

Utrecht University
MSc Social Psychology

Thesis

Are you afraid of the dark?

The psychological consequences of darkness

Karin van Wouwe – 3277054

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Accompanied by Daniel Lakens

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Abstract

Although it is generally known that children are afraid of the dark, little is known about this anxiety in adults. The current article examines whether darkness has a psychological influence on people. This is done either by manipulating the lighting of a room (Experiment 1), or by reminding people about walking down the street at night (Experiment 2). Overt, implicit, and behavioural measures are used to investigate the influence of darkness. Affective self-reports and task performance did not differ between the light and dark condition. However, gender differences revealed that women tend to be more scared of the dark than men, while as children, men and women indicated to be equally scared. Additional analyses also revealed that people's believe in a just world does not seem to be that stable. When reminded about darkness, this belief is lower the more a person has experienced unpleasant things in the dark.

Are you afraid of the dark? In movies, when it gets really scary it is always dark outside and suddenly all the lights fall out. What is it about darkness that makes it so scary? And does darkness really make people scared, or are other emotions involved? Being afraid of the dark is very common for children. When they go to sleep children often want to leave on a light or leave a door open so they will not be surrounded by total darkness. There is not much known about this anxiety in adults, but that does not mean darkness has no influence once people get older. It is still unclear what kind of emotions are provoked by darkness. The main question in the current research is: “What are the psychological consequences of being in the dark?”

The loss of visual information that arises as a result of darkness leads to a situation characterised by tension, anxiety, and uncertainty (Grillon, Pellowski, Merinkangas, & Davis, 1997). Darkness has been demonstrated to make people scared shown by a physiological measurement; it facilitates the acoustic startle reflex in humans. When people receive acoustic startle stimuli in a dark environment, they show larger startle responses. Evidence that these large startle responses are induced by anxiety is derived from animal studies. Rats are, in contrast to humans who are diurnal, nocturnal and exhibit increased startle reflex in illuminated places (Grillon et al, 1997). Assuming these differences between people and mice, being afraid of the dark seems to be of evolutionary origin.

Schaller, Park, and Mueller (2003) found that when participants were placed in a dark environment, beliefs about danger in the world were associated with more stereotyping of Black people. A concept linked to the belief in a dangerous world is the better known *belief in a just world* (BJW; Lerner, 1965). Belief in a just world asserts that people have a need to believe that people generally get what they deserve in life (Van Prooijen & Van den Bos, 2009). In the following experiments, we will examine the influence of darkness on BJW as well as its influence on anxiety and more basic forms of anxiety. In two experiments, people

will either be placed in the dark, or are asked to remember a situation in the past. Is it possible to find differences on peoples' BJW, anxiety and related behavioural measures in these situations? After childhood, does darkness still have real psychological consequences?

Belief in a just world

The belief in a just world (BJW) assumes that individuals have a need to believe that they live in a world where people generally get what they deserve. People are motivated to perceive the surrounding social world as a just place where good things happen to good people and bad things happen to bad people (Van Prooijen & Van den Bos, 2009). This belief enables people to confront their physical and social environment as though it were stable and orderly.

Therefore, the belief in a just world serves important adaptive functions and individuals are motivated to protect this belief (Dalbert, 1999). Is it possible to influence this belief by (thinking about) darkness? There is evidence that, when people had an unfair experience, they still protect their BJW, by changing their view of the situation so it becomes fair (Hafer & Correy, 1999). However, one could argue that it makes more sense that unfair/negative experiences instead threaten people's BJW. This could be a general effect but it could also be person-specific, with personal experiences being an important moderator of the direct effects of (thinking about) darkness.

Anxiety

Startle studies show that darkness elicits physiological anxiety, which is related to the psychological anxiety that we will examine. Anxiety is elicited by unpredictability and by the perception of potential, unseen, or symbolic threats and is behaviourally associated with avoidance (Grillon, 2008). The temporary type of anxiety that is caused by darkness is called state anxiety, which is explained by Spielberger and Sydeman (1994) as transient emotional states, consisting of consciously perceived feelings of tension, apprehension, nervousness, and worry, and associated with activation or arousal of the autonomic nervous system, (which)

vary in intensity and fluctuate over time as a function of perceived physical or psychological danger. Although it is often called “fear” of the dark, darkness actually seems to facilitate anxiety and not fear, because it is temporally uncertain danger instead of an imminent threat (Grillon, 2008).

Psychological effects of darkness

Darkness has shown to promote aggressive behaviour. Participants delivered higher intensity shocks to a victim in a dimly lit room than in a well-lit setting (Page & Moss, 1976). In the dimly lit room, the subject and victim were not able to see each other. When the victim was in another room, there was no difference in intensity of shocks between the two conditions. It is proposed that darkness produces an increase in feelings of anonymity and a resulting decrease in inhibitions. However, this was not measured in the experiment. A more recent experiment done by Zhong, Bohns, and Gino (in press), did measure this feeling of illusory anonymity. They found that subjects placed in a room with dimmed lighting cheated more and thus earned more undeserved money than those in a well-lit room. A similar effect emerged when participants wore sunglasses. When explicitly asked, participants who wore sunglasses reported feeling more anonymous during the study than participants who wore clear glasses. This sense of anonymity mediated the relationship between darkness and self-interested behaviours (Zhong et al., in press).

