

# Disgust and Fear Related UCS-expectancy Bias in Blood Fearful individuals

Citation for published version (APA):

van Overveld, M., de Jong, P. J., & Peters, M. L. (2010). Disgust and Fear Related UCS-expectancy Bias in Blood Fearful individuals. *Clinical Psychology & Psychotherapy*, 17(2), 100-109. <https://doi.org/10.1002/cpp.639>

## Document status and date:

Published: 01/01/2010

## DOI:

[10.1002/cpp.639](https://doi.org/10.1002/cpp.639)

## Document Version:

Publisher's PDF, also known as Version of record

## Document license:

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# *Disgust and Fear-Related UCS-Expectancy Bias in Blood-Fearful Individuals*

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People with specific fears tend to overestimate the occurrence of unpleasant consequences in situations involving their feared objects. Such expectancy bias logically acts in a way to confirm phobic fear and avoidance. Increasing evidence suggests that blood phobia is qualitatively different from other specific phobias. Confrontation with phobic stimuli gives rise to disgust and repulsion rather than (threat-induced) fear. Therefore, this study examined the role of disgust-related UCS expectancies following confrontation with blood phobia-relevant stimuli. Using a thought-experiment procedure, high ( $n = 30$ ) and low ( $n = 30$ ) blood-fearful individuals estimated the probability that the presentation of slides showing a bloody wound and a series of filler slides would be followed by a sip of nauseating juice, a threat-related electrical shock or nothing. Although participants generally expected shock and juice following blood, UCS expectancies for both aversive outcomes for blood were significantly more pronounced in high blood-fearful participants. This implicates that UCS-expectancy biases may be involved in the development and maintenance of blood phobia. Copyright © 2009 John Wiley & Sons, Ltd.

## Key Practitioner's Message

This paper is relevant to clinical practitioners:

- To learn whether disgust and fear could both be important factors in blood phobia;
- To examine the role of UCS expectancies in the maintenance of phobic complaints; and
- To learn whether cognitive biases towards disgust are relevant to psychopathology (in particular, blood phobia) and to learn about the relevance of addressing disgust-related UCS expectancies for blood in future treatments.

**Keywords:** Experiment, UCS-Expectancy Bias, Disgust, Blood Phobia, Specific Phobia

## INTRODUCTION

Individuals with specific phobias hold strong convictions that catastrophic consequences occur upon confrontation with phobic stimuli and tend to overestimate the predictive relationship between

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phobic stimuli (CS) and aversive outcomes (UCS) (UCS-expectancy bias; Davey, 1992). Accordingly, laboratory studies show that, for example, spider phobic individuals are characterized by a relatively strong expectancy bias for aversive UCS outcomes (e.g., electrical shock) following spiders (e.g., de Jong & Peters, 2007b; van Overveld, de Jong, & Peters, 2006). Similar findings have been observed in panic disorder (Wiedemann, Pauli, & Dengler, 2001) and snake phobia (McNally & Heatherton, 1993). In apparent conflict with the idea that associative biases are generally involved in the maintenance of specific phobias, a series of experiments in the context of blood-injection-injury (BII) fears showed that the tendency to selectively associate BII-relevant stimuli with aversive outcomes was not especially pronounced in BII-fearful individuals (Pury & Mineka, 1997).

However, studies on phobia-relevant associative biases (including the experiments by Pury and Mineka) predominantly focused on fear or threat-related UCS outcomes (electrical shock or loud tone). Meanwhile, in addition to fear-related preoccupations, disgust seems to be critically involved in blood phobia (Page, 1994; Sawchuk, Lohr, Tolin, Lee, & Kleinknecht, 2000). Indirect evidence for this comes from studies showing that blood-fearful individuals systematically display enhanced levels of disgust propensity (de Jong & Merckelbach, 1998; Sawchuk et al., 2000) and disgust sensitivity (van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006). Studies directly testing individuals' emotional responses upon confrontation with blood-relevant materials underline the role of disgust in blood fears: blood-fearful individuals primarily report experiencing disgust when confronted with BII stimuli (Sawchuk et al., 2000; Tolin, Lohr, Sawchuk, & Lee, 1997). Because affective similarity between stimuli and outcomes seems an important factor in generating associative biases (e.g., Tomarken, Sutton, & Mineka, 1995), inflated expectancies of outcomes that elicit disgust rather than fear may be primarily involved in blood phobia. If so, this may explain the absence of relatively strong associative biases in BII-fearful individuals in previous research using fear-related rather than disgust-related aversive outcomes (Pury & Mineka, 1997).

