The image of eyes: psychological mechanisms and effects on littering in a real-world setting

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Abstract

Different studies, both inside and outside the lab, demonstrated positive effects of eye images on behavior. We conducted two studies to better understand this effect on human behavior in a real-world context, and examined whether the perception of the role of the watching eyes is of importance too. A 3 (eyes) x 2 (markings) design, comparing wide open eyes, neutral eyes and a control condition with flowers, combined with a suggestion of authority (manipulated by police markings or neutral control markings) was used in both studies. First, we tried to get more insight in the psychological mechanisms behind the eye effect, by administering a questionnaire (study 1). Second, we examined whether littering behavior on a university campus would reduce in the presence of an image of eyes (study 2). Our results suggest that images of eyes can reduce littering behavior. However, attention should be paid to the characteristics of the eyes, as its behavioral effects can turn out very differently. Gender of the subject may be of importance too, especially when adding a suggestion of authority to the eyes. Reputational concerns and fear of punishment might not be the underlying psychological mechanisms behind the eye-effect, or the results are at least hard to interpret. These findings have positive implication for the application of eye images in reducing littering behavior, but further research is needed.

Introduction

One out of five Dutch residents mentions littering on the streets a frequent problem (Centraal Bureau voor de Statistiek (CBS), 2011). One reason for this is that plastics, polystyrene, paper, glass and other materials accumulate in the environment and may cause safety and health issues; people may trip or cut themselves, smouldering cigarette butts may cause fire, bacteria may be spread, or rats may be attracted to litter (Schultz, Bator, Large, Bruni & Tabanico, 2011). In addition, litter is unsightly (Pandey, 1990) and expensive to clean and process (Deloitte, 2010). Finally, and in line with the Broken Windows Theory (Wilson & Kelling, 1982), litter may spread to other, more severe forms of undesirable behavior, such as increased theft rates (Keizer, Lindenberg & Steg, 2008). As littering is usually considered a substantial societal problem, local governments are looking for measures to reduce littering.

Numerous anti-littering interventions have been proposed, ranging from more salient receptacles to the threat of sanctions (Schultz, Large, Tabanico, Bruni & Bator, 2009). Recently, research has begun to explore the possible impact of more subtle measures, such as the mere presence of a pair of eyes (see e.g. Nettle, Nott & Bateson, 2012). The use of eye images for the purpose of behavioral change is supported by Emery (2000), who states that a gaze is an important component of social interaction. The eyes represent different levels of signal value depending on the status, disposition and emotional state of the sender and receiver. Different eye images consequently can elicit different behavior. In the present research we will examine to what extent images of eyes may reduce littering in a public environment; particularly we will focus on the underlying psychological mechanisms driving this effect and on whether the effects vary depending on the specific features of the eyes.

In the following paragraphs, we will discuss a brief overview of relevant research, in which we refer to different studies measuring the efficacy of eye images on behaviors. These behaviors range from the donation of money, to bicycle theft. This discussion will lead us to the details of the current study and corresponding hypotheses, in which we focus on littering behavior.

Existing research on the eye-effect

Controlled lab studies, examining the efficacy of images of eyes, quite consistently demonstrate positive effects of eyes on desired behavior. Particularly, research shows that stylized eye-like shapes on a desktop background increase the donation of money (Haley & Fessler, 2005). Keller & Pfattheicher (2011) showed that in the presence of a subtle cue (a drawing of eyes), individuals donate more money to a charity organization than in the absence of this cue. In a study of Rigdon, Ishii, Watabe and Kitayama (2009) even an extreme weak social cue (three dots in a watching-eyes configuration) resulted in an increase of the donation of money. However, these studies have been questioned because they all took place in highly controlled environments. The question is whether the same effects would be demonstrated in a real world setting, in which people would be less focused on the images of eyes, and behavior takes place in a more natural setting. Additional studies in a real world setting were conducted to further examine this. Bateson, Nettle and Roberts (2006) demonstrated that the image of a pair of eyes is enough to increase desired behavior (contributions to an honesty box). Powell, Roberts and Nettle (2012) showed that displaying cartoon eyes increased donations by 48%. Nettle et al. (2012) even demonstrated a reduction in bicycle thefts when showing an image of a pair of real eyes (accompanied by a text and a police sign). Ernest-Jones, Nettle and Bateson (2011) found a significant effect of eye images (photographs) on the self-clearing of litter in a cafeteria. Costumers left less litter in the presence of posters

featuring eyes. In conclusion, images of eyes may result in an increase of different desired behaviors in a real world setting too.

Although the eye-effect has been demonstrated in a number of studies, both inside and outside the lab, the specific psychological mechanisms that may explain the effects are much less examined. Two suggestions have been made as to why images of eyes are effective in increasing desired behavior (see e.g. Ernest-Jones et al., 2011; Oda, Niwa, Honma & Hiraishi, 2011), of which both are focusing on the consequences of being watched by eyes. The first explanation is that images of eyes cause reputational concerns; decision making is based on a representation of one's own reputation in the eyes of others (i.e. what other people think of me). Individuals who see themselves as the subjects of others' appraisal, are in a state of public self-awareness. This may lead to more desired behavior, in order to meet the perceived expectations of others (Govern & Marsch, 2001). The second explanation is fear of punishment; decision making is based on the threat of punishment. Although no actual observation (and reputational consequences or threat of punishment) in the case of eye images takes place, it still can make us react to it as if they are real eyes that are watching us; Latané (1981) found that people do not make a difference in whether the presence of others is real, simulated or imagined. The general idea is that humans have fast, automatic psychological mechanisms, which may respond to all eye-like stimuli (Izuma, 2012).

A recent study by Carbon and Hesslinger (2011) may shed some first light on the validity of these two explanations; thirteen participants were asked to rate the original pictures from Bateson et al.'s (2006) study in terms of 'observing' and 'frightening'. The 'observing' variable arguably matches the idea of reputational concerns (assuming that observation likely leads to reputational concerns), while 'frightening' is more likely to be related to fear of punishment. It turned out that both variables were closely (and to a similar extent) related to the amount of money placed into the honesty box (donated in the main study of Bateson et al.