Schaller et al. (2003) showed that darkness has an impact on ethnic stereotypes. They conducted two experiments in which participants were shown photos of black men in either a well-lit or a dark room. Participants’ belief in a dangerous world was also measured using a questionnaire. The more people believe in a dangerous world, the more they express overt and implicit prejudices. This is exactly what they found. When photos of Black men were shown under the condition of ambient light, participants’ beliefs about the dangerous world did not predict stereotyping against Black men. However, when under condition of ambient darkness,

beliefs about danger in the world were associated with more derogatory stereotypes of Blacks. For this group the words hostility, untrustworthiness, and other highly danger-relevant words were more strongly linked to Black men (Schaller et al., 2003).

Current research aims to examine thoroughly the psychological consequences of darkness, whereby we are interested more specifically in the effects of darkness on BJW, anxiety and related behavioural measures.

Overview of the research

Using two experiments, we tested whether darkness has psychological effects on people. The main hypothesis is that people feel more uncomfortable when they are placed in a dark environment/ think about darkness than when they are placed in a light environment/ think about daylight. This was measured using overt, implicit and behaviour tasks. In experiment 1, darkness was manipulated by placing people in a dark environment. We examined whether room dimness promoted emotional interference, anxiety, and uncertainty. Negative affect towards being treated unfair were also expected to be induced by room dimness. We further expected belief in a just world and trust to be reduced for participants placed in the dark. In experiment 2, a writing instruction was used to make darkness salient. Expected was that thinking about darkness would promote anxiety and negative affect reactions towards being treated unfair. Also, thinking about darkness was expected to reduce the belief in a just world.

Experiment 1

Method

Participants and design. Sixty-seven students (32 men and 35 women) at Utrecht University participated in the experiment and were paid € 6,- for their participation. The mean age of the participants was 21.16, SD = 2.94. Participants were randomly assigned to one of

the two conditions (illumination: light vs. darkness). The study lasted approximately 45 minutes.

Procedure. Upon entry in the laboratory, participants were seated in separate cubicles. Each windowless cubicle contained a personal computer, monitor, and keyboard that were used to present the stimulus information and to register the data. Participants were randomly assigned to either a well lit cubicle (half of the participants) or to a near-total dark cubicle (the other half of the participants). In the darkness condition, the only light in the cubicle came from the computer screen. The brightness of the screen was adjusted to the darkness in the laboratory, so participants would not be blinded by the lighting. The experimenter accompanied the participants to their cubicle and told them the following: “There has recently been done some work at the lightning in the laboratory. The lights in the laboratory are now *on/off*. You should have no problem performing the task”.

Emotional Stroop Task. The first task consisted of an Emotional Stroop Task (Mathews, & MacLeod, 1985). This is a paradigm to investigate interference effects of emotional material on cognitive processing. Subjects had to name the ink colour of word stimuli as fast and accurately as possible, while at the same time ignoring the word meaning. Slowing of naming the ink colour of emotional as compared to neutral words represents the emotional interference effect and indicates biasing of attentional resources towards the emotionally salient information. Interference is an indicator of automatic processing of negative stimuli as they have greater significance for the individual.

Participants were required to colour-name words related to physical or social threat, together with control words having no threat-related meaning. Words related to physical or social threat, and neutral words in red, green, yellow, and blue colour were displayed one after another on a black computer screen. The use of the computer for the task is derived from the

study of Dresler, Mériaux, Heekeren, and van der Meer (2009). Words with similar content were presented in blocks, and the order of presentation of these blocks was fully balanced.

Subjects had to indicate the ink colour of the presented words using four keys of a standard computer keyboard, while ignoring the meaning of the word. Words were presented on the screen until a response was given. Assignment of colours to keys was counterbalanced across subjects, with key 1 always red, key 9 always green, and the keys 2 and 0 randomly blue and yellow.

Twelve words associated with physical threat and 12 words associated with social threat were used. Two further sets of positive (non-threat) words were used on the basis of frequency-matching with each of the threat words (Mathews, & MacLeod, 1985). The experiment consisted of eight practice trials and two runs of real trials. Each real run contained four blocks of neutral physical words, neutral social words, physical threat words, and social threat words, respectively (in total 16 blocks). Within each block 12 words (trials) were presented. In total, subjects were exposed to 24 physical threat, 24 social threat, and 48 neutral words. Before each block a fixation cross was presented for 6 s; trials were separated by a fixation cross displayed for 1.5 s. Mean reaction times and error rates for physical threat, social threat, neutral physical, and neutral social words, respectively, were used as dependent variables.

IAT-Anxiety. The second task consisted of an IAT-Anxiety (Egloff, & Schmukle, 2002). The IAT measures strengths of associations between concepts by comparing response times on two combined discrimination tasks. Participants are required to sort stimuli representing four concepts using just two responses, each assigned to two of the four concepts. The basic assumption of the IAT is that if two concepts are highly associated, the sorting task will be easier (i.e. faster) when the two associated concepts share the same response key than when they share different response keys (Egloff & Schmukle, 2002). The IAT anxiety

combines the categorisation into self and other categories with the classification of items into anxiety and calmness categories. An IAT effect indicating implicit anxiety is then computed as the difference between self + anxiety and self + calmness. Thus, because it measures the relative ease of categorising self items with anxiety items as compared with self items with calmness items, the IAT–Anxiety effect is an indicator of the implicit self-concept of anxiety. The IAT–Anxiety comprises a sequence of five blocks. Participants were instructed that they would be making a series of category judgments. On each trial, a stimulus word was presented in the center of a computer screen, and participants pressed a left or right key to categorize the stimulus as quickly and correctly as possible into one of the categories. Stimuli from the self (e.g., *me, my*) and other (e.g., *they, your*) categories were presented, as well as stimuli from the anxiety (e.g., *nervous, afraid*) and calmness (e.g., *relaxed, balanced*) categories (see the Appendix for the complete stimulus set, which consisted of five items per category). The IAT procedure comprises five blocks.