In a first exploration of this, de Jong and Peters (2007a) investigated associative biases for harm- and disgust-related outcomes to follow presentation of blood slides. After a pre-experimental thought experiment procedure similar to that of McNally and Heatherton (1993), the actual experi-

ment was conducted. During the pre-experimental thought experiment, high and low blood-fearful individuals estimated which part of a series of hypothetical slides containing certain stimuli (i.e., rabbits, flowers and blood-donation scenes) would be followed by a disgust-relevant outcome (a sip of disgusting juice), a fear-relevant outcome (electrical shock) or a neutral outcome (nothing), if they were to participate in such an experiment. Participants generally expected aversive outcomes (shock and juice) following blood slides, but in apparent conflict with the hypothesis that disgust-related associative biases would be especially pronounced in fearful individuals, no differences emerged between groups (or outcomes). The *a priori* bias did not prove robust, as it diminished during the actual experiment at online and post-experimental measurements (de Jong & Peters, 2007a).

However, the absence of significant differences in *a priori* UCS expectancies between high and low fearful individuals might have been caused by having only one category of salient negative stimuli (i.e., blood-donation slides) within the design. In the absence of concurrent negatively valenced stimuli, participants may have generally associated the (single) category of slides with negative connotations (i.e., blood slides) with the aversive outcomes (cf. de Jong, Merckelbach, Arntz, & Nijman, 1992). Therefore, in the present study, three filler slides were included as a concurrent category of negative slides and which were prototypical of the investigated emotions, more specifically fear (a gun pointed at the viewer), disgust (maggots) or the combination of both (growling dog; see also Huijding & de Jong, 2007). Adding such stimuli renders the stimuli of interest less salient and more ambiguous as to the stimulus/outcome associations. Thus, the presence of these competing negatively valenced stimuli is likely to undermine the UCS-expectancy bias for blood in low blood-fearful individuals, thereby increasing the sensitivity of the procedure to detect differential UCS-expectancy biases related to blood stimuli (cf. de Jong et al., 1992).

Another feature of the study by de Jong and Peters (2007a) that might have blurred their results concerns their operationalization of UCS-expectancy bias. They asked participants to estimate which part of all slides would be followed by the various consequences throughout the entire experiment (expectancies of covariation; e.g., McNally & Heatherton, 1993). Such a covariation rating task is quite abstract and easily misunderstood (cf. Amin & Lovibond, 1997). These features may well have introduced noise, thereby further undermining

the sensitivity of the procedure to find individual differences in UCS-expectancy bias. Therefore, the present study adopted a more simple and straightforward procedure by investigating UCS expectancies without performing the actual experiment (akin to *a priori* measurements). Participants were asked to rate the probability that a particular outcome would occur following a specific slide that was representative for a certain category (see Davey, Cavanagh, & Lamb, 2003). Instead of estimating covariation expectancies for the full experiment, participants only imagined what they believed would happen for that specific slide at that particular moment. Additionally, to enhance a clear representation of associated feelings with that stimulus, participants were also shown an exemplar slide to ensure a vivid and also more standardized imagination of the appropriate stimuli.

In short, the present study tested the hypothesis that high blood-fearful individuals are characterized by a blood-relevant aversive UCS-expectancy bias that is especially pronounced for disgust outcomes. As a subsidiary issue, we tested whether we could replicate the earlier finding that participants in general show differential outcome expectancies regarding prototypical disgust-relevant (maggots) and stimuli that involve both fear and disgust (growling dogs) (e.g., Davey et al., 2003). In addition, we added a more prototypical threat-relevant stimulus (gun). If so, this would sustain the validity of the presently used procedure.