(2006)). Although this is a first indication that reputational concerns and fear of punishment both may explain the behavioral effects of eye images in a natural setting, we cannot conclude this with certainty on the basis of just this study. Remarkably, no other studies have examined the psychological mechanisms which may be activated by eye images. One of the goals of this study is to examine this further.

Concerns of punishment become even more interesting in light of the previously discussed study of Nettle et al. (2012); in this study, a police sign has been used additional to a cue of being watched. It was not clear whether the eye image and police sign in combination, or one of them alone did cause the effects found (reduction of bicycle theft). According to the Social Control Theory (Hirschi, 1969), social control through the presence of authority figures who may induce punishment might increase desired behavior. The perception of (the role of) the person who is watching, therefore might be an important factor to consider too. The eye effect in the Nettle et al. (2012) study, might have been particularly strong because it was accompanied by the police sign. People probably associate the eyes (combined with the police sign) with a policeman, which is an authority figure. This association possibly caused increased concerns of punishment, which led to increased desired behavior (reduction of bicycle theft).

The second goal of this study is to examine the effectiveness of different types of eye images in increasing desired behavior. It might make a difference whether the images are photographs, drawings, or stylized eyes. Also different angles of the images (sideway of frontal), or gender can make a difference. For example, in the study of Bateson et al. (2006), which used five different pictures of eyes, some images seemed to be more effective than others. Specifically, the results indicate that wide open eyes with a frontal view are the most effective. However, this was not further explored nor tested. Ernest-Jones et al. (2011), which used eight different photographs in their study, did not examine or mention differences in

efficacy at all. Further examination is therefore needed. As a first step, we will examine whether a picture of frontal wide open eyes is more effective in changing behavior to more desired, than frontal neutral eyes, as we would expect from the Bateson et al. (2006) study. These eyes will be combined with a suggestion of authority (in the form of police striping), to examine whether the role of the person who is watching also affects behavior.

Study design and overview of hypotheses

An experimental approach (consisting of two sub-studies) is used to better understand the effects of two types of eyes (wide open eyes, neutral eyes, and flowers as control), combined with the suggestion of authority (police markings, and neutral control markings). First, a pilot study in the form of a questionnaire will be conducted, to examine the psychological mechanisms that may explain the eye-effects. In particularly, reputational concerns and concerns of punishment will be examined. In addition, some other feelings, and experiences are explored to get more insight in the underlying psychological mechanisms activated by images of eyes. In study 2, a field experiment will be conducted to examine the effect of the eye images and suggestion of authority on littering behavior. We will test the following hypotheses:

Hypothesis 1: A main effect of eyes on reputational concerns is expected. Participants are more concerned about their reputation in the presence of a poster with eye images, in comparison with flowers (with a larger effect of wide open eyes).

Hypothesis 2: An interaction effect of eyes and police markings is expected on concerns of punishment. Participants are more concerned of punishment in the presence of a poster with eye images (compared to flowers), particularly when they are combined with police markings (compared to the combination with neutral markings).

Assuming that reputational and punishment concerns are the underlying psychological mechanisms driving the behavioral effects in previous eye-image studies, littering behavior in study 2 should decrease in accordance with the above-mentioned hypotheses.

Study 1: Questionnaire

Method

Procedure and participants. At the railway station in Hengelo and in the intercity train between Hengelo and Deventer, Dutch-speaking (young) adults were asked by one of two researchers to volunteer for an anonymous questionnaire regarding the influence of the environment on people's mood. It would only take five to ten minutes. If the answer was yes, they received a clipboard with the questionnaire to fill in.

A total of 147 Dutch-speaking persons participated in the questionnaire. Data of 26 participants were excluded because they often filled in the same answers, which may indicate that they have not looked very seriously at the questions. In this way 121 participants (43.0% male, 55.4% female, 1.6% unknown) were included in the final dataset, ranging in age from 16 to 71 years (M = 28.0, SD = 14.2). Of this group, 52.1% is recruited at the train and 47.9% at the railway station.

Design and setup. On the clipboard, and next to the questionnaire a colour printed image (26.8 by 19.6 cm) was positioned as social cue manipulation. This image looked like a movie poster on which a non existing date for a screen test was reflected. In this poster one of six conditions (3 x 2 between subjects design) was incorporated (see figure 1). The first variable was 'eyes'. It consisted of two images of human eyes (wide open, and neutral) and a control image (flowers). The second variable was 'markings', which consisted of a police marking (recognizable as Dutch police markings on cars) and a neutral control marking (horizontal stripes). The two pictures of eyes that have been used were chosen so that they resembled the images that seemed to be the most effective as social cue based on the study of Bateson et al.

(2006). The eyes in the different eye images belonged to the same person, were looking directly at the observer and almost all colours had been removed. The control condition with flowers did have the same colouration as the eyes, so no effects could be caused by colour differences. Both marking conditions also consisted of the same colours (except a little white), so they differed only in configuration. Participants were assigned to only one of the six conditions. The configuration of the overall image was the same for all six.

Figure 1. The six conditions that have been used during pilot and field study. From left to right: Wide open eyes, neutral eyes, and control (flowers). Upper row: Police markings. Lower row: Control (neutral markings)

Because of the number of clipboards, only six participants at a time could participate, and they all received the same condition. The conditions were randomly assigned to every round. After ten minutes, the researcher collected the finished questionnaires as agreed and

thanked the participant. No time-limit was attached, so more time could be taken if needed. After collecting all questionnaires, a new round started.

The questionnaire was presented on two sheets of white A4 paper. These sheets were one behind the other clipped on the right side of a black double sided folding clipboard (measures 22.5cm x 33.5cm). See figure 2 for the clipboard with social cue and questionnaire. The social cue poster was always in view of the participant while filling in the questionnaire. On the first paper of the questionnaire, no explicit references were made to the social cue. The second page was only present in the four conditions with eyes and the questions explicitly referred to the experience of the social cue.