Participants practised the discrimination of self and other items (target discrimination) in the first block, which comprised 20 trials (each item was presented twice). They did the same for the attribute discrimination by sorting items into anxiety and calmness categories in Block 2 and by practising the switched key assignment in Block 4 (20 items each). The critical Blocks 3 and 5 consisted of 20 practice trials and 60 critical trials (see table 1). In these trials, participants categorised items into two combined categories, each including the attribute and the target concept that were assigned to the same key. Participants were told they would be making a series of category judgements.

On each trial, a stimulus word was displayed in the centre of a computer screen. Category labels were displayed on the left and right sides of the screen. Participants used the letter *Q* on the left side of the keyboard and the letter *P* on the right side of the keyboard for their responses. They were told, “Please try to be as accurate as possible, while also going as

quickly as possible. If your selection is incorrect, the word WRONG will be shown on the screen. To continue to the next judgement, you must make the correct selection.”

Participants were told to keep their index fingers on the *Q* and *P* keys throughout the experiment to facilitate fast responding. An intertrial interval of 150 ms was used. The computer recorded elapsed time between the start of each stimulus presentation and the correct response. The IAT effect for anxiety was computed by subtracting the mean latency in the critical trials of Block 3 (self _ anxiety) from the critical trials of Block 5 (self _ calmness).

Table 1

Task sequence of the IAT-anxiety

Block	No. of trials	Task	Category label	
			Left key	Right key
1	20	Target discrimination	Me	Others
2	20	Attribute discrimination	Anxiety	Calmness
3	20 + 60	Initial combined task	Me, anxiety	Others, calmness
4	20	Reversed attribute discrimination	Calmness	Anxiety
5	20 + 60	Reversed combined task	Me, calmness	Others, anxiety

Affective self-reports. The third task consisted of several questionnaires. To control for an effect of the darkness manipulation on affect, all participants completed the Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988), on which they reported on 20 items how they felt at the moment. The PANAS consists of two 10-item subsets (Watson et al., 1988), one measuring positive affect (PA) and one measuring negative affect (NA).

State anxiety was measured by the Dutch state version of the STAI (Van der Ploeg, 2000). On 20 items, participants had to rate how anxious they felt at the moment on a 7-point scale ranging from 1 (not at all) to 7 (very much).

Emotional uncertainty was measured by the Dutch version of the emotional uncertainty factor of the Uncertainty Response Scale (URS; Greco, & Roger, 2001). Participants rated how they felt at the moment on a 7-point scale ranging from 1 (totally not) to 7 (totally yes) on 15 items.

The Belief in a Just World Scale (Lipkus, 1991) consists of 16 items measuring the extent to which respondents believe that individuals deserve their fates (i.e., that the world is just). The scale consists of two sub scales, with eight items measuring personal BJW and eight items measuring BJW other. The items were rated on a 7-point scale ranging from 1 (completely disagree) to 7 (completely agree).

Justice Scenario. In the fourth task participants read and responded to stimulus information by means of a scenario. The scenario consisted of an unfair procedure manipulation, by telling participants that they were not allowed to voice their opinion (Van den Bos, Wilke, & Lind, 1998). Participants' outcome and procedural satisfaction and fairness judgments were the dependent variables.

Participants were asked to imagine the following situation:

You would like to spend 6 months in California to conduct research for your Master's thesis. The university you would like to attend is highly recommended. You will work together with highly esteemed professors. All of this offers you good career opportunities. Furthermore, California has some other advantages as well: for example, sun, sea, beach, and studying under palm trees. To pay for your stay and research in California, you apply for a grant at "Students Around the World" (SAW). To decide

whether they will award you the grant, you will have to appear before the grant committee of SAW.

This was followed by the manipulation of procedure. Participants read the following sentences (manipulated information in italics):

You appear before the committee. The committee gives you *no voice*: The committee *does not ask you* to voice your opinion about the amount of money you think you need for your stay and research in California.

Then, all participants read the following:

A week after this you are informed about the amount of money you are allowed: You will receive € 3000,-.

After participants read the scenario, they were asked questions pertaining to the dependent variables. All ratings were made on 7-point scales. Outcome satisfaction was assessed by asking participants how satisfied they were with the € 3000,- that they received (1 = *very dissatisfied*, 7 = *very satisfied*). Outcome fairness judgments were solicited by asking participants how fair they considered the € 3000,- that they received (1 = *very unfair*, 7 = *very fair*). Procedural satisfaction was assessed by asking participants how satisfied they were with the procedure used to decide about the € 3000,- that they received (1 = *very dissatisfied*, 7 = *very satisfied*). Procedural fairness judgments were measured by asking participants how fair they considered the procedure used to decide about the € 3000,- that they received (1 = *very unfair*, 7 = *very fair*).

Trust Game. The last task was a trust game (Berg, Dickhaut, & McCabe, 1995). In this study participants decided how much of the €2 of their show-up fee they would send to an anonymous counterpart who is endowed with €0. Participants were informed that when they send €2 to the other, the experimenter would four double it so the other receives €8.