## METHODS

### Participants

Students at the faculties of Medicine, Health Sciences, and Psychology at Maastricht University were recruited via posters and advertisements in the university buildings. Eventually, 212 students completed the Blood subscale of the Medical Fear Survey (MFS; Kleinknecht, Thorndike, & Walls, 1996). The 30 highest- and 30 lowest-scoring individuals were invited to participate. As the majority of students at these faculties are women, the research population in the present study also consisted predominantly of women ( $n = 52$ ; 86.7%). Mean age was 22.9 years (Standard Deviation [SD] = 6.86). As high blood fear has a relatively low prevalence (3–4% in a normal population; Costello, 1982), participants qualified as high blood fearful if two of the following criteria were met: (a) they rated themselves at least 7 on a scale from 1 (not blood fearful at all) to 10 (extremely blood fearful);

(b) MFS-Blood > 5; and (c) Blood-Injury Phobia Questionnaire (BIQ)-Fear subscale (de Jong & Merckelbach, 1998) >20. These criteria were based on the distribution of blood fear in another study using a large sample of students (van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006) and on earlier experiences in our lab. As low blood fear participants are more readily available, more stringent criteria could be used for this group. Thus, to ensure a valid contrast between groups, they (a) rated themselves non-blood fearful (<5); (b) MFS-Blood < 5; (c) BIQ-Fear < 18.

### Materials

*Disgust Scale (DS; Haidt, McCauley, & Rozin, 1994)*

The DS measures disgust propensity across several domains. The first part contains 16 true/false-type questions. Participants rate their agreement to 16 statements (e.g., 'I probably would not go to my favourite restaurant if I found out that the cook had a cold'). The second part inquires how disgusted participants would be upon confrontation with 16 disgusting stimuli (e.g., 'You see a man with his intestines exposed after an accident'.) using a scale from 0 ('not disgusting at all') to 2 ('very disgusting'). In accordance with recent suggestions from a psychometric evaluation that favoured a three-subscale distribution over the original distribution (Olatunji et al., 2007), only 25 of the 32 items were used to calculate the subscales Core disgust ( $\alpha = 0.59$ ; present study), Animal-Reminder disgust ( $\alpha = 0.35$ ; present study) and Contamination ( $\alpha = 0.51$ ; present study), as well as a total score ( $\alpha = 0.77$ ; present study).

*Disgust Propensity and Sensitivity Scale-Revised (DPSS-R; van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006)*

This index measures disgust propensity (i.e., how rapidly one experiences disgust) and disgust sensitivity (i.e., how unpleasant is the disgust experience to the individual) (Cavanagh & Davey, 2000a). Here, the shortened version of the DPSS-R was administered, where individuals rate their agreement with 12 propositions concerning the frequency of certain symptoms (e.g., 'I find something disgusting') and their emotional impact (e.g., 'When I am disgusted, I am worried that I might pass out') on a scale from 1 ('never') to 5 ('always'; range: 12–60). Both subscales propensity ( $\alpha = 0.83$ , Fergus & Valentiner, 2009; 0.82, present study) and sensitivity ( $\alpha = 0.80$ , Fergus & Valentiner, 2009; 0.82, present study) show satisfactory reliability.

*BIQ (de Jong & Merckelbach, 1998)*

The BIQ examines fear of blood and fainting history using two 10-item subscales. Items are derived from two widely established and psychometrically sound indices of specific fears, the Fear Questionnaire (Marks & Mathews, 1979) and the Fear Survey Schedule (Wolpe & Lang, 1964). On the first part, BIQ-Fear, participants rate their fear of 10 blood items (e.g., 'Please rate how afraid you are of: 1. blood, 2. hospitals, etc.') on a scale from 0 ('no fear') to 4 ('maximal fear'; range = 0–40). The BIQ-Fear is reliable (0.82–0.87, Merckelbach, Muris, de Jong, & de Jongh, 1999; 0.91, present study). On the second part, BIQ-Fainting, participants rate their fainting history for the BIQ-Fear items (e.g., 'Please rate how often you have fainted in the presence of: 1. blood, etc.') on a scale from 0 ('never') to 2 ('often'; range: 0–20). Internal consistency is satisfactory ( $\alpha = 0.73$ – $0.78$ , Merckelbach et al., 1999; 0.81, present study).

*MFS (Kleinknecht et al., 1996)*

This questionnaire assesses fear of medical stimuli using five 10-item subscales (Mutilation, Sharp Objects, Examinations and Symptoms as Intimation of Illness, Injections and Blood Draws, and Blood). Participants rate whether a series of statements are typical of them on a scale from 0 (very slightly) to 4 (extremely). The subscales are reliable ( $\alpha = 0.84$ – $0.94$ ; Kleinknecht, Kleinknecht, Sawchuk, Lee, & Lohr, 1999; 0.87–0.97, present study). Further, factor analyses support its factor structure, indicating that it is a valid index for blood phobia (Kleinknecht et al., 1996).

