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Review Article

Artificial surveillance cues do not increase generosity: two meta-analyses

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ABSTRACT

Many studies have seemingly demonstrated that anonymous individuals who are shown artificial cues of being watched behave as if they are being watched by real people. However, several studies have failed to replicate this surveillance cue effect. In light of these mixed results, we conducted two meta-analyses investigating the effect of artificial observation cues on generosity. Overall, our meta-analyses found no evidence to support the claim that artificial surveillance cues increase generosity, either by increasing how generous individuals are, or by increasing the probability that individuals will show any generosity at all. Therefore, surveillance cue effects should be interpreted cautiously.

1. Introduction

People who know or believe their actions are being observed by others behave differently (e.g., Aiello & Svec, 1993; Bond & Titus, 1983; Latané, 1981; Putz, 1975; Risko & Kingstone, 2011; Triplett, 1898; Zajonc, 1965). For example, they are more generous (Kurzban, 2001; Satow, 1975), more helpful (van Rompay, Vonk, & Fransen, 2009), and more likely to participate in moralistic punishment (Kurzban, DeScioli, & O'Brien, 2007; Piazza & Bering, 2008). It has been hypothesized that this tendency is so deeply ingrained that even artificial cues of being observed are sufficient to impact behavior. The last decade has witnessed the introduction and development of a literature which seemingly supports this idea: Anonymous individuals shown mere images of watching eyes (or similarly artificial surveillance cues) behave more prosocially, as if they are being watched by real people.

However, when considering the artificial surveillance cue literature as a whole, the results are inconsistent, often conditional on (or moderated by) certain variables, and occasionally contradictory. In the present paper, we review the artificial surveillance cue literature, paying special attention to generosity, the topic most frequently investigated. We then describe two meta-analyses we conducted investigating the effect of artificial observation cues on generosity.

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Papers reporting surveillance cue effects describe several desirable behaviors. The dependent variables that have been studied by surveillance cue researchers are listed in Table 1. They include a variety of prosocial outcomes, such as increased generosity (e.g., Pfattheicher, 2015), reduced littering (e.g., Bateson et al., 2015), and increased voter turnout to an election (e.g., Panagopoulos, 2015). Researchers have also investigated the impact of surveillance cues on hand washing, free-riding, reported moral judgment, dishonesty, disposal of recyclables, reported religiosity, socially desirable responding, ambiguity aversion, antisocial punishment, bicycle theft, conservation attitudes, food choices, self-reported likelihood of helping or desiring revenge, self-rated possession of positive traits, probability estimation, prosocial lying, reciprocal altruism, the spotlight effect, survey participation, and third-party punishment.

1.1. Generosity

Many claimed surveillance cue effects are related to generosity. Researchers interested in whether artificial cues of being watched increase generosity have utilized the social discounting task (Sparks, 2010), charity donation paradigms (Ekström, 2012; Fathi, Bateson, & Nettle, 2014; Keller & Pfattheicher, 2011; Pfattheicher, 2015; Pfattheicher & Keller, 2015), and economic games such as the public goods game (Burnham & Hare, 2007) and the dictator game (e.g., Haley & Fessler, 2005).

In a dictator game, one of two players, the dictator, receives money and decides how to allocate it among him/herself and the second player. The second player merely accepts what the dictator offers, if the dictator offers anything at all. The dictator game was utilized by one of the first, and possibly best known, artificial surveillance cue studies (Haley & Fessler, 2005). Half of the dictators were presented with a stylized image of eyes on their computer desktop; the other half were presented with a control desktop image. Dictators allocated more money, on average, in the eyes condition. Evidence for increased generosity due to images of watching eyes has been found in other dictator game studies as well (e.g., Baillon, Selim, & van Dolder, 2013; Oda, Niwa, Honma, & Hiraishi, 2011).

Some dictator game studies, however, did not reveal significantly increased generosity among dictators presented with images of eyes (e.g., Fujii, Takagishi, Koizumi, & Okada, 2015; Jolij & de Haan, 2014; Matsugasaki, Tsukamoto, & Ohtsubo, 2015; Sparks, 2010; Vogt, Efferson, Berger, & Fehr, 2015; White, 2015). One such experiment was conducted by Tane and Takezawa (2011). The authors suggested that their use of a dark, sound-proof room in which participants sat alone canceled out the watching eyes effects. This explanation is plausible; on the other hand, Tane and Takezawa's results are what one would expect them to be if observation cues have no effect on behavior.