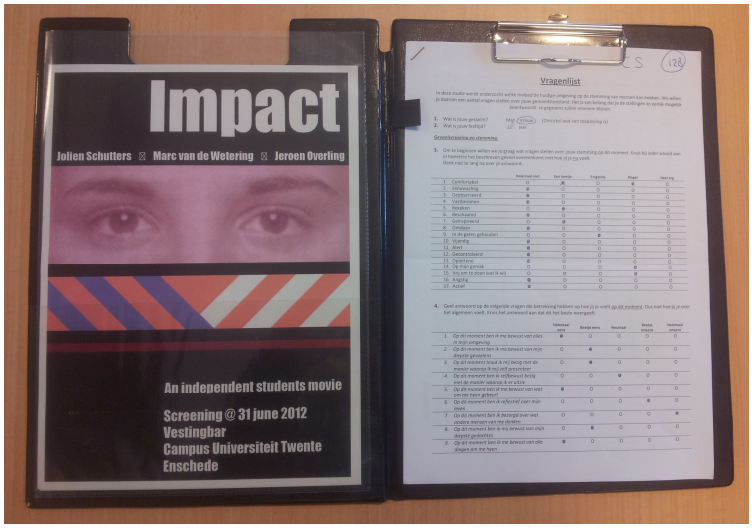

Figure 2. An example of the clipboard with social cue manipulation and questionnaire which is used in the pilot study.

Measurements.

Reputational concerns. Reputational concerns were examined by measuring '*public self-awareness*'. This is part of the Situational Self-Awareness Scale (SSAS) of Govern and Marsch (2001). Participants were asked how they felt at that moment. The answers ranged from 1 (strongly agree) to 5 (strongly disagree), and consisted of the following 3 items: 'right now, I am concerned about the way I present myself', 'right now, I am self-conscious about

the way I look' and 'right now, I am concerned about what other people think of me'. Cronbach's alpha was .62.

Fear of punishment. By measuring '*Negative Affect*' (NA) and '*experience of deterrence*', we examined fear of punishment. The NA scale we used, is part of the short-form of the Positive and Negative Affect Scale developed by Thompson (2007). Participants were asked how they felt at that moment. The NA scale consisted of the following 5 items: 'afraid', 'upset', 'hostile', 'nervous', and 'ashamed'. The answers ranged from 1 (not at all) to 5 (very much). Cronbach's alpha was .66.

We constructed a deterrence scale with 4 self made items. These items inquired about the participants impression of the person on the image in terms of 'intimidating', 'authoritarian', 'aggressive', and 'scary'. The possible answers ranged from 1 (strongly disagree) to 7 (strongly agree). As the items explicitly referred to the person on the image, it was not present in the flower conditions. Cronbach's alpha was .83.

Feelings of observation. Additionally, to examine whether the eye images evoked a general feeling of being observed, we included a '*feelings of being watched'* scale, which indicated to what degree participants felt they were being observed. This was measured by 3 self made items. Participants were asked how they felt at that moment. The possible answers ranged from 1 (not at all) to 5 (very much), and consisted of the following items: 'monitored', 'looked at' and 'observed'. Cronbach's alpha was .70.

We also constructed an '*experience of supervision'* scale, which consisted of 3 self made items. It inquired about the participants impression of the person on the image in terms of 'controls', 'judges', and 'looks at', and also may be an indicator for feelings of observation. The following sentence had to be completed: 'I feel that the person in the picture … me'. The possible answers ranged from 1 (strongly disagree) to 7 (strongly agree). As the items

explicitly referred to the person on the image, it was not present in the flower conditions. Cronbach's alpha was .66.

Profession with respect. As the perception of the role of the person who is watching might be an important factor to consider, we measured whether participants think the person on the image is practising a profession with respect. This could be an indication of the extent to which the participants linked the police markings to the person on the image. A scale was developed in which the following sentence had to be completed: 'The person in the picture is probably a…'. The possible answers ranged from 1 (strongly disagree) to 7 (strongly agree) and consisted of the following 4 items: 'civil servant', 'policeman', 'guard', and 'director'. The items explicitly referred to the person on the image, so it was not present in the flower conditions. Cronbach's alpha was .71.

Results

Factor analysis. We conducted an exploratory factor analysis with the principal component method on the items of the newly formed constructs 'experience of deterrence', 'feelings of being watched', and 'experience of supervision'. As the items of the deterrence and supervision scale were not present in the flower conditions (in contrast to the being watched scale), this conditions were not included in the analysis. The analysis resulted in three factors with an eigenvalue above one. However, one item ('I feel controlled') which was supposed to load on 'feelings of being watched' loaded .38 on this factor. We deleted this item (which was not mentioned in the preceding method section), and did the analysis again. This again resulted in three factors, which explained 65.1% of the variance (see table 1 for the results of the factor analysis). These results suggest that it is suitable to compute mean scores for these three scales.

Table 1. *Results of the factor analysis of the 10 items used to examine the underlying psychological mechanisms of the eye-effect.*

Items	Factor 1: Experience of Deterrence	Factor 2: Feelings of Being Watched	Factor 3: Experience of Supervision
I think the image is *intimidating*	.88		
I think the image is *authoritarian*	.82		
I think the image is *aggressive*	.75		
I think the image is *scary*	.73		
I feel *looked at*		.84	
I feel *observed*		.78	
I feel *monitored*		.78	
I have the feeling that the person on the image *looks at* me			.77
I have the feeling that the person on the image *controls* me			.76
I have the feeling that the person on the image *judges* me			.74
% explained variance	29.8	19.9	15.4

Note: Factor loadings < .40 are omitted.

Analyses of Variance (ANOVAs). To analyse the effects of the two factors on the dependent variables, Analyses of Variance (ANOVAs) were used. Mean scores were computed for the scales that were formed. The independent variables were eyes (wide open eyes, neutral eyes, and flowers as control), and markings (police marking, and neutral marking as control). The variables 'public self-awareness', 'negative affect' and 'experience of deterrence' were analysed, to test the two hypothesis of this study. The remaining variables were analysed to gain more insight in other effects of the social cue conditions. Notice that the flower conditions were not present in some of the measurements, because they explicitly referred to the person on the picture. Table 2 shows the number of participants per condition.