*Multidimensional Blood/Injury Phobia Inventory (MBPI; Wenzel & Holt, 2003)*

This questionnaire measures fear of blood, covering a broad domain of stimuli and possible responses. It contains 40 items on four types of stimuli (injections, hospitals, blood and injury) and five types of responses (fear, avoidance, worry, fainting and disgust). Participants rate the degree to which each item is typical of them on a scale from 0 (very slightly or not at all) to 4 (extremely). A total score and six subscales (Injections, Hospitals, Fainting, Blood-Self, Injury, Blood/Injury-Others) can be calculated. Internal consistency is high for both total score ( $\alpha = 0.91$ ; Wenzel & Holt, 2003; 0.97, present study) and subscales ( $\alpha = 0.86$ – $0.96$ , present study). Additionally, the MBPI appears a valid index for blood fear with respect to

concurrent, convergent and discriminant validity (Wenzel & Holt, 2003).

*Procedure*

Upon arrival at the lab, participants completed the disgust scale-revised (DS-R), DPSS-R, BIQ, MFS and MBPI. Next, they received a verbal introduction and a binder containing the UCS questionnaire (introduction in Appendix).

To determine UCS expectancies for blood, a blood slide was included, which depicted a small, bloody wound on someone's leg. To render the stimulus of interest (i.e., blood) less salient and more ambiguous as to the stimulus/outcome associations, three filler slides were included as concurrent categories of negative slides that were related to the emotions of concern, namely fear (a gun pointed at the viewer), disgust (maggots), and both fear and disgust (growling dog) (cf. de Jong et al., 1992). A neutral stimulus (rabbit) was used to provide an anchor point to evaluate the differential UCS expectancy bias towards these stimuli (e.g., Davey et al., 2003; van Overveld et al., 2006).

In the binder, exemplary color slides<sup>1</sup> of each stimulus were presented on the page prior to the page containing questions regarding that stimulus. So, on the first page, participants would read, 'The following slide appears: maggots' together with an exemplary slide. On the next page, participants would read, 'Imagine that during the experiment you will be shown the following slide: maggots. What do you think the chances are that this slide depicting maggots will be followed by an electrical shock?' This question was repeated for all outcomes (i.e., juice, nothing). Ratings were obtained using a 100-mm visual analog scale (VAS) from 0 ('very small') to 100 ('very large'). The sequence of ratings was fixed in a random order and resulted in 15 UCS-expectancy ratings per person (5 slides  $\times$  3 outcomes) pertaining to the probability that the slides (in this order: maggots, rabbit, blood, dog and gun) would be followed by a particular outcome (in this order: shock, juice and nothing). After completion, participants received a small financial incentive.

<sup>1</sup>The exemplary slides were obtained from the International Affect Picture System (numbers: 1300, 1610, 6230), except the slides depicting a small, bloody wound and maggots, which were retrieved from the World Wide Web. All slides were successfully used in previous studies in our lab (e.g., de Jong, van den Hout, & Merckelbach, 1995; van Overveld et al., 2006), with the exception of the blood slide. All slides can be obtained on request from the corresponding author.

## RESULTS

### Statistical Analyses

Missing values were estimated using regression analyses following recommendations of Schafer and Graham (2002). Independent sample *t*-tests examined whether low and high fearful obtained different scores on the various questionnaires (MFS, BIQ, MBPI, DS-R, DPSS-R). Next, UCS expectancies were calculated by subtracting the expectancy of a neutral outcome from the outcome of interest (for example, disgust expectancy for maggots = UCS expectancy of a sip of juice following maggots – UCS expectancy of the neutral consequence following maggots).

In accordance with earlier work (van Overveld et al., 2006), an analysis of variance (ANOVA) with the within-subjects factor outcome type (shock minus nothing, juice minus nothing) and the between-subjects factor blood fear (high, low) was used to examine if UCS expectations for blood differ as a function of group. Differences in UCS expectations for the filler slides were tested using an ANOVA with the within-subject factors slide type (rabbit, dog, maggots, gun) and outcome

type (shock minus nothing, juice minus nothing) and the between-subject factor blood fear (high, low). Subsequently, to determine which outcome was most strongly associated with each stimulus, three *post-hoc t*-tests were performed (comparing expectation of shock versus nothing, juice versus nothing and shock versus juice).