1.2. Inconsistencies in the literature

When considering the artificial surveillance cue literature as a whole, many studies have obtained nonsignificant results (Bolton, Rivas, Prachar, & Jones, 2015; Cai, Huang, Wu, & Kou, 2015; Carbon & Hesslinger, 2011; Fehr & Schneider, 2010; Fujii et al., 2015; Jolij & de Haan, 2014; Kuliga, Tanja-Dijkstra, & Verhoeven, 2011; Matland & Murray, 2015; Matsugasaki et al., 2015; Northover, Pedersen, Andrews, & Cohen, 2016; Pedersen, 2016; Raihani & Bshary, 2012; Sparks, 2010; Sparks & Barclay, 2015; Tane & Takezawa, 2011; Vogt et al., 2015; White, 2015; and L. Tiokhin, personal communication, January 7, 2016) and significant results are often conditional. Significant results hinge on the methods of data analysis, participant or surveillance cue traits, or specific features of the environment. While conditional effects are often illuminating, we are concerned that the conditions on which surveillance cue effects seemingly depend differ from study to study.

For example, some studies have suggested that surveillance cue effects are augmented by, or dependent on, the number of people in the vicinity. Powell, Roberts, and Nettle (2012) investigated the effect of surveillance cues on generosity in a supermarket study. Buckets located at checkouts were used to collect donations to a charity. Half of the buckets displayed an image of eyes and the other half displayed an image of three stars. Donations were 48% higher to eyes than control buckets. Observation cues apparently affected donations more strongly when there were fewer customers present. During slow weeks, the eyes buckets received 59% more in donations per thousand customers; during busier weeks, the eyes buckets received only 28% more. In another field experiment, litter was left on fewer cafeteria tables when photographs of eyes were placed on the walls (Ernest-Jones, Nettle, & Bateson, 2011). This was especially true when the cafeteria contained relatively few people. Finally, Ekström (2012) placed images on recycling machines in Swedish supermarkets. Customers used the machines to recycle cans and bottles and were given a choice of whether to keep the money earned or donate it to a charity. An image of eyes was displayed for half the time and a control image of flowers was displayed the other half. When considering only the days on which few recycling customers visited the stores, there was a 30% increase in the amount of money donated in the surveillance cue condition, but overall, there was no difference in the amount donated by customers when the machines displayed eyes compared to flowers.

These three studies suggest that surveillance cues may be redundant in the presence of large numbers of people. This is theoretically sensible inasmuch as it seems likely that an individual in this situation is already receiving surveillance cues from the crowd of real people in the vicinity. The possibility that the noise of a large crowd distracts individuals and decreases the likelihood of the surveillance cue being noticed has not been ruled out, however (Ekström, 2012). Nonetheless, another field study of littering behavior found the opposite conditional effect: Bicyclists on a university campus who were exposed to images of watching eyes were less likely to litter than those who were not exposed to observation cues, but only when there was a greater number of people in the vicinity (Bateson, Callow, Holmes, Redmond Roche, & Nettle, 2013). Thus, the moderating effect of crowd density is unclear.

In some studies, the watching eyes effect was found when the data were analyzed in certain ways, but not in others. In a dictator game experiment conducted by Raihani and Bshary (2012), dictators shown surveillance cues were more likely to give something rather than nothing, but dictators shown surveillance cues did not give more money on average; in fact, they gave less compared to control groups. Nettle et al.

Table 1
Dependent variables of surveillance cue studies.

Dependent variable	Studies
Generosity	See Tables 2 and 4
Hand washing	Beyfus et al., 2016; Bolton et al., 2015; Carbon & Hesslinger, 2011; Kuliga et al., 2011, September
Voting participation	Matland & Murray, 2015; Panagopoulos, 2014a, 2014b, 2015
Free-riding	Bateson et al., 2006; Brudermann, Bartel, Fenzl, & Seebauer, 2015; Manesi, Van Lange, & Pollet, 2016
Littering	Bateson et al., 2013; Bateson et al., 2015; Ernest-Jones et al., 2011
Moral judgment	Bourrat, Baumard, & McKay, 2011; Northover et al., 2016; Sparks & Barclay, 2015
Dishonesty	Cai et al., 2015; Hoffman et al., 2015
Disposal of recyclables	Francey & Bergmüller, 2012; Franzen, Berner, Paulenz, & Steiner, 2015
Religiosity	Northover et al., 2016; Rutjens & van Elk, 2015
Socially desirable responding	Pfattheicher, 2015; White, 2015
Ambiguity aversion	Baillon et al., 2013
Antisocial punishment	Baillon et al., 2013
Bicycle theft	Nettle, Nott, & Bateson, 2012
Conservation attitudes	Manesi et al., 2015
Food choices	Bittner & Kulesz, 2015
Likelihood of desiring revenge	Carbon & Hesslinger, 2011
Likelihood of helping	Carbon & Hesslinger, 2011
Possession of positive traits	Northover et al., 2016
Probability estimation	Baillon et al., 2013
Prosocial lying	Oda, Kato, & Hiraishi, 2015
Prosocial punishment	Horita & Takezawa, 2014
Reciprocal altruism	Fehr & Schneider, 2010
Spotlight effect	Pfattheicher & Keller, 2015
Survey participation	Pedersen, 2016