Participants were told that after their decision the other decides how much of the €8 they

return. When the participant does not give the other their money, he/she keeps €2 and the other does not get anything. Participants were asked how many cents they would give the other and if they would give their whole €2 to the other. After making a decision, participants were told we were only interested in how much money they would give to another person but that there was not really an other person and they would keep their €2.

After the five tasks participants had to answer several questions about the experiment. First they answered to open ended questions: “What do you think about the lab in which you just performed the studies?” and “What do you think was the purpose of one or more of the experiments you just performed?”. Then they rated on a 7-point scale (1 = *not at all*, 7 = *very much*) to what extent performing the study differed from their expectations, how unpleasant it was to perform the study with the current lightning (Grillon et al., 1997), how fearful of the dark they were 1) when they were a child and 2) at the present time (Grillon et al., 1997), how sleepy they felt at the moment (Åkerstedt, & Gillberg, 1990), and how anonymous they felt at the moment (Zhong et al., in press). When the participants had answered these questions, they were thoroughly debriefed and paid for their participation.

Results

Gender differences. Although there were no significant differences between conditions indicating how afraid of the dark they were at the present time ($M = 2.18$, $SD = 1.22$ vs. $M = 2.09$, $SD = 1.53$), $F(1, 65) < 1$, $p = .84$, there was a significant sex effect with women indicating more fearfulness than men ($M = 2.74$, $SD = 1.56$ vs. $M = 1.47$, $SD = 0.67$), $F(1, 65) = 17.67$, $p < .0001$. This effect disappeared when participants were asked how fearful at the dark they were when they were children ($M = 3.19$, $SD = 1.71$ vs. $M = 3.51$, $SD = 1.79$), $F(1, 65) < 1$, $p = .46$.

Emotional Stroop Task. Colour-naming errors were eliminated from the data set. Individual reaction times of less than 400 and more than 2000 ms. were also excluded from

further analysis. Reaction times to colour-name each word were analysed using a repeated-measure analysis of variance to detect any effects due to group, valence (threat vs non-threat) and word type (physical vs social). Mean reaction times for social threat, physical threat, and neutral words, respectively, are displayed in Table 1. No significant main or interaction effects were found. The total mean reaction time was not significantly longer in the dark condition ($M = 706.33$, $SD = 170.22$) than in the light condition ($M = 654.57$, $SD = 113.53$), $t(65) < 1$, $p = .15$. There was no main effect for word type ($F(1, 65) = 1.39$, $p = .24$), neither for valence ($F(1, 65) < 1$, $p = .51$).

IAT Anxiety. IAT data were treated in accordance with the procedure outlined by Greenwald, McGhee, and Schwartz (1998): (a) The first two trials of each block of critical trials were dropped, (b) trials with latencies less than 300 ms or greater than 3,000 ms were recoded to 300 ms or 3,000 ms, respectively, and (c) the resulting values were log transformed before they were averaged. For presentation purposes, average IAT effects were reported in milliseconds. There were no participants with error rates that exceeded 20% or with mean latencies above 2,000 ms (participants with these values are usually dropped from analyses).

The IAT effect for anxiety was computed by subtracting the mean latency in the critical trials of Block 3 (self + anxiety; other + calmness) from the critical trials of Block 5 (self + calmness; other + anxiety). This procedure resulted in an IAT-anxiety difference score of 184 ms ($SD = 175$) for the total sample. This means the average association between self + calmness is higher than the average association between self + anxiety for all participants. As indicated by a t test, there were no significant differences between the two lightning conditions ($M = 208$, $SD = 183$ vs. $M = 160$, $SD = 166$), $t(65) = 1.13$, $p = 0.26$.

PANAS. An independent-Samples t test revealed that there were no significant differences in positive affect between the two conditions ($M = 4.42$, $SD = 0.99$ vs. $M = 4.55$,

$SD = 0.79$), $t(65) < 1$, $p = .57$. Neither there were significant differences in negative affect between the two conditions ($M = 2.22$, $SD = 0.98$ vs. $M = 1.95$, $SD = 0.14$), $t(65) = 1.26$, $p = .21$.

Emotional uncertainty. Self-reported uncertainty was not different between participants in different lightning conditions ($M = 3.36$, $SD = 0.94$ vs. $M = 3.37$, $SD = 0.91$), $t(65) < 1$, $p = .95$.

State anxiety. No significant differences on self-reported anxiety were found between participants in the light ($M = 2.87$, $SD = 0.93$) and the dark condition ($M = 2.64$, $SD = 0.87$). $t(65) = 1.04$, $p = .30$.

Belief in a just world. An independent-Samples t test revealed that there were no significant differences in thinking that the world is a just place between the two conditions ($M = 4.01$, $SD = 0.83$ vs. $M = 4.11$, $SD = 0.75$), $t(65) < 1$, $p = .60$.

Justice Scenario. The procedure and outcome of the scenario were not differently judged by participants in the light and dark environment. A t test revealed no significant differences ($M = 3.99$, $SD = 0.77$ vs. $M = 3.87$, $SD = 1.04$), $t(65) < 1$, $p = .58$.

Trust Game. In the trust game participants were asked how many cents they would give to the other. A t -test revealed that there were no significant differences between participants in the light ($M = 151.53$, $SD = 66.70$) and in the dark condition ($M = 136.61$, $SD = 81.82$), $t(65) < 1$, $p = .42$. However, there was a significant main effect for sex; women gave less money than men ($M = 126.00$, $SD = 82.13$ vs. $M = 164.06$, $SD = 59.89$), $F(1, 66) = 4.58$, $p < .05$. A chi-square test revealed that there was no significant difference in giving the 2 euro to the other between participants in the light and dark condition. $\chi^2(1) = 0.875$, $p = .35$.