Table 2. *Number and percentage of participants per condition in pilot study*

	Eyes			
Markings	Wide open	Neutral	Control: Flower	Total
Police	22 (18.2%)	16 (13.2%)	23 (19.0%)	61 (50.4%)
Control: Neutral	19 (15.7%)	19 (15.7%)	22 (18.2%)	60 (49.6%)
Total	41 (33.9%)	35 (28.9%)	45 (37.2%)	121 (100%)

Reputational concerns. The results of this ANOVA revealed no significant main or interaction effects for either of the two independent variables on public self-awareness. That is, neither eyes ($F(2,115) = 1.544$, $p = .218$), nor markings ($F(1,115) = .614$, $p = .435$), nor the interactions among them ($F(2,115) = 1.960$, $p = .146$) influenced public self-awareness. On the basis of these results, we may conclude that reputational concerns might not explain the effects of eye images (which rejects hypothesis 1) on desired behavior. Reputational concerns are also not affected by the markings in this study, or the interaction between the two manipulated variables.

Fear of punishment. Hypothesis 2 states that participants are more concerned of punishment in the presence of a poster with eye images (compared to flowers), particularly when they are combined with police markings. We tested this hypothesis on the basis of negative affect (NA) and experience of deterrence.

An ANOVA did not show a main effect of eyes ($F(2,114) = .002$, $p = .998$), or markings ($F(1,114) = .135$, $p = .714$) on negative affect. A significant interaction (figure 3) was found between eyes and markings, on negative affect ($F(2,114) = 3.127$, $p = .048$). In the case of neutral markings, both eye images cause more negative affect than flowers. However, in the case of police markings, flowers cause more negative affect than both eye images.

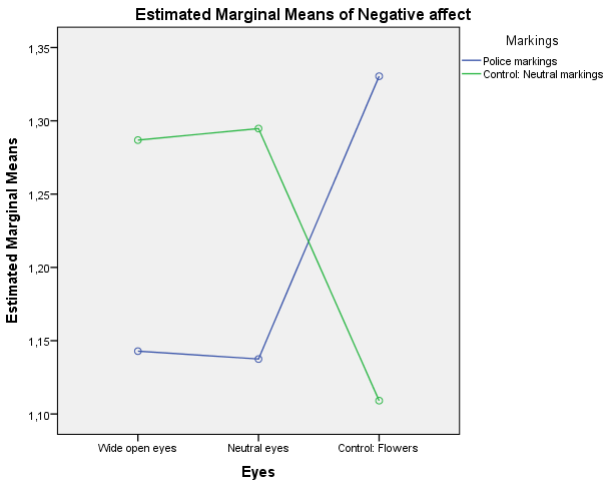

Figure 3. The interaction between eyes and markings on negative affect.

The results of an ANOVA revealed no significant main or interaction effects for either of the two independent variables (eyes and markings) on the experience of deterrence. That is, neither eyes ($F(1,69) = .334$, $p = .565$), or markings ($F(1,69) = .170$, $p = .681$), nor the interaction among them ($F(1,69) = .615$, $p = .436$) influenced experience of deterrence.

In conclusion, hypothesis 2 is partially confirmed; participants are more concerned of punishment (measured by negative affect) in the presence of a poster with eye images (compared to flowers), when they are combined with neutral markings. When combined with police markings, however, the presence of a poster with flowers is causing the most concerns of punishment. When explicitly referring to the person on the image (flower conditions where not present), no effects were found of eyes or (the combination with) markings on experience of deterrence.

Feelings of observation. An ANOVA revealed a significant main effect of eyes on feelings of being watched ($F(2,114) = 3.705$, $p = .028$). Bonferroni post hoc tests showed that participants feel less being watched in the presence of a poster with wide open eyes ($M = 1.43$, $SD = .65$), than in the presence of flowers ($M = 1.86$, $SD = .85$). Wide open eyes and neutral eyes ($M = 1.61$, $SD = .60$) did not differ significantly, just like neutral eyes and

flowers. No main effect of markings ($F(1,114) = .000$, $p = .984$), or an interaction between eyes and markings ($F(2,114) = 1.127$, $p = .327$) for feelings of being watched was found.

No main effects of eyes ($F(1,68) = 1.872$, $p = .176$) or markings ($F(1,68) = 1.157$, $p = .286$) were found on experience of supervision. Also no interaction effect between the two independent variables was found on experience of supervision ($F(1,68) = .563$, $p = .456$). Remarkably, the separate item 'looks at' of this construct reveals a main effect of eyes ($F(1,68) = 10.002$, $p = .002$). This item is very neutral (without value judgment) compared to the other construct items 'control' and 'judges'. Participants' ratings of the 'looks at' item are higher in the case of wide open eyes ($M = 5.05$, $SD = 1.131$), than in the case of neutral eyes (M = 3.97, $SD = 1.787$). As these items explicitly referred to the person on the image, the eye conditions cannot be compared with the flower condition. No main effect of markings ($F(1,68) = .812$, $p = .371$), or an interaction effect ($F(1,68) = ,000$ $p = .995$) between eyes and markings on 'looks at' was found.

In conclusion, the additional analysis to examine whether the images may have evoked feelings of observation, did only show a main effect of eyes for 'feelings of being watched'; participants feel the most watched in the presence of flowers, and the least in the presence of wide open eyes. When explicitly referring to the person on the images (flower conditions where not present), no effects were found of eyes or (the combination with) markings on experience of supervision. Nevertheless, the analysis of the separate item 'looks at' did reveal a main effect of eyes; participants' ratings of this item are higher in the case of wide open eyes, than in the case of neutral eyes. This is inconsistent with the main effect of eyes for 'feelings of being watched'.

Profession with respect. The results of the ANOVA did not reveal significant main or interaction effects for the two independent variables on 'profession with respect'. Eyes ($F(1,68) = 1.081$, $p = .302$), markings ($F(1,68) = .800$, $p = .374$), and the interaction ($F(1,68)$

= .020, p = .889), did not influence ‘profession with respect’. This suggests that the impression of the person on the image in terms of authority does not differ between the conditions.