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(2013) likewise found an increased percentage of dictators who gave something but no difference in mean donations between the eyes condition and the control condition.

Francey and Bergmüller (2012) found something different in their field experiment. The researchers placed trash on bus stop benches in Geneva. People spent a significantly greater amount of time disposing of garbage when images of eyes were displayed compared to when images of flowers were displayed, but the actual proportion of people who threw away trash did not differ significantly between groups.

Finally, Bateson, Nettle, and Roberts (2006) investigated the effect of watching eyes on payments to an honesty box. The honesty box, which was located in a university break room, was used to collect money for coffee and tea. Coffee drinkers made anonymous decisions about how much money to put in the box. When a photograph of eyes was displayed on a cupboard door, nearly three times as much money was contributed to the honesty box compared to when a photograph of flowers was displayed. According to Carbon and Hesslinger (2011), however, the statistical analysis reported in the paper was inappropriate due to violated assumptions. When Carbon and Hesslinger analyzed the data using four different statistical analyses they deemed appropriate, one test yielded a significant result whereas three did not.

In other studies, the results were conditional on participant traits. In a dictator game study conducted by Rigdon, Ishii, Watabe, and Kitayama (2009), men exposed to a surveillance cue were significantly more generous than men shown a control image, but this pattern was not seen among women. Keller and Pfattheicher (2011) conducted a charity donation lab study. Participants who were high in prevention-focused self-regulation (i.e., highly focused on preventing negative events in their lives) donated more money to charity in the eyes condition than they did in the no-eyes condition. Participants who were low in prevention-focused self-regulation showed the opposite pattern: They donated less money to charity in the eyes condition than they did in the no-eyes condition. The first finding was replicated in two samples by Pfattheicher (2015). The second finding was replicated in one sample, but not the other. In a study of third-party punishment conducted by Horita and Takezawa (2014), participants in the surveillance cue condition punished unfair players more than participants in the control condition, but only if they felt little anger toward unfair players; there was no main effect for surveillance cues. A charity donation study by Pfattheicher and Keller (2015) found that participants high in chronic public self-awareness donated more in the surveillance cue condition, but the surveillance cue seemingly had no effect on participants who were low in chronic public self-awareness.

Situational variables have been claimed to moderate artificial surveillance cue effects as well. In one study, dictators whose receivers were members of their minimal ingroup were apparently affected by observation cues, whereas dictators whose receivers were members of an outgroup were not (Mifune, Hashimoto, & Yamagishi, 2010). And in a dictator game study conducted by Sparks and Barclay (2013), dictators who were shown an image of eyes only briefly were more generous than dictators in a control condition, but dictators who were shown the image of eyes for a longer period of time were not. When the same authors investigated moral judgment, however, the duration of surveillance cue visibility made no difference; in fact, neither short- nor long-duration surveillance cues affected participant behavior (Sparks & Barclay, 2015).

In summary, the literature presents a mixed picture of artificial observation cues. Several studies, including our own (Northover et al., 2016), have failed to replicate surveillance cue effects, and many papers report mixed or qualified results. The conditional surveillance cue effects reported by papers have rarely been replicated. How robust and powerful is the watching eyes effect? Does it even exist? To more systematically investigate these questions, we conducted two meta-analyses.

As discussed previously, the surveillance cues literature describes the effect of surveillance cues on different kinds of behavior. A meta-analysis is only interpretable if the studies included examine the same phenomenon, however (Lipsey & Wilson, 2001). Therefore, rather than putting all studies into a single analysis, we chose one theme: generosity. We investigated generosity because it is arguably the most frequently studied category of behavior in the surveillance cues literature, excluding the broader and more subjective category of 'prosocial behavior' (see Table 1).