Discussion

The results of the first experiment did not provide support for the predicted influence of darkness on affective self-reports and task performance. Room dimness was not enough to

influence people's feelings and beliefs. Therefore, for the second experiment, we used a different approach. Using a writing instruction, people were reminded about darkness to examine if this has more influence on people.

Experiment 2

Method

Participants and design. 42 students (26 men and 16 women) at Eindhoven University of Technology participated in the experiment and were paid for their participation.

Participants were randomly assigned to one of the two conditions (darkness salience: salient vs. control). The study lasted approximately five minutes. The mean age of the participants was 21.07, $SD = 3.61$.

Procedure. Darkness salience was manipulated by means of a writing instruction derived from Galinsky, Gruenfeld, and Magee (2003). Participants assigned to the darkness salient condition were instructed as follows: Please recall the last time you were walking down the street by yourself at night when it was dark. Try to relive the situation and describe, as specifically as you can, what happened, how you felt, what you thought, etc. Participants assigned to the control condition were instructed as follows: Please recall the last time you were walking down the street during daytime. Try to relive the situation and describe, as specifically as you can, what happened, how you felt, what you thought, etc. After the manipulation participants had to complete the Belief in a Just World Scale (Lipkus, 1991). Then they completed the 10 negative affect (NA) items of the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988).

Justice Scenario. In the next part participants read and responded to stimulus information by means of a scenario. The scenario consisted of an inaccurate procedure manipulation, by making a decision based on not so accurate information (Van den Bos & Miedema, 2000). Participants were asked to imagine the following situation:

You are someone who wants a job. You have applied for a vacant position in an organization, MicroMac inc., and you want this position very much. MicroMac informs you that they are interested in you and they invite you to participate in the selection process that as a standard procedure, all screened applicants at MicroMac have to complete. The selection process consists of nine parts: an intelligence test, a personality test, a test assessing mathematics skills, a test assessing understanding of technical matters, a test assessing calculation skills, a test assessing language skills, a questionnaire assessing demographic data, a test assessing achievement motivation, and an interview with a personnel officer at MicroMac. You go to MicroMac and participate in the selection process.

This was followed by the manipulation of procedure. Participants read the sentence:

A week after you participated in the selection process you are informed that 1 of the 9 parts of the selection process was graded.

After this, the dependent variables were solicited. Main dependent variables were participants' negative-affect reactions toward treatment, by asking participants to rate on a 7-point scale (1 = not at all, 7 = very much) how angry, hostile, furious, and infuriated they felt about the way they were treated. To further validate the manipulation of procedure, procedural justice judgments were solicited by asking participants how fair (1 = very unfair, 7 = very fair) and justified (1 = very unjustified, 7 = very justified) they considered the way in which they had been treated.

In the last part of the experiment participants completed the short version of the STAI (Marteau & Bekker, 1992). The six-item short form included the following items: calm, tense, upset, relaxed, content and worried. On these items, participants had to rate how anxious they felt at the moment on a 7-point scale ranging from 1 (not at all) to 7 (very much).

After the experiment, participants had to rate on a 7-point scale (1 = *never*, 7 = *very often*) if they had ever experienced something unpleasant in the dark, and on a 7-point scale (1 = *not at all*, 7 = *very much*) how fearful of the dark they were 1) when they were a child and 2) at the present time (Grillon et al., 1997). After the participants had answered these questions, they were thoroughly debriefed and paid for their participation.

Results

Data reduction. Two participants were removed from the dataset because they did not follow the writing instructions properly.

Gender differences. As in the first experiment, women indicated to be more fearful of the dark than men at the moment ($M = 2.73$, $SD = 1.53$ vs. $M = 1.68$, $SD = 0.69$), $F(1, 38) = 8.97$, $p < .01$, but not when they were children ($M = 3.93$, $SD = 1.83$ vs. $M = 3.16$, $SD = 1.75$), $F(1, 38) = 1.58$, $p = .22$.

Negative Affect. An independent-Samples t test revealed that there were no significant differences in negative affect between the two conditions ($M = 1.84$, $SD = 0.76$ vs. $M = 1.96$, $SD = 0.85$), $t(38) = < 1$, $p = .66$.

Inaccurate procedure. The procedure and outcome of the scenario were not differently judged by participants in the light and dark environment. A t test revealed no significant differences ($M = 2.70$, $SD = 1.09$ vs. $M = 2.33$, $SD = 0.80$), $t(38) < 1$, $p = .22$.