However, actual feelings and experience of the person on the image might be different from the behavioral effects caused by the image. Therefore, the behavioral effects of the six different images on littering behavior will be tested in a real world setting.

Study 2: Field Experiment

Method

Procedure and participants. The field-experiment took place on the campus of the University of Twente in an (outdoor) bicycle shed, which was close to an university building. People who where present on the campus became subject to the study as they walked into the bicycle shed (the experimental area) to take their bicycle. While they took their bicycle (on which a flyer was attached) out of a rack, their littering behavior with regard to this flyer was observed.

A total of 948 persons participated in the field experiment, which could be students, employees, or even visitors to the campus. Data of 4 participants were excluded, as their littering behavior could not be properly observed because of a large distance. In this way 944 participants (59.9% male, 40.1% female) were included in the final dataset. The researchers estimated 21 (2.2%) subjects above the age of 40, and 923 (97.8%) under the age of 40. Since people in the Netherlands normally go to university at the age of 18 or above, everybody was most likely adult.

Design and setup. The field experiment followed the same 3 (wide open eyes, neutral eyes, and flowers as control) x 2 (Police markings, and neutral control markings) between subjects design as the questionnaire described in study 1. The social cue manipulations were

now positioned on flyers and posters. Flyers (A6 format: 14.8 by 10.5 cm) were stapled on one handle of all the bicycles in the shed (see figure 4). The flyers served, besides to serving as a social cue manipulation, as a means to measure littering behavior. At five locations around the bicycle shed, two posters (A1 format: 84.1 by 59.4 cm) on hardboard were placed at a metal standard with the back to each other (see figure 5). This was a supplementary social cue, to be sure the manipulation worked.

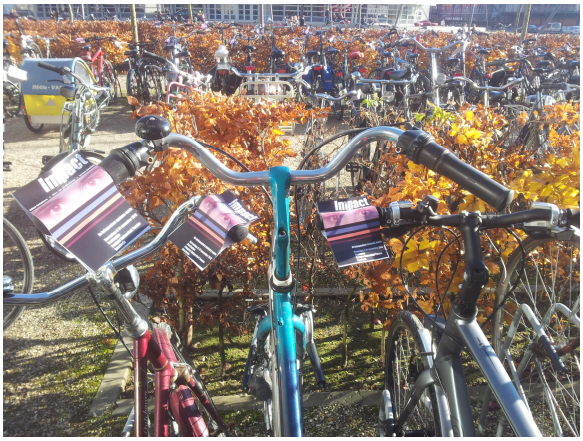

Figure 4. Stapled flyer on bicycle

Figure 5. Poster at experimental area

The experiment took place by daylight at a bicycle shed, at twelve weekdays in October and November. The location was the campus of University of Twente, where flyers are distributed on bicycles regularly. Trash cans were not available in the immediate environment. Adjacent to the bicycle shed, there was a four storey university building (see appendix A for an overview of the experimental environment). Only one condition a day was tested and was randomly assigned. A condition was never assigned twice to the same day of the week, to prevent for day effects. The weather forecast was always consulted before starting the experiment, to be sure it was going to be a dry day.

Before starting the observation, a flyer was attached to every bicycle within the experimental area, by means of two staples. Other (old) flyers were removed first. The handle was chosen as location because it catches the eye easily, and people had to notice it without a

doubt when grabbing their bicycle. To make it impossible to slide it to the middle of the handlebar without removing, the flyer was attached to the side of the bell or handbrake (if possible). As the flyer was attached not to tight and not to loose, participants could easily remove the flyer, but it did not blow away by a gust of wind. After attaching the flyers, posters were placed at such a way that participants did have to notice them, independent from which direction they came. The image on the poster was the same as the image on the flyer. At last, all litter in the experimental environment was removed. Thereafter, approximately ten flyers were littered within the experimental area, because a clean environment generates little littering (e.g. Cialdini, Reno & Kallgren, 1990). These flyers matched the experimental condition of that day.

After the preparations, the field experiment started. Two observers were positioned at the fourth floor in a nearby building and every participant was observed by one of them. A trial has shown that interrater reliability was good. Observation took 3 to 4 hours per day and did not start before 11:00 in the morning. People who approached the racks to take their bicycle, participated without knowing. By mutual agreement the observers decided which individual to observe. Observation stopped after the participant dropped or tucked away the flyer, or when he got out of sight. After approximately two hours, the environment was restored to its original state (like when the experiment started), and no observation took place. All new bicycles got a flyer. When the environment was very messy, some littered flyers were removed. After approximately 15 minutes the experiment continued. When it was getting dark outside, or when we did have enough participants for that day (N=75), the observation stopped. Remaining flyers on bicycles were removed, just like all the materials and litter.

Measurements. Two observers scored gender, age (below or above 40), and littering behavior, which is going to be described now.

Littering of flyer. This measurement scale consisted of 3 possible litter observations, sorted from 'taking along' to 'littering'. 'Taking along' (1) meant that a subject took along the flyer after removing it from the handlebar, or left it on the handlebar. When leaving the flyer on the handlebar, subjects consciously chose to take the annoying flyer with them. This justifies our choice to put this behavior under this category. 'Shifting responsibility' (2) was measured when the subject put the flyer on someone else's bike or property. 'Littering' (3) meant that a subject deliberately dropped the flyer on the ground within the experimental area. Dropping the flyer outside the experimental area was not included; it was hard to observe because of the distance.

Results

In table 2, we show the number and percentages of participants in each of the six conditions and in total.

Table 2. *Number and percentage of participants per condition in field experiment*

	Eyes			
Markings	Wide open	Neutral	Control: Flower	Total
Police	157 (16.6%)	156 (16.5%)	155 (16.4%)	468 (49.6%)
Control: Neutral	159 (16.8%)	158 (16.7%)	159 (16.8%)	476 (50.4%)
Total	316 (33.5%)	314 (33.3%)	314 (33.3%)	944 (100%)

Of the 944 participants, 467 (49.5%) littered the flyer, 182 (19.3%) shifted responsibility and 295 (31.3%) took along the flyer. In figure 6, the percentages of litter behavior in the combined experimental conditions can be found.