### Descriptives

Table 1 shows that, as expected, the high blood-fearful group scored significantly higher on fear of blood (BIQ, MFS, MBPI), disgust propensity (DS-R, disgust propensity and sensitivity scale-revised sensitivity (DPSS-R-S)) and disgust sensitivity (DPSS-R-S). A chi-square test revealed that the high blood-fearful group did not differ in gender distribution from the low fearful group ( $\chi^2 [2, N = 60] = 0.58; p = 0.77$ ).

### UCS Expectations for Blood

A 2 (Outcome: shock minus nothing, juice minus nothing)  $\times$  2 (Blood Fear: high or low) ANOVA was performed. The significant intercept ( $F [1, 58]$

Table 1. Mean scores on questionnaires for high and low blood fearful-participants

Indices	High fear	Low fear	<i>t</i> (58)	<i>p</i>
DS-R total	14.40 (2.79)	11.33 (2.96)	-4.13	<0.01
Core	11.17 (2.29)	9.63 (2.67)	-2.39	0.02
A-R	5.93 (1.57)	4.33 (1.58)	-3.93	<0.01
Contamination	5.50 (1.22)	3.57 (1.27)	-5.98	<0.01
DPSS-R				
Propensity	18.53 (3.12)	14.47 (2.37)	-5.69	<0.01
Sensitivity	15.10 (4.16)	10.10 (2.34)	-5.74	<0.01
BIQ-Fear	27.83 (6.53)	14.70 (3.20)	-9.89	<0.01
BIQ-Faint	11.37 (2.17)	10.10 (0.40)	-3.14	<0.01
MFS				
Injections	17.77 (8.49)	3.27 (3.34)	-8.70	<0.01
Sharp Objects	10.47 (7.64)	4.13 (3.16)	-4.20	<0.01
Disease	11.47 (5.47)	6.07 (3.56)	-4.53	<0.01
Mutilation	21.27 (8.15)	6.70 (4.79)	-8.44	<0.01
Blood	13.27 (7.37)	1.20 (1.85)	-8.70	<0.01
MBPI total	63.50 (23.11)	8.30 (8.67)	-12.25	<0.01
Injections	13.70 (5.79)	1.23 (2.73)	-10.67	<0.01
Hospitals	5.00 (4.39)	0.83 (1.56)	-4.90	<0.01
Fainting	4.00 (4.71)	0.27 (0.94)	-4.26	<0.01
Blood-Self	9.17 (4.36)	0.33 (0.66)	-10.96	<0.01
Injury	8.23 (4.07)	2.53 (2.40)	-6.61	<0.01
Valid <i>N</i>	30	30		60

DS-R = Disgust Scale-Revised. A-R = Animal-Reminder disgust. DPSS-R = Disgust Propensity and Sensitivity Scale-Revised. BIQ = Blood/Injury Phobia Questionnaire; MFS = Medical Fears Survey; MBPI = Multidimensional Blood/Injury Phobia Inventory.

Note: Standard Deviations are described in parentheses.

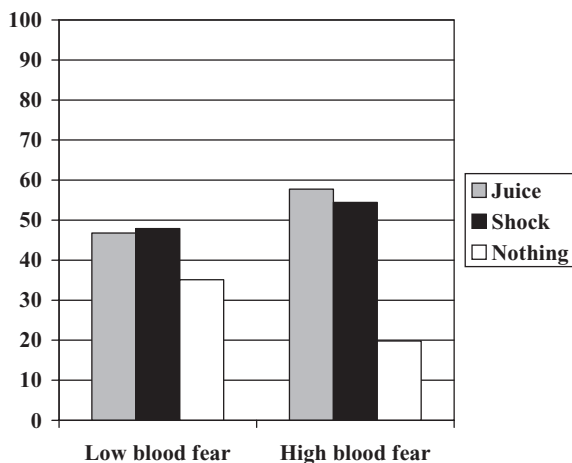


Figure 1. UCS expectancies for the blood slide in high and low blood-fearful participants

= 18.13;  $p < 0.01$ ;  $d = 0.24$ ) indicates that overall, participants expected aversive outcomes following the blood slide. There was no main effect of Outcome ( $F [1, 58] = 0.42$ ;  $p = 0.84$ ;  $d < 0.01$ ), so generally, participants expected shock and juice equally strongly. Yet, a significant main effect of Group ( $F [1, 58] = 4.46$ ;  $p = 0.04$ ;  $d = 0.07$ ) shows that high blood-fearful participants expected aversive outcomes more strongly than low blood-fearful participants. This inflated outcome expectancy was similar for both outcome types as the interaction term Outcome  $\times$  Group was not significant ( $F [1, 58] = 0.18$ ;  $p = 0.68$ ;  $d < 0.01$ ). Figure 1 provides a visual summary, although it should be mentioned that for the purpose of clarity, absolute UCS ratings are presented there.