2. Method

2.1. Inclusion criteria

We analyzed studies that investigated the effect of visual, artificial, cues of being watched on generosity. The kind of observation cues we selected were those that resembled a watching face or eyes; they were generally photographs or stylized images of eyes. For this review, we were not interested in surveillance cues that might have led participants to believe a real human could see them, such as one-way mirrors or surveillance cameras. We operationalized generosity as giving material resources to others, for reasons other than direct reciprocity, without expecting anything from those others in return. 'Material resources' usually refers to money or objects that were exchanged for money, such as points or tokens. Two of the studies involved a social discounting task (Sparks, 2010) in which participants chose between a certain amount of money for themselves or a different (usually smaller) amount of money for both themselves and someone else. The rest of the studies involved economic games (usually the dictator game) or donations to charity. We included studies in which a surveillance cue condition was compared to a control condition that lacked both artificial and genuine visual cues of being watched.

The first meta-analysis included measures of the amount of resources given by participants. We call this the 'amount given' meta-analysis. The second meta-analysis included measures of the proportion of participants who gave something rather than nothing. We call this the 'proportion who gave' meta-analysis. A previous meta-analysis of seven dictator game studies (involving 887 total participants) conducted by Nettle et al. (2013) found that, although the mean amount of money donated by dictators was the same for surveillance cue and control conditions, the proportion of dictators who gave something was greater in the surveillance cue conditions.

2.1.1. Excluded data

Excluded data are listed in Table 2. We omitted studies in which the observation cues were potentially confounded with other variables. First, we excluded a study by Manesi, Van Lange, and Pollet (2015) in which participants were shown an image of a butterfly either with or without eyespots on its wings. Participants were asked if they would donate their participation payment to a conservation program targeting the butterfly they saw. Although the eyespots may have elicited in participants a feeling of being watched, the eyespots also potentially increased the beauty of the butterfly; participants rated the eye-spotted butterfly as significantly more beautiful than the spotless butterfly. The potential effect of a feeling of being watched on generosity was confounded with liking for the butterfly with eyespots on its wings. This seems important given that the dependent variable was related to conservation of the butterfly. Second, we excluded studies in which participants were shown images of their game partners or people who were purportedly their game partners (e.g., Burnham, 2003; Smith et al., 2009). Although these images may have served as good surveillance cues, they also introduced potential confounding variables by providing participants with information about their game partners that participants in control groups did not have. In a dictator game, for example, dictators provided with photos of their recipients might have cared more about their recipients than they would have if they had not seen the photos (the "identifiable victim effect": Burnham, 2003; Jenni & Loewenstein, 1997; Schelling, 1968). In studies like these, dictators in the surveillance cue conditions might give their recipients more money than dictators in the control conditions because they care more about their recipients than the control group dictators.

We excluded three additional studies for statistical reasons. We excluded a study conducted in a supermarket by Powell et al. (2012) because their dependent variable, British pounds donated to charity, was measured in aggregated form (i.e., per thousand customers), whereas the other studies in the meta-analyses measured individual decisions. Studies based on aggregated data produce larger effect sizes than studies based on individual measurements (S. West, personal communication, March 17, 2016). Another supermarket study (Ekström, 2012) included a mix of aggregated and individualized measures. Individualized data were available on the proportion of recycling customers who donated, so we included this study in the 'proportion who gave' meta-analysis, but because only aggregated data were available on the amount of money participants donated, we excluded this study from the 'amount given' meta-analysis. Finally, we excluded a study by Fujii et al. (2015) because it employed a within-subjects design, whereas the other studies in our meta-analyses utilized a between-subjects design. A single within-subjects effect size among an otherwise uniformly between-subjects set of effect sizes might have introduced heterogeneity into the meta-analyses; we could not statistically investigate whether effect sizes differ for between- and within-subject designs without a greater number of within-subject studies (M. Okun, personal communication, March 12, 2016).

Finally, we excluded a subset of data from two experiments conducted by Sparks (2010). Participants had the chance to be generous toward different beneficiaries. We included data on generosity toward charities and anonymous strangers but excluded data on generosity toward friends and family. This made the contrasts from this study comparable to the contrasts from the other studies in the generosity meta-analyses, all of which measured generosity toward anonymous strangers or charities, but never friends or family members. Generosity between anonymous strangers differs in many ways from generosity between friends and kin (Kurzban, Burton-Chellew, & West, 2015).