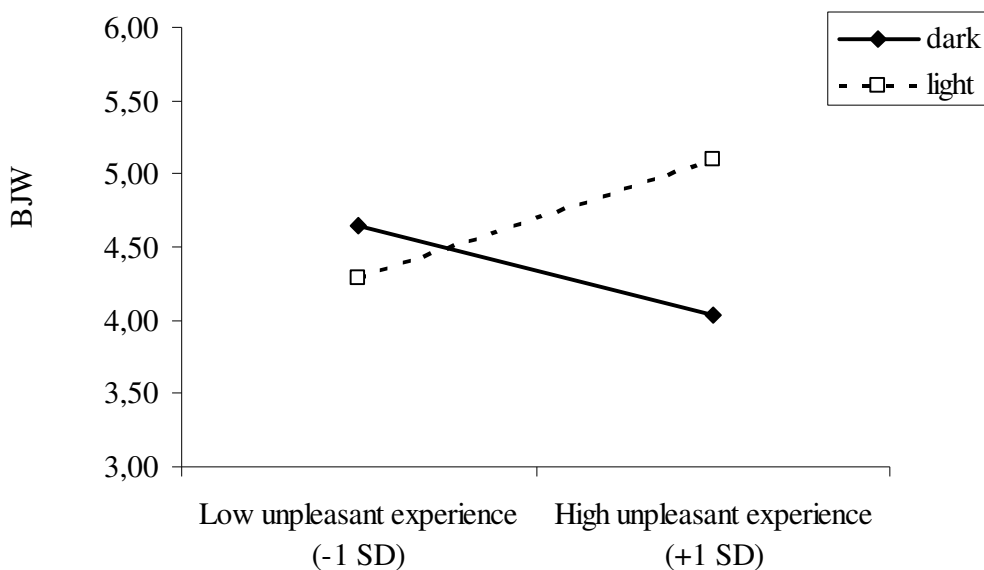
Short state anxiety. No significant differences on self-reported anxiety were found between participants in the light ($M = 2.52$, $SD = 1.00$) and the dark condition ($M = 3.04$, $SD = 1.21$), $t(38) = 1.48$, $p = .15$.

Belief in a just world. Additional analysis were performed to investigate the influence of individual differences on the darkness manipulation. Belief in a just world was entered in a regression analysis with lighting (light/dark dummy coded with dark as the reference group) and negative experiences as predictors. Negative experience did not predict belief in a just

world ($\beta = -.01, p = .94$), neither did condition ($\beta = .19, p = .26$). However, there was a significant interaction between lighting and negative experience ($\beta = .61, p < .01$, see fig. 1).

When people did not have had many negative experiences, people in the light and dark condition did not differ on their BJW. However, thinking about light or dark did have an influence on people when they have had more negative experiences. People who had more negative experiences and who were thinking about walking in the dark at night had a lower BJW, while people with more negative experiences who thought about walking on the street during daytime had a higher BJW.

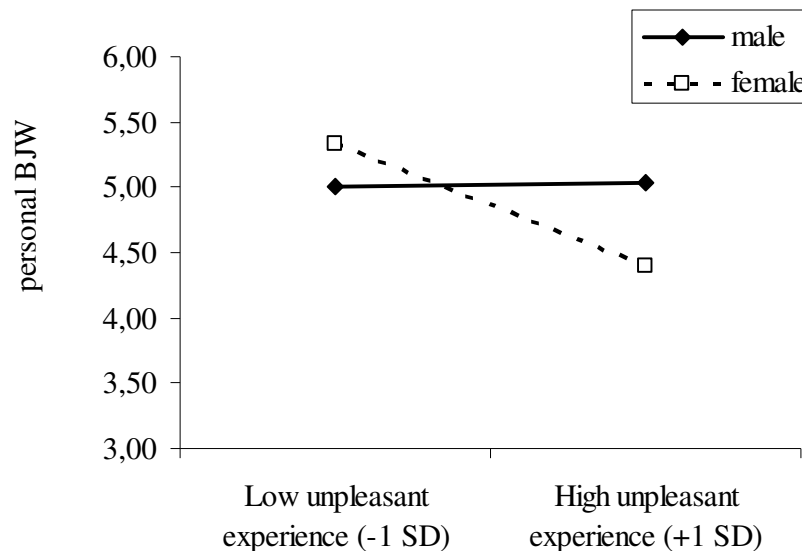
Figure 1



The belief in a just world scale consists of two subscales. One about self and the other one about other people. There is a marginal significant difference between women and men on BJW other, with men having a higher BJW other in general ($M = 4.11, SD = .82$) than women ($M = 3.50, SD = 1.34$), $F(1, 38) = 3.19, p < .10$.

Personal BJW was entered in a regressions analysis with gender (dummy coded with male as the reference group) and negative experiences as predictors. Negative experience did not predict personal BJW ($\beta = -.19, p = .24$), neither did gender ($\beta = -.07, p = .66$). However, there was a marginal significant interaction between gender and negative experience ($\beta = -.37, p < .10$, see fig. 2). For men, the personal BJW score did not change whether they had many unpleasant experiences in the dark or not. For women, however, their score on personal BJW was higher when they did not have many negative experiences in the dark and lower when they had more negative experiences.