#### UCS Expectations for the Other Stimuli

A 4 (Slide Type: rabbit, dog, maggots, gun)  $\times$  2 (Outcome: shock minus nothing, juice minus nothing)  $\times$  2 (Blood Fear: high, low) ANOVA revealed a main effect for Slide Type ( $F [3, 56] = 33.35$ ;  $p < 0.01$ ;  $d = 0.64$ ), showing that some slides were associated with aversive outcomes more strongly than others. A main effect for Outcome ( $F [1, 58] = 50.43$ ;  $p < 0.01$ ;  $d = 0.46$ ) indicated that overall, participants expected shock more often than juice. The main effect of Group was not significant ( $F [1, 58] = 0.16$ ;  $p = 0.69$ ;  $d < 0.01$ ), so no differences were observed between groups in expectations of aversive outcomes in general.

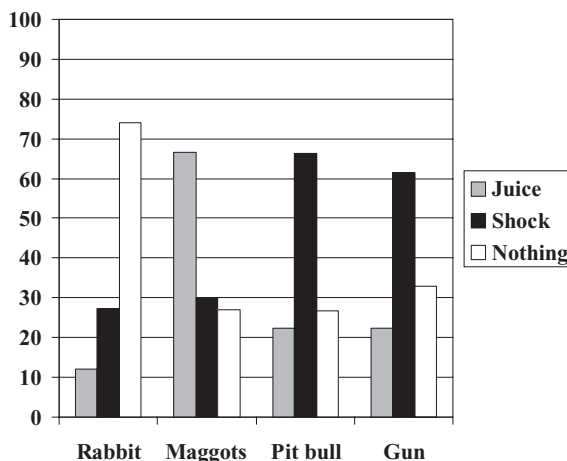


Figure 2. UCS expectancies for all participants

As expected and supporting the validity of the present approach, the interaction term Slide Type  $\times$  Outcome was significant ( $F [3, 56] = 32.97$ ;  $p < 0.01$ ;  $d = 0.64$ ), indicating that the UCS expectancies varied as a function of stimulus type. Most importantly, this effect was similar for both groups, as indicated by non-significant interaction term Slide Type  $\times$  Outcome  $\times$  Group ( $F [3, 56] = 1.13$ ;  $p = 0.34$ ;  $d = 0.06$ ).

*Post-hoc* paired samples *t*-tests showed that participants associated the rabbit significantly more strongly with nothing compared with juice ( $t [59] = -11.74$ ;  $p < 0.01$ ) or shock ( $t [59] = -6.252$ ;  $p < 0.01$ ) and stronger with shock than juice ( $t [59] = 4.38$ ;  $p < 0.01$ ). Maggots were associated most strongly with juice compared with shock ( $t [59] = -7.53$ ;  $p < 0.01$ ) or nothing ( $t [59] = 5.85$ ;  $p < 0.01$ ). There were no differences in expectations of shock versus nothing ( $t [59] = 0.56$ ;  $p = 0.58$ ). The dog was significantly more strongly associated with shock compared with juice ( $t [59] = 8.53$ ;  $p < 0.01$ ) or nothing ( $t [59] = 6.27$ ;  $p < 0.01$ ). There were no differences between expectations of juice versus nothing ( $t [59] = -0.88$ ;  $p = 0.38$ ). The gun was associated significantly stronger with shock compared with juice ( $t [59] = 7.23$ ;  $p < 0.01$ ) or nothing ( $t [59] = 4.09$ ;  $p < 0.01$ ). There was a trend towards a stronger association with nothing than with juice ( $t [59] = -1.83$ ;  $p = 0.07$ ). Thus, the rabbit was most strongly associated with nothing, maggots with juice, and dog and gun with shock. Figure 2 provides a visual summary of the absolute UCS ratings following each stimulus.

## DISCUSSION

The main findings are (a) participants generally expected both fear- and disgust-related outcomes following blood; (b) UCS expectancies for aversive outcomes following blood were most pronounced in high blood-fearful individuals; and (c) attesting to the validity of the present approach, participants generally showed differential outcome expectancies for prototypical disgust- and fear-related stimuli.