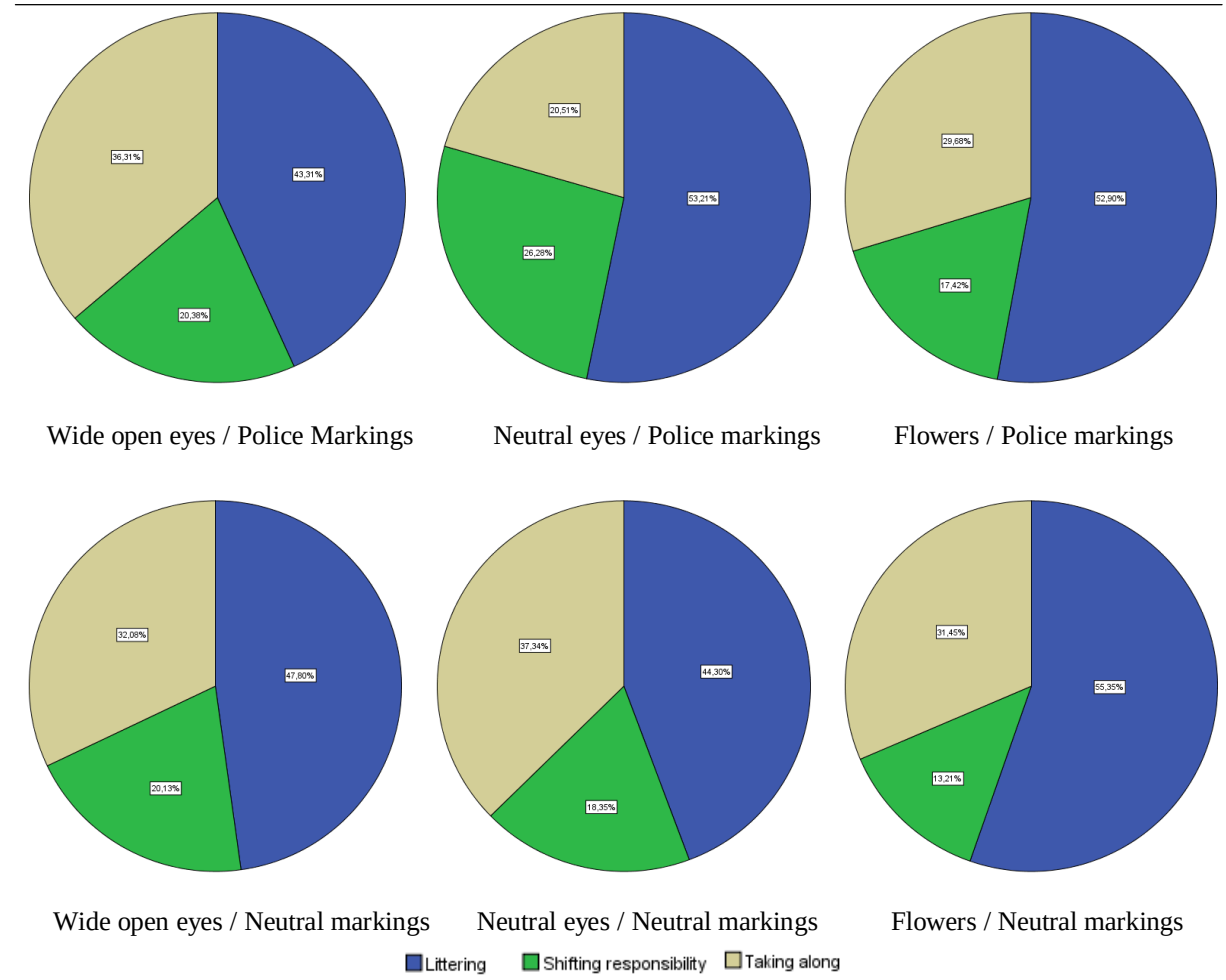

Figure 6. Percentages of litter behavior per condition.

Effects of eyes and markings on littering behavior. To analyse the effects of eyes and markings on littering behavior, a 3 (wide open eyes, neutral eyes, and flowers as control) x 2 (police markings, and neutral control markings) Analyses of Variance (ANOVA) is used.

An ANOVA did not show a main effect of eyes ($F(2,938) = 1.598$, $p = .203$), or markings ($F(1,938) = .909$, $p = .341$) on littering behavior. Hypothesis 1 states that a main effect of eyes is expected. The results do not confirm this. A significant interaction (figure 7) was found between eyes and markings on littering behavior ($F(2,938) = 3.316$, $p = .037$).

Both eye images (particularly neutral eyes) reduced littering behavior when combined with the neutral control markings (compared to flowers). When combined with police markings,

only wide open eyes reduced littering behavior. Neutral eyes combined with police markings, cause people to litter more than in the case of flowers. On the basis of hypothesis 2, we would expect that littering behavior would reduce in the presence of a poster with eye images (compared to flowers), particularly when they are combined with police markings. This is only partially confirmed, mainly because of the increase of littering behavior when neutral eyes are combined with police marking.