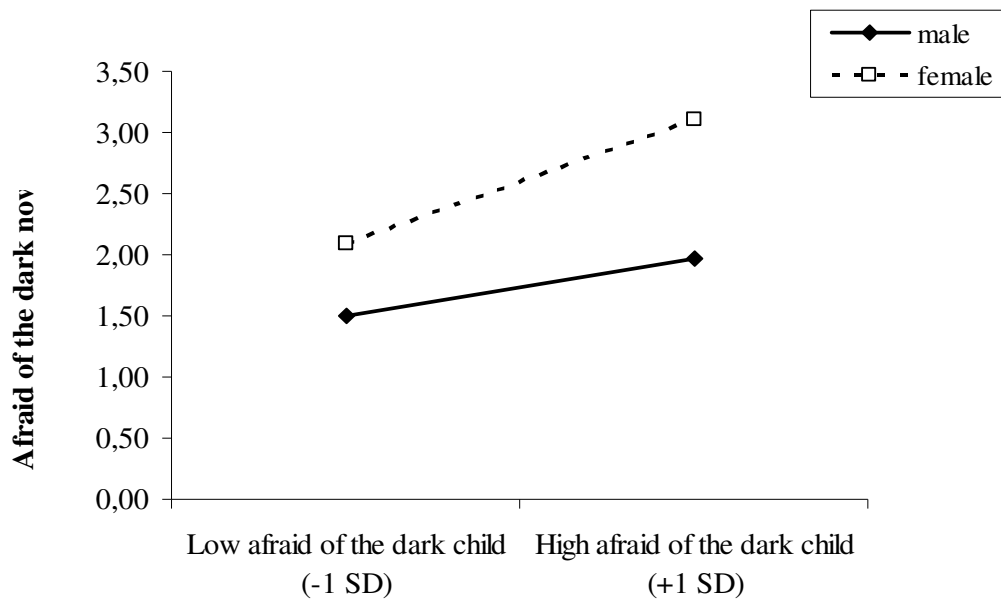
Figure 2



Afraid of the dark. How afraid of the dark people were at the moment they participated in the experiment was entered in a regressions analysis with gender (dummy coded with male as the reference group) and how fearful of the dark people were as a child as predictors. As expected, how afraid of the dark people are now was predicted both by how afraid of the dark they were as children as by gender. People who were more fearful of the dark as children are

more fearful of the dark at the moment ($\beta = .42, p < .05$). Second, as mentioned before, women indicated to be more afraid of the dark than men ($\beta = .36, p < .05$). The interaction between being afraid of the dark as a child and gender did not reach significance ($p > .30$), indicating that the relation between being afraid of the dark as a child and being afraid of the dark now did not differ based on gender (see figure 3).

Figure 3



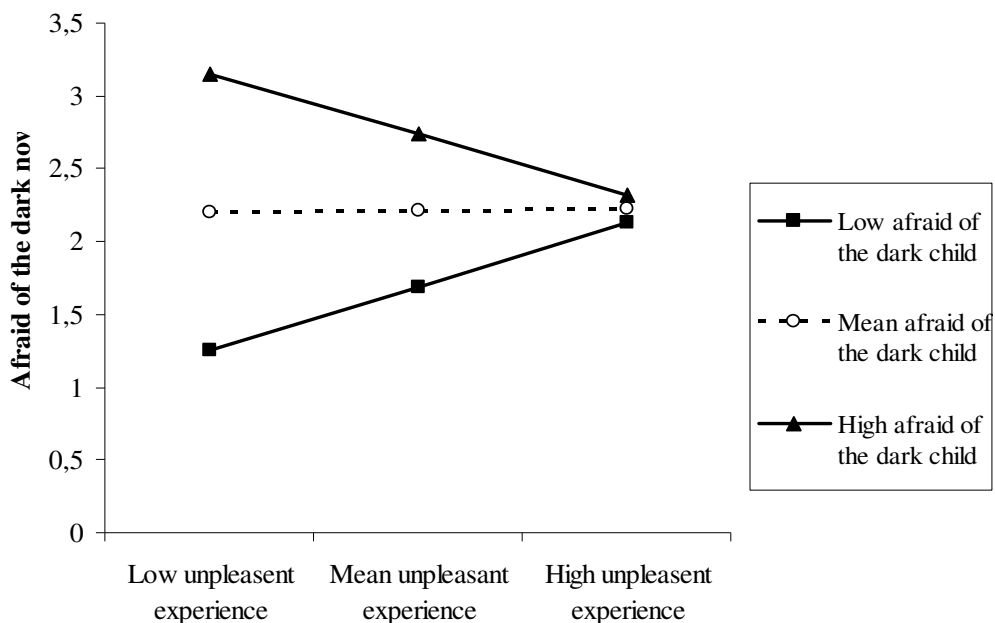
How fearful of the dark people were as a child was entered in a regressions analysis with gender (dummy coded with male as the reference group) and negative experiences in the dark as predictors. How afraid of the dark people were as a child was predicted by negative experiences. People who had more negative experiences in the dark were more fearful of the dark when they were a child ($\beta = .30, p < .1$). Gender did not have an influence ($\beta = .23, p = .14$).

Remarkable is that how afraid of the dark people are as adults was predicted by the opposite. When current fear of the dark was entered in a regression analyses only gender

proved to be a significant predictor ($\beta = .44, p < .01$). Negative experiences in the dark did not have an influence ($\beta = .08, p = .61$).

Negative experiences did have an influence in another way on being afraid of the dark. How fearful of the dark people were as adults was entered in a regressions analysis with unpleasant experiences and how fearful of the dark people were as a child as predictors. As mentioned before, only how fearful of the dark people were as children had a direct influence on their current fear of the dark. However, there was a significant interaction between being afraid of the dark as a child and negative experiences in the dark. ($\beta = -.36, p < .05$, see fig. 4). When people did not have many negative experiences in the dark, how afraid of the dark they were as a child seems to determine how afraid of the dark they are currently. However, the more people had negative experiences in the dark, the less influence has being afraid of the dark as a child.

Figure 4



Discussion

The results of the second experiment did not provide support for the predicted psychological influence of thinking about darkness. However, we found some interesting interaction effects. When people thought about darkness, their BJW was lower when they had more negative experiences in the dark. Negative experiences in the dark also had an effect of being afraid of the dark. When people had many of these experiences, this had more influence than being afraid of the dark as a child.

General Discussion

We investigated whether darkness would have a psychological influence on people's feelings and beliefs. In the first experiment, in which we placed participants in a dark room, affective self-reports and task performance did not differ between the light and dark condition. It seems that just placing people in a dark cubicle is not enough to make them afraid. A possible reason that darkness did not evoke anxiety is that participants who had to perform the experiment in the dark were told that the lights were off and that they should have no problem performing the task. We did this because participants could otherwise question why the lights were off and might turn on the lights themselves. But telling this might have had an unintended reassuring effect.