Corroborating earlier work (Davey et al., 2003; van Overveld et al., 2006), differential UCS expectancies were observed. Participants associated a dog and a gun with a feared outcome (shock), maggots with a disgust-related outcome (juice), and rabbit with a neutral outcome (nothing). Most importantly, the differential UCS associations for the blood slide differentiated between groups. High blood-fearful individuals expected both aversive outcomes following blood significantly more strongly than low blood-fearful individuals. This sustains the notion that blood-fearful individuals are characterized by a phobia-relevant UCS-expectancy bias.

The finding that high blood-fearful individuals display a UCS-expectancy bias for blood-related stimuli contrasts with earlier work by de Jong and Peters (2007a), who did not find evidence for *a priori* UCS expectancies for aversive outcomes, specifically in high blood-fearful participants. In that study, high and low blood-fearful participants generally expected aversive outcomes (shock and juice) following hypothetical presentation of blood slides, but no differences emerged between groups. However, by using only one salient negative stimulus (i.e., blood-donation slides) in their experiment, participants may have generally associated the (only) category of slides with negative connotations (i.e., blood slides) with the aversive outcomes (cf. de Jong et al., 1992). Therefore, in the present study, three slides were included that were prototypical of fear (a gun), disgust (maggots) or a combination of both (growling dogs) as concurrent categories of negative slides. The present results are consistent with the prediction that this would undermine the UCS-expectancy bias for blood-relevant stimuli in *low fearful* individuals. Thus, the inclusion of additional salient negative stimuli seems to have increased the sensitivity of the procedure and suggests that the absence of differential UCS-expectancy biases in earlier work by de Jong and Peters (2007a) might have been the result of methodological issues (i.e., inflated UCS

expectancies for blood slides in their control group by using only blood-related slides as salient negative stimuli).

UCS expectancies for both aversive outcomes were equally strong, suggesting that threat and disgust expectancies may be equally important to blood phobia. However, the threat-related outcome expectations might have been inflated by the use of an exemplary slide depicting a small, bloody wound. That is, the fear-related outcome expectancies may partially be the result of a close semantic connotation between a (painful) wound and a conceptually related outcome (i.e., painful electrical shock). Therefore, expectations of specifically fear-related outcomes may be reduced when using an exemplary slide depicting only blood. Nevertheless, although UCS expectancies for both aversive outcomes were equally strong in blood-fearful individuals, the current findings clearly support the view that enhanced UCS-expectancy biases appear as a universal phenomenon in phobic complaints and may thus also play a role in the maintenance of blood phobia.

The finding that blood-fearful individuals display a disgust and fear-related UCS-expectancy bias is an important first step in determining whether this type of expectancy bias is indeed involved in the maintenance of the phobic complaints. It should be acknowledged, however, that although the available evidence is consistent with the alleged reciprocal relationship between blood fear and UCS-expectancy bias (e.g., Davey, 1997), it cannot be ruled out on the basis of the present findings that UCS-expectancy biases are mere epiphenomena of (blood) fears. While causality problems of the present type are hard to solve, they are theoretically very important. One way to further explore this causality issue would be to see how UCS-expectancy bias is affected by successful treatment. If UCS-expectancy bias plays a critical role in the maintenance of complaints, it should be substantially reduced after successful treatment. Moreover, a critical implication of the proposed reciprocal relationship between complaints and expectancy bias would be that successfully treated patients who nevertheless show a post-treatment bias are more vulnerable to relapse than patients who do not display such a post-treatment bias (cf. de Jong et al., 1995). Finally, the most rigorous way to test the causal properties of UCS-expectancy bias would be to specifically reduce UCS-expectancy bias and to test whether this results in a reduction of blood fear (cf. MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002).



If UCS-expectancy biases are indeed involved in the maintenance of psychopathological symptoms, then it could be that differential UCS-expectancy biases are relevant to specific types of psychopathology. Thus, expectations of disgusting outcomes may be more relevant in disorders where disgust is hypothesized to be predominantly involved, such as blood phobia (Page, 1994), whereas for disorders where fear appears as the primary motor of phobic distress (e.g., spider phobia; Tolin et al., 1997), fear-related expectancies may be relatively more important. Additionally, it would be interesting to investigate whether treatment can be enhanced by addressing specific UCS expectancies and belief systems regarding phobic objects. Furthermore, if (residual) UCS-expectancy biases indeed undermine the consolidation of treatment effects (cf. de Jong et al., 1995), it may be of clinical significance to signal such biases in a preliminary stage in order to prevent relapse.