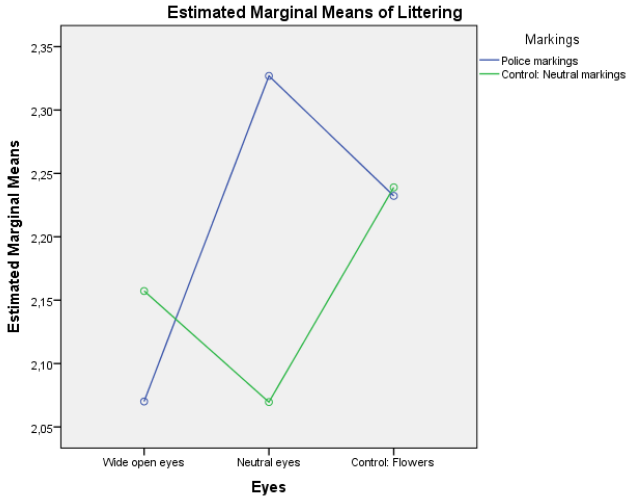

Figure 7. The interaction between eyes and markings on littering behavior

The interacting role of gender. Additionally, to analyse the effect of gender on littering behavior, we added this variables to the ANOVA as a third factor (beside eyes and markings), which resulted in two significant effects. A main effect of gender ($F(1,932) = 13.981$, $p = .000$) on littering behavior was found. Littering is higher for men ($M = 2.27$, $SD = .86$) than for women ($M = 2.06$, $SD = .90$). This main effect, however, must be interpreted by a significant interaction; a three-way interaction ($F(2,932) = 5.021$, $p = .007$) was found between eyes, markings and gender on littering behavior. To interpret this interaction, separate graphs were made for men and women (see figure 8). For men, wide open eyes and neutral eyes (combined with the neutral control markings), are both effective in reducing littering behavior, particularly the wide open eyes. When the eyes or flowers are combined

with a suggestion of authority (police markings), littering rates in all three (two type of eyes, and flowers) conditions increase, relative to when they are combined with the neutral markings. For wide open eyes, combined with the suggestion of authority, littering behavior is still lower than in the control condition (flowers combined with neutral markings). For men, this seems to confirm that eyes reduce littering behavior, particularly the wide open eyes. It is not confirmed that the addition of police markings further decreases littering. The interaction effect of eyes and markings (for men and women together) that was found previously, seems to be caused almost entirely by women; neutral eyes combined with neutral control markings appear to be the most effective combination in reducing littering behavior. When police markings are added to the neutral eyes, littering seems to increase (compared to the two control flower conditions). In the case of wide open eyes, the opposite seems to happen. The (second) best way to reduce littering in women, is the combination of wide open eyes with police markings. This time, the combination of wide open eyes with neutral markings seems to increase littering. Littering behavior in the flower condition does not seem to be dependent on the addition of police markings.

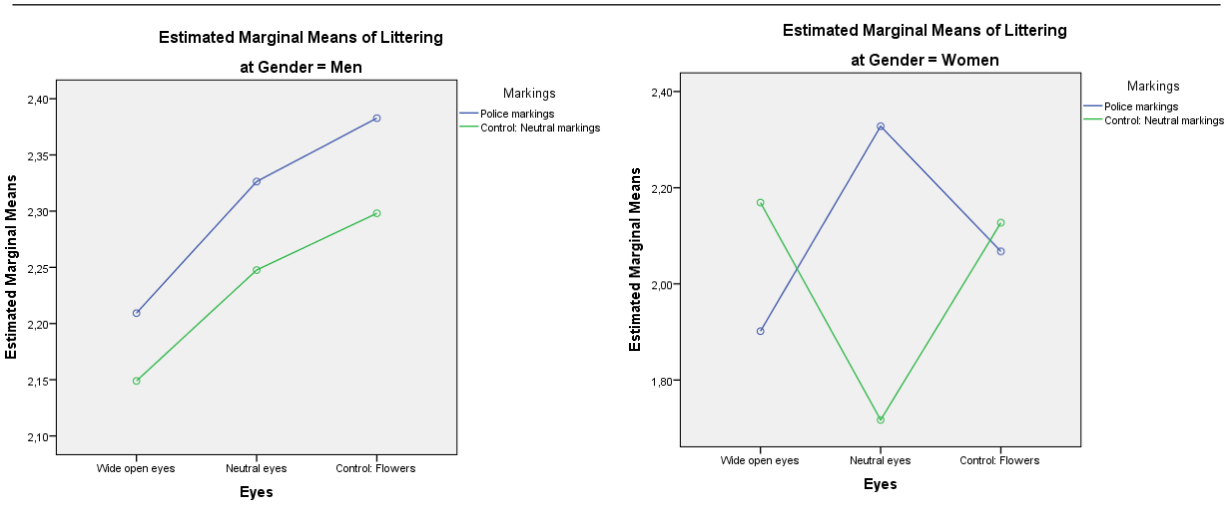

Figure 8. Two-way interactions between eyes and markings on littering behavior for men and women separately

In the light of these additional results, the expected main effect of eyes (hypothesis 1 and partially hypothesis 2) on littering behavior was probably not confirmed due to gender effects: these hypothesis seems to be correct for men but not for women. Support for the expected interaction of eyes and markings on littering behavior only seems to decrease further.

General discussion

The present research adopted an experimental approach to investigate the effects of two types of eyes (wide open eyes, neutral eyes, and flowers as control), combined with the suggestion of authority (police markings, and neutral control markings). In study 1, a questionnaire was used to examine the underlying psychological mechanisms that may be activated by (the combination of) eyes and markings. In study 2, a field experiment was conducted to examine the effects of the two variables on littering behavior in a real-world setting. Before moving on to study 1, the last study will be discussed first.

Effects of eyes and suggestion of authority on littering behavior

Our results suggest that images of eyes can reduce littering behavior. Both types of eyes (without a suggestion of authority) are effective in reducing littering behavior. These findings are consistent with the study of Ernest-Jones et al. (2011), in which costumers left less litter in the presence of posters featuring eyes. The neutral eyes are more effective than wide open eyes. In the study of Bateson et al. (2006) however, wide open eyes are more effective than neutral eyes in increasing desired behavior, but this could be due to their use of two different persons for the eye images. Adding a suggestion of authority (police markings) to the wide open eyes, makes them as effective as neutral eyes only, in reducing littering behavior. In an attempt to explain why subtle neutral eyes are as effective as the striking wide open eyes with police markings, we think the following; neutral eyes make individuals aware of all the watching people who are really present (which was the case sometimes), while the wide open

eyes with suggestion of authority on its own induce a feeling of being watched. However, adding a suggestion of authority to the neutral eyes, seems to provoke littering behavior. It may be that the neutral eyes in this study are radiating some kind of accusing or unknown emotion, where people are not immediately aware of because of its subtlety. Combining this eyes with police markings, probably let people think the watching eyes belong to a policeman, what may emphasize the accusing nature of the eyes. An accusing gaze of a policeman when you haven't committed any offence, may feel stigmatizing. Like a self-fulfilling prophecy, individuals do litter more. In the study of Nettle et al. (2012), it seems that the used eyes (which were accompanied by a police sign and text) in their manipulation are the most similar to our wide open eyes. That a reduction of bicycle theft was found, instead of an increase, thus corresponds to our findings. However, it is certainly of importance to be careful in combining eyes with a suggestion of authority.