2.1.2. Reducing conditions

Some studies involved more than one surveillance cue condition or control condition. To maintain statistical independence within each meta-analysis, we chose a single comparison (between one surveillance cue condition and one control condition) for each study. Therefore, in situations with multiple surveillance cue or control conditions, we either pooled the surveillance cue (or control) conditions together to form one surveillance cue (or control) condition, or we chose one surveillance cue (or control) condition over others, in effect excluding one or more conditions. The goal of our meta-analyses was to compare any surveillance cue conditions that met our criteria to any control conditions that met our criteria, and not to make distinctions between different kinds of surveillance cues or different kinds of control conditions. Therefore, we preferred to pool conditions, and did so for three studies (Haley & Fessler, 2005; Raihani & Bshary, 2012; Sparks & Barclay, 2013). For reasons we will explain, however, we chose to exclude a subset of conditions from two studies (Jolij & de Haan, 2014; White, 2015).

Haley and Fessler (2005) utilized five different conditions. In some of these conditions, participants wore earmuffs meant to serve as anti-surveillance cues by reducing the sound of other people in the room. We combined the two conditions lacking surveillance cues into one control group and the three conditions involving surveillance cues into one surveillance cue group, disregarding the use (or not) of earmuffs. Raihani and Bshary (2012) exposed participants to one of four kinds of images: an image of eyes, an image of flowers, an image of a black square, and no image. We combined the latter three conditions into one control condition. Sparks and Barclay (2013) employed two distinct surveillance cue conditions in their dictator game study: 'constant eyespots', in which dictators could see the eye images during the whole experiment, and 'sudden eyespots', in which the eye images were visible to dictators only while they made their decision – probably under 30 seconds for most participants (A. Sparks, personal communication, June 8, 2016). We combined these two surveillance cue conditions into one.

We excluded some conditions from two studies. Jolij and de Haan (2014) exposed half of their participants to masked stimuli and half to unmasked stimuli. The masked stimuli, which the researchers referred to as the unconscious stimuli, were only visible for 10 milliseconds. Because subconscious presentation of cues was not used in any other studies, we included only the unmasked (conscious) conditions (i.e., unmasked surveillance cues and unmasked control stimuli).

An experiment conducted by White (2015) employed three conditions. In two of the conditions, the participant's computer occasionally flickered to reveal the desktop. In the 'computer malfunction with eye-images' condition, there was an image of eyes on the desktop, whereas the desktop displayed no image in the 'computer malfunction' condition. In the third condition, the participant's computer never flickered and the participant never saw an image of eyes (the 'no malfunction' condition). We chose to exclude the 'no malfunction' condition because participants in both of the computer malfunction conditions indicated significantly more frustration than participants in the 'no malfunction' condition. Frustration could plausibly affect generosity. Participants in the surveillance cue condition, who were all exposed to frustrating computer malfunction, might have been more frustrated as a group than participants in the control condition if the control condition was formed by pooling the 'no malfunction' and 'computer malfunction' conditions. This would have introduced a likely confound into the contrast. Therefore, we compared the 'computer malfunction with eye-images' (surveillance cue) condition with the 'computer malfunction' (control) condition.

2.2. Literature search

To find published studies, we conducted searches on Web of Science and PsycINFO on October 20, 2015. We used the search terms "cues of being watched" OR "eyespots" OR "social cues" OR "eye cues" OR "surveillance cues" OR "eye images" OR "eye-like" OR "perception of human face" OR "watching eyes" OR "images of eyes" OR "observation cues" OR "cues of observation" OR "eye spots" OR "eyespot effects". The references cited by the papers we obtained with these searches provided additional studies.

Table 2
Data excluded from meta-analyses.

Study	What was excluded	Reason for exclusion
Burnham, 2003	Entire study	Potential confound
Ekström, 2012	Entire study excluded from 'amount given' meta-analysis	Aggregated data
Fujii et al., 2015	Entire study	Within-subjects design
Jolij & de Haan, 2014	Masked surveillance cue and masked control conditions	Conditions were subconscious
Manesi et al., 2015	Entire study	Potential confound
Powell et al., 2012	Entire study	Aggregated data
Smith et al., 2009	Entire study	Potential confound
Sparks, 2010 Study 1	Data on generosity toward friends, siblings, and cousins	Different from generosity toward strangers
Sparks, 2010 Study 3	Data on generosity toward siblings	Different from generosity toward strangers
White, 2015	The 'no malfunction' condition	Potential confound

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To find unpublished studies, we sent out a call for unpublished data to the Society of Experimental Social Psychology (SESP), the Society for Personality and Social Psychology (SPSP), the Society for the Psychological Study of Social Issues (SPSSI), and the Human Behavior and Evolution Society (HBES). Additionally, Dr. Yohsuke Ohtsubo kindly forwarded our message to the Human Behavior and Evolution Society of Japan (HBES-J). Finally, Dr. Stefan Pfattheicher helpfully provided a list of additional studies, both published and unpublished.