Further, several points should be addressed in future research. First, as the high blood-fearful participants lacked a clinical diagnosis of blood phobia, it may be questioned whether this group was genuinely blood fearful. However, adding to the validity of the claim that they were indeed blood fearful, scores on indices of blood fear were significantly higher in the high blood-fearful group compared with that in the low blood fearful group. More importantly, scores on indices of blood fear of the high fearful participants resembled those reported in earlier studies that did incorporate clinical populations (Kleinknecht, 1993; Wenzel & Holt, 2003). Future research should nevertheless investigate if similar or perhaps even more pronounced results emerge when using a treatment-seeking sample.

Second, a fixed sequence was used to present the various stimuli. Thus, it may be that order effects could have biased the present findings beneficially. It may be advisable to counterbalance the presentation of the various stimuli in future research to control for the possibility of any order effects.

Third, to ensure a vivid and more standardized imagery of the stimuli, the present study altered the original design for a hypothetical thought experiment from McNally and Heatherton (1993) by using exemplar slides. However, as these slides were presented immediately before the questions pertaining to that stimulus, it remains to be established whether prior or online UCS expectancies are measured. Future work should therefore include exemplar slides only after the introduction, prior to the start of the experiment (see also van Overveld et al., 2006).

Fourth, the present study relied on a thought experiment procedure. Although such a procedure is widely used in research on expectancy bias (e.g., McNally & Heatherton, 1993; Davey et al., 2003), it should be acknowledged that UCS expectancies in real-life situations may not fully correspond with those in hypothetical situations (e.g., Parkinson & Manstead, 1993). It can therefore not be ruled out that the present results provide an inaccurate reflection of blood fearfuls' actual expectancies when being confronted with real blood-relevant stimuli. However, because blood-fearful individuals are normally quite successful in avoiding real-life phobic cues, it seems of major concern what type of UCS expectancies people hold when they explicitly consider the possibility of a confrontation with blood-relevant stimuli (cf. de Jong, Merckelbach, Bögels, & Kindt, 1998). It seems that such explicit considerations regarding the anticipated effects of a confrontation with a phobic stimulus can be reasonably successfully investigated with a hypothetical thought experiment procedure. It would nevertheless be interesting to investigate in future research whether a similar pattern of outcome expectancies would emerge during actual encounters with blood-related stimuli in an actual experiment (cf. de Jong & Peters, 2007a). Following this, it would be interesting for future studies to expose high and low blood-fearful individuals to an actual illusory correlation experiment (e.g., de Jong & Peters, 2007a) rather than to an imaginary experiment. Such a procedure also allows exploring whether initial disgust and fear-related outcome expectancies vary with respect to their sensitivity to corrective experiences. The relative (in)sensitivity to disconfirming information may provide important clues with respect to the importance of disgust-relevant and fear-relevant UCS representations in blood phobia.

## ACKNOWLEDGEMENT

For her efforts regarding data collection, the authors thank Franca Leeuwis.

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## APPENDIX

### *Introduction*

This brief questionnaire studies how people perceive experimental research. You are about to participate in a thought experiment. This means that we will ask you to imagine a specific situation as vividly as possible. After this, you will be asked to complete a questionnaire. You will now receive a short description of an experiment, after which you are to imagine being a participant in that experiment.

### *Description of the Experiment*

You are invited here to participate in an experimental study at the laboratory. You will be asked to sit down in a comfortable chair, and view a series of slides, projected on a large screen. Two electrodes will be placed on your upper arm and

before the experiment starts a level of electrical shock will be selected in consultation with you. This will be done so the level is certainly unpleasant, yet not painful. During the experiment you will receive shocks at certain moments. Also, a catheter will be inserted in your mouth, and taped to your cheek, so at certain moments a fluid can be injected. This fluid tastes very bitter, and is quite nauseating. The fluid is, however, just like the shock, unpleasant yet harmless and without side effects.

During the experiment, you will view a series of slides of five different categories: maggots, rabbits, blood, dogs, and weapons. Each slide is presented for exactly six seconds and is immediately followed by one of three consequences: either you will receive a short but unpleasant electrical shock, or a shot of the nauseating, bitter fluid will be injected into your mouth, or nothing will happen.

Now imagine that you are seated in the chair, with electrodes attached to your right upper arm and a catheter inserted in your mouth. The light is waning and the first slide will soon appear on the screen. You may now complete the questionnaire.