Littering rates are higher for men than for women, but a more interesting interaction was found; the (combined) effect of eyes and markings on littering behavior was dependent on gender. In the case of men, the effect of eyes on littering behavior was relatively as expected; wide open eyes and neutral eyes (combined with the neutral control markings), are both effective in reducing littering behavior, particularly the wide open eyes. Adding a suggestion of authority, however, reduces this effect and is therefore probably not useful. The focus on the eyes may be reduced by the attention-grabbing police markings (reducing the eye-effect). In the light of these results, wide open eyes without the suggestion of authority (as manipulated in this study) therefore might be the best way to reduce littering behavior in men. For women, the results are more awkward; neutral eyes (without a suggestion of authority) are the most effective in reducing littering behavior, but however do increase littering rates when combined with the suggestion of authority (police markings). As mentioned before, an explanation may be that littering is provoked by an accusing gaze of a policeman. Finding this

effect only for women may be due to the fact that women are more accurate than men in recognizing subtle facial displays of emotion (see e.g. Hoffmann, Kessler, Eppel, Rukavina & Traue, 2010). On the basis of this study, that cannot be proven. In the case of wide open eyes (combined with the neutral markings) littering rates do slightly increase, but however slightly decrease when combined with the suggestion of authority (police markings). Perhaps women perceive a kind of helplessness or other unpleasant emotion when watching the wide open eyes, and they want to get rid of this feeling; the flyer is thrown to the ground. The effect of this penetrating eyes may weaken when the attention-grabbing police markings are added.

Concluding, our field study confirms the possible preventive effect of eyes and the suggestion of authority on littering behavior in a real world setting, but we must be careful with the interpretation of is. When we talk about men and women together, images of neutral eyes without suggestion of authority, or wide open eyes with suggestion of authority are the best ways to prevent littering behavior. For men alone, wide open eyes without suggestion of authority are the most effective. For women alone, neutral eyes without suggestion of authority seem to work best. This is interesting to know, since the male/female ratio is not the same in all situations, or sometimes it is only needed to increase desired behavior in one of the two sexes. It seems that more attention should be paid to the characteristics of the eyes, and differences in perception between men and women. This study was a first attempt to gain more insight in this characteristics and differences. If one really wants to use eye-images as a measure to reduce littering behavior, or other real-world behaviors, it is clear that more research should be conducted to find the most effective eyes for men and women.

The psychological mechanisms behind the eye-effect

To examine the effect of eye-images on reputational concerns, we measured public self-awareness. Our results show that eye-images do not cause reputational concerns, leading to the conclusion that reputational concerns may not be the underlying psychological mechanism

which makes people behave more desired. This is not in accordance with our expectations. It is also not consistent with the findings of Carbon and Hesslinger (2011), but this could be due to the fact that it is unclear whether their 'observed' item matches our construct of reputational concerns. Markings, or the interaction of eyes with marking also do not seem to cause differences in reputational concerns.

We examined fear of punishment by measuring negative affect (NA) and experience of deterrence. The results partially confirmed hypothesis 2; fear of punishment (measured by NA) increases in the presence of a poster with (both) eye-images, in the absence of the suggestion of authority. When adding the suggestion of authority (police markings), both type of eyes do not seem to affect fear of punishment, since the (control) combination of flowers and neutral markings is causing approximately the same level of fear of punishment. These findings may suggest that fear of punishment may be one of the underlying psychological mechanisms explaining the eye-effect, but only in the absence of the suggestion of authority. Remarkable is that flowers, combined with the suggestion of authority, are causing the same levels of fear of punishment as the eye images without the suggestion of authority. Although it seems like NA is a good indicator for fear, it does not indicate to what one is afraid of. The manipulations in this study might induce fear for something else than punishment, resulting in the somewhat strange results. The additional finding that experience of deterrence of the person on the eye image does not differ between the four (combined) conditions, however might be an indication that we need to be careful with the interpretation of the before mentioned interaction. This finding however may be due to intentional underestimating experiences of deterrence; people were explicit asked to rate the person on the image. It may perhaps be that people do not want to admit that a person on a picture is deterrent, resulting in these outcomes.

The two examined psychological mechanisms behind the eye-effect, are both focussing on the consequences of being observed by eyes. Unfortunately, the eyes in this study did not induce a general feeling of being watched. A picture of flowers induced even more feelings of being watched. It also appears that both eyes are experienced as equally supervising. Possibly, the lack of feeling observed by the eyes is one of the problems in finding the expected results in this study for reputational concerns and fear of punishment. However, this could be due to the environment in which the questionnaire was conducted; the presence of real observers in the train or on the railway station may have overruled our social cue, what causes the (partially) unexpected results.

In addition to the lack of feelings of being observed, the results indicate that the police markings might not be linked to the person on the image; the perception of the role (profession with respect) of the person on the image was equal in all conditions with eyes. Maybe our manipulation was too obvious and colorful. In future research a police cap and a neutral cap may be used to manipulate perception of the role of the person on the eye image, or a police sign which was used in the Nettle et al. (2012) study.

We are aware of the fact that study 1 and 2 are two separate studies with different subjects in different contexts, with a few possible limitations. It is therefore difficult and maybe wrong to relate the results of study 1 and 2 to each other. However, the effects of the eyes (combined with a suggestion of authority) on littering behavior in study 2, do not seem to be related to the effects found on the examined psychological mechanisms. It therefore is necessary to conduct further research. The possibility that another psychological mechanism may have caused the effects on littering behavior should not be forgotten.

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Appendix A: Overview of the experimental environment