The 'amount given' meta-analysis included data from 2,732 participants from 26 experiments described in 18 papers (1 unpublished) and 2 theses. The 'proportion who gave' meta-analysis included data from 19,512 participants from 27 experiments described in 19 papers (1 unpublished) and 2 theses.

2.3. Statistical approach

We followed procedures outlined by Lipsey and Wilson (2001). When the requisite statistics were not reported in papers, we asked the authors to provide them. Some of the authors sent us their data; in those cases, we calculated the statistics ourselves. For both meta-analyses, we calculated an effect size for each individual experiment, weighted the individual effect sizes using a random effects model, and calculated the mean effect size, the standard error of the mean effect size, and the 95% confidence interval of the mean effect size.

2.3.1. Calculation of effect sizes and weights

The effect size of interest was the measure of generosity (mean amount given for the first meta-analysis, the proportion of participants who gave for the second) for the surveillance cue condition compared to the same for the control condition.

2.3.1.1 Amount given. The first meta-analysis we conducted investigated the effect of artificial surveillance cues on generosity measured as amount given. Each data point consisted of a comparison between the mean amount of resources (usually money) given by participants in a study's surveillance cue condition and those given by participants in the control condition. Participants who gave nothing were included in mean calculations. For each comparison, we calculated the pooled standard deviation according to

$$s_p = \sqrt{\frac{(n_{sur}-1)s_{sur}^2 + (n_{con}-1)s_{con}^2}{(n_{sur}-1) + (n_{con}-1)}} \quad (1)$$

where n_{sur} was the sample size for the surveillance cue condition, n_{con} was the sample size for the control condition, s_{sur}^2 was the variance for the surveillance cue condition, and s_{con}^2 was the variance for the control condition. Next, we calculated the standardized mean difference effect size for each data point according to

$$ES_{sm} = \frac{\overline{X}_{sur}-\overline{X}_{con}}{s_p} \quad (2)$$

where $\overline{X}_{sur}$ was the mean for the surveillance cue condition and $\overline{X}_{con}$ was the mean for the control condition. Because this value of the effect size may be upwardly biased, we applied a correction (Hedges, 1981) to calculate an unbiased effect size, Hedges' g, according to

$$ES'_{sm} = \left[1-\frac{3}{4N-9}\right]ES_{sm} \quad (3)$$

where N was the total sample size. The next step was to calculate the standard error of the standardized mean difference effect size according to:

$$SE_{sm} = \sqrt{\frac{n_{sur}+n_{con}}{n_{sur}n_{con}} + \frac{\left(ES'_{sm}\right)^2}{2(n_{sur}+n_{con})}} \quad (4)$$

Finally, a weight was calculated for each individual experiment as follows:

$$w_{sm} = \frac{1}{SE_{sm}^2} \quad (5)$$

This weight was the inverse of the variance associated with the subject-level sampling error (SE_{sm}^2).

2.3.1.1. Proportion who gave. The second meta-analysis we conducted investigated the effect of artificial surveillance cues on generosity measured as the proportion of participants who gave something rather than nothing. Each data point consisted of a comparison between the proportion of participants who gave in a study's surveillance cue condition and the proportion of participants who gave in the control condition. For each comparison, we recorded the number of participants who gave and the number who did not in both groups. Next, we calculated the odds-ratio according to

$$ES_{OR} = \frac{ad}{bc} \quad (6)$$

where a and b are the number of participants who gave something versus gave nothing, respectively, in the surveillance cue condition, and c and d are the number of participants who gave something versus gave nothing, respectively, in the control condition. Next, we converted the odds-ratio to the logged odds-ratio, which allows for easier calculation of the standard error (Lipsey & Wilson, 2001). The logged odds-ratio was calculated as

$$ES_{LOR} = log_e(ES_{OR}) \quad (7)$$

where e is the base of the natural logarithm, approximately 2.718. Next, we calculated the standard error of the logged odds-ratio as follows:

$$SE_{LOR} = \sqrt{\frac{1}{a}+\frac{1}{b}+\frac{1}{c}+\frac{1}{d}} \quad (8)$$

Finally, a weight was calculated for each individual study as follows:

$$w_{LOR} = \frac{1}{SE_{LOR}^2} \quad (9)$$

This weight was the inverse of the variance associated with the subject-level sampling error (SE_{LOR}^2).