In the second experiment, darkness was made salient in another way. People were asked to describe what they feel when they are walking down the street in the dark or in the light, depending on condition. Again, there were no direct effects of thinking about darkness or light. For some aspects, people have an evolutionary fear, like the fear of snakes. For darkness, this evolutionary fear does not seem to be so important that being in the dark automatically elicits anxiety. Other aspects of darkness presumably have an influence. It

seems that we overlooked the (negative) experiences people had in the dark and emotions that arise when people are in the dark. Additional analyses did reveal some interesting effects.

Afraid of the dark. The extent to which participants reported to be afraid in the dark was influenced by different factors. First, women were more afraid of the dark than men. Second, the more people were afraid of the dark as a child, the more afraid of the dark they are now. Third, negative experiences in the dark have an influence on being afraid of the dark. When people have experienced many unpleasant things in the dark, this influence becomes more important than the influence of being afraid of the dark as a child.

There is a difference between men and women in self-report on being afraid of the dark. Men indicated to be less afraid of the dark than women. The question is if men are really less afraid of the dark, or more likely to give a socially desirable answer. When the same question is asked about being afraid of the dark but as a child, men indicated to be as afraid of the dark as women. Logically, gender roles are more important as people get older. Being afraid of the dark is not really manly, so in that way, it is socially desirable for a man to say not to be scared of the dark. There is also the possibility that men are really not that scared of the dark compared to women when they get older. As children, a lot of people are afraid of monsters and other strange creatures that emerge in the dark. There is no clear difference in the things boys and girls are scared of. However, as grown ups, for women it is more likely to be bothered on the street at night by a stranger. For men, it is more likely to be involved in a fight. Because on average men are stronger than women, they are probably less scared of being alone in the dark. More research is necessary to draw reliable conclusions.

Negative experiences in the dark do have an impact on being scared of the dark. In the experiments we have done people were just put in a dark or light cubicle or wrote about walking down the street at night or during daytime. Nothing happened when they sat in the dark or when they wrote about the dark. Grillon et al. (1997) also put people in a light or a

dark environment to measure the startle reflex, but at the same time they presented participants with an acoustic startle probe consisting of white noise. This white noise was a negative stimulus, and it could be that experiencing this unpleasant noise in the dark had a different effect than experiencing this unpleasant noise in the light. Probably the noise causes different emotions in the dark than in the light. In our experiments people did not experience strongly emotional situations. When they would have been presented with emotional situations, we might have found more influence of our darkness manipulation. Emotions are possibly felt or experienced differently in the dark and in the light. Future research could investigate this possibility.

Furthermore, the startle reflex is a biological response. The biological response to be afraid of the dark could be different than an explicit or implicit effect that was measured in our experiments. The effect found on ethnic stereotyping (Schaller et al., 2003) could also have been caused by something else than just being in the dark. Photos of black men were shown either in the dark or in the light. These could have made people remember encountering a black man. Thinking about this encounter in the dark could have another effect than thinking about this in the light. Possibly, being in the dark made people scared and being scared made them remember negative, scary things they experienced with black men. In the future, it is important to take into account former experiences people had in the dark.

Belief in a just world. The results of the experiment suggest that the belief in a just world is actually not that stable. It depends on the amount of negative experiences people had in the dark. When reminded about darkness, the more people have had unpleasant experiences in the dark, the less they believed the world is a just place where people get what they deserve. It seems that the interaction between environment and experience is important here. The reduction in the belief that the world is a just place arose only because people were instructed to think about the dark. It could be that thinking about darkness reminded people about the

negative experiences they had in the dark, and that this made them think about the world as not such a just place. Thinking about light probably did not make people think about the negative experiences they had in the dark. So although they did have many unpleasant experiences in the dark, maybe they were not reminded about it and even saw the world as a fairer place than people with less unpleasant experiences in the dark.

There is a gender difference for the personal BJW. Belief in a just world is said to serve important adaptive functions, for example victims of an unjust fate are motivated to defend this belief (Dalbert, 1999). According to just world theory, unfair outcomes threaten the BJW by providing evidence to the contrary. This threat leads to discomfort, that the individual is motivated to reduce. Given that there is a basic need to maintain the belief in a just world, individuals may be more likely to reduce the discomfort by altering the situation so it becomes "fair," rather than by changing their belief in the fairness of the world (Hafer & Correy, 1999). This is probably what happened for men. When they had more negative experiences in the dark, their personal belief that the world is a just place did not change, indicating they changed the situation to reduce discomfort. It could also be that men just did not see their negative experiences in the dark as unfair. For women, something else happened. When they had more negative experiences in the dark, their personal BJW was lower. Possibly, women could not alter the situation, so they reduced their discomfort by changing their personal belief in a just world. It could be that for women, the negative experiences in the dark were so unfair, that they were not able to change their view on the situation. More research is necessary to provide more conclusive evidence about experiences that can alter the belief in a just world.

Conclusion

It seems that having experienced something scary in the dark is more important than an evolutionary fear of the dark. The more people experience unpleasant things in the dark,

the more they learn to be afraid of the dark. Just being in the dark or thinking about darkness does not have such a strong influence on being scared. Also, the belief in a just world is not always stable but can depend on previous events. For future research, it is important to take into account the experiences people had.

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