is difficult to answer—it becomes more appropriate to ask *why attentional dwelling on positive stimuli is so limited*. One possibility is that positive stimuli signal safety and the absence of danger, allowing attention to be withdrawn more readily. Alternatively, positive scenes may simply be easier to process, with processing fluency facilitating rapid disengagement. At present, these possibilities remain speculative. Future studies should therefore aim to disentangle attentional capture and attentional disengagement directly (e.g., Grafton & MacLeod, 2014; Gerdes et al., 2008).

Limitations

Several limitations of the present study should be acknowledged. First, as in many dot-probe studies using naturalistic images, cue type was realized by different sets of complex stimuli. Consequently, differences between cue categories cannot be attributed exclusively to their semantic or motivational meaning, because subtle perceptual differences between image sets may also have contributed to the observed effects. The critical comparison in the present context, however, concerns the modulation of the cleanliness-related bias by motivational state across studies. Because the same stimulus set was used in both the neutral and disgust conditions of Boğa and Wentura (2025), this moderation cannot readily be explained by perceptual stimulus characteristics alone. Second, the present study included only female participants to maintain comparability with Vogt et al. (2011) and Boğa and Wentura (2025). Although this decision was methodologically justified, it limits the generalizability of the findings. Future studies should examine whether the present pattern also extends to male participants and more diverse samples. Third, the observed effects were relatively small. However, this is not unusual in research using the dot-probe paradigm, where attentional bias effects are typically modest and are often accompanied by substantial between-participant variability. Importantly, our conclusions do not rest on a single isolated effect but on the coherent pattern observed across the present experiment and the two previous studies (Boğa & Wentura, 2025; Vogt et al., 2011). The theoretical interpretation is based primarily on this convergence of findings rather than on the magnitude of any individual effect.

Conclusions

The present findings suggest that the motivational modulation reported by Vogt et al. (2011) is more readily interpreted as reflecting prolonged attentional dwelling than enhanced initial attentional capture. Cleanliness-related cues elicited an early attentional bias even in a neutral motivational context, whereas motivational relevance appears to determine whether this initial attentional allocation is maintained over time. Although this interpretation remains tentative and requires confirmation with paradigms that separately assess attentional engagement and disengagement (e.g., Grafton & MacLeod, 2014), it provides a coherent account of the present findings together with those of Boğa and Wentura (2025). More generally, the results have methodological implications for research using the dot-probe paradigm. When the aim is to assess attentional capture, relatively short cue-target onset asynchronies should be preferred because longer intervals permit additional attentional processes, making the interpretation of cueing effects increasingly ambiguous. Future investigations of motivated attentional bias should therefore combine short CTOAs with paradigms that distinguish initial attentional engagement from subsequent disengagement (e.g., Grafton & MacLeod, 2014; Gerdes et al., 2008) allowing a more precise characterization of how motivation shapes attentional processing.

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