2.3.2. Homogeneity analysis

We conducted a Cochran's Q test for both meta-analyses. Cochran's Q test is used to determine if the individual effect sizes in a meta-analysis estimate the same population effect size. If they do, the dispersion of the individual effect sizes around the mean is not greater than that expected from sampling error alone. A distribution like this is considered homogeneous. Cochran's Q tests the null hypothesis that the effect size distribution is homogeneous.

Each individual study's effect size was multiplied by its weight to create its weighted effect size, w_iES_i. The mean effect size was then calculated as follows:

$$\overline{ES} = \frac{\sum(w_iES_i)}{\sum w_i} \quad (10)$$

where $\sum(w_iES_i)$ was the sum of the weighted effect sizes and $\sum w_i$ was the sum of the inverse variance weights. Next, the Q statistic was calculated as

$$Q = \sum w_i\left(ES_i-\overline{ES}\right)^2 \quad (11)$$

where w_i was the individual weight for $i = 1$ to k (the number of effect sizes), and ES_i was the individual effect size for $i = 1$ to k. Q is distributed as a chi-square statistic with $k - 1$ degrees of freedom. A significant Q test suggests the effect sizes are heterogeneous.

2.3.3. Calculation of overall effect size

We chose a random effects model to calculate the overall effect sizes of the meta-analyses. A random effects model assumes that, in addition to sampling error, the individual effect sizes differ from the population mean by randomly distributed variance from other sources. We calculated random variance with the following formula:

$$v_\theta = \frac{Q-(k-1)}{\sum w_i - \left(\sum w_i^2 / \sum w_i\right)} \quad (12)$$

This calculated random variance was added to the sampling error variance of each individual effect size and the inverse variance weights were recalculated as $1/(v_\theta + SE^2)$. The mean effect size was recalculated using the new weights. The standard error of the mean was calculated as follows:

$$SE_{\overline{ES}} = \sqrt{\frac{1}{\sum w_i}} \quad (13)$$

Finally, we calculated the 95% confidence interval for both meta-analyses. The lower and upper limits were calculated as

$$\overline{ES}_L = \overline{ES} - 1.96(SE_{\overline{ES}}) \quad (14)$$

and

$$\overline{ES}_U = \overline{ES} + 1.96(SE_{\overline{ES}}) \quad (15)$$

respectively.

3. Results

3.1. Amount given

The findings for the 'amount given' meta-analysis are summarized in Table 3 and plotted in Fig. 1. The mean effect size, calculated as the mean difference, is 0.03 (SE = 0.05), indicating that participants in the surveillance cue conditions were slightly more generous than participants in the control conditions. However, this effect size is very small and not significantly different from zero; the 95% confidence interval of the effect size is −0.08 to 0.13. The Q test for homogeneity of effect sizes was significant, $Q(25) = 40.81$, $p = .02$. This suggests that the effect size distribution is heterogeneous; fortunately, we used a random effects model, and a random effects model does not assume homogeneity of effect sizes (Cumming, 2014; Lipsey & Wilson, 2001).

3.2. Proportion who gave

The findings for the 'proportion who gave' meta-analysis are summarized in Table 4 and plotted in Fig. 2. The mean effect size, calculated as the logged odds-ratio, is 0.16 (SE = 0.10), indicating that a greater proportion of participants in the surveillance cue conditions gave something compared to participants in the control conditions. Converting the logged odds-ratio into an odds-ratio to help with interpretation, we get 1.17, meaning participants in the surveillance cue conditions were 1.17 times more likely to give than participants in the control conditions, with a 95% confidence interval of −0.04 to 0.35. Because the confidence interval includes zero, the overall mean effect size is not significantly different from zero. The Q test for homogeneity of effect sizes was not significant, $Q(26) = 34.98$, $p = .11$. This suggests that the effect size distribution is homogeneous.

4. Discussion

We first descriptively reviewed the surveillance cues literature, paying special attention to generosity. While several experiments reported effects, we also noted that the significance of effects sometimes hinged on inconsistent moderating variables, or on the particular ways that data were analyzed in particular experiments. Wishing to be more systematic, we conducted two meta-analyses of studies investigating the effect of artificial surveillance cues on generosity. The first meta-analysis was comprised of measures of the mean amount of resources participants gave in surveillance cue and control conditions. The overall effect size was small and not significantly different from zero. Because researchers have suggested that it is the probability of participants giving something that is affected by surveillance cues rather than the amount given (Nettle et al., 2013), our second meta-analysis investigated this operationalization of generosity. Again, however, the mean effect size was small and not significantly different from zero.

Overall, our meta-analyses found no evidence that artificial cues of being watched increase generosity, either by increasing how generous individuals are or by increasing the probability individuals will show any generosity at all.

4.1. Limitations and future directions

We attempted to include unpublished studies, but only found one that met the criteria for inclusion in our meta-analyses. If there are unpublished studies with positive effects, our meta-analyses could be underestimating the true effect sizes. If there are unpublished studies with null results, which is more likely (Ioannidis & Trikalinos, 2007), the true effect sizes may be even smaller than those estimated by our meta-analyses.

Our meta-analyses investigated the effect of artificial surveillance cues on generosity. However, surveillance cue studies report effects on many behaviors, such as hand washing, voting, littering, theft, and dishonesty. Our meta-analyses do not speak directly to such behaviors. Future research is required to determine which behaviors, if any, are affected by surveillance cues, to what extent they are affected, and under which conditions they are affected.

Many surveillance cue papers have reported moderating variables or effects conditional on features of participants, the environment, or the surveillance cues. Surveillance cue effects have been reported as appearing in men but not women (Rigdon et al., 2009), or among an ingroup but not an outgroup (Mifune et al., 2010); they have been described as having the opposite effect on participants high in prevention-focused self-regulation than they do on those low in prevention-focused self-regulation (Keller & Pfattheicher, 2011; Pfattheicher, 2015); they have been reported as only affecting participants who are high in chronic public self-awareness (Pfattheicher & Keller, 2015) or not angry (Horita & Takezawa, 2014); they have been described as only working under certain conditions, such as when they are shown briefly (Sparks & Barclay, 2013), or when the number of people in an area is low (Ekström, 2012) or, conversely, high (Bateson et al., 2013); and surveillance cues have been reported as causing people to spend more time throwing away trash but not increasing the proportion of people who throw away trash (Francey & Bergmüller, 2012). Our meta-analyses did not consider any of these qualifications. The importance of moderators and other qualifications is therefore still an open question. Confidence in conditional effects, as with any effect, should be apportioned to their ability to be replicated repeatedly with large samples.

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Table 3
'Amount given' meta-analysis statistics.

Study	Design	*N*	*SE*	ES	95% CI
Haley and Fessler (2005)	Dictator game	124	0.19	0.30	[−0.06, 0.67]
Burnham and Hare (2007)	Public goods game	96	0.21	0.45	[0.05, 0.86]
Rigdon et al. (2009)	Dictator game	113	0.19	0.18	[−0.19, 0.55]
Mifune et al. (2010)	Dictator game	140	0.17	0.01	[−0.32, 0.34]
Sparks (2010) Study 1	Social discounting task	106	0.19	−0.22	[−0.60, 0.16]
Sparks (2010) Study 2	Dictator game	83	0.22	0.04	[−0.39, 0.47]
Sparks (2010) Study 3	Social discounting task	107	0.20	−0.48	[−0.87, −0.10]
Keller and Pfattheicher (2011) Study 1	Charity donation	60	0.26	0.12	[−0.39, 0.62]
Keller and Pfattheicher (2011) Study 2	Charity donation	40	0.32	−0.04	[−0.66, 0.58]
Oda et al. (2011)	Dictator game	61	0.26	0.59	[0.07, 1.10]
Tane and Takezawa (2011) Study 1	Dictator game	40	0.32	−0.44	[−1.07, 0.19]
Tane and Takezawa (2011) Study 2	Dictator game	40	0.32	−0.13	[−0.75, 0.49]
Raihani and Bshary (2012)	Dictator game	387	0.12	−0.23	[−0.47, 0.00]
Baillon et al. (2013)	Dictator game	110	0.19	0.33	[−0.05, 0.71]
Nettle et al. (2013)	Dictator game	118	0.19	0.03	[−0.34, 0.39]
Sparks and Barclay (2013)	Dictator game	188	0.16	0.02	[−0.29, 0.34]
Fathi et al. (2014)	Charity donation	122	0.18	0.15	[−0.20, 0.51]
Jolij and de Haan (2014)	Dictator game	60	0.26	0.28	[−0.23, 0.78]
Cai et al. (2015) Pilot Study	Dictator game	49	0.29	0.63	[0.05, 1.20]
Matsugasaki et al. (2015) Study 1	Dictator game	33	0.35	−0.42	[−1.11, 0.27]
Matsugasaki et al. (2015) Study 2	Dictator game	49	0.29	0.09	[−0.47, 0.65]
Pfattheicher (2015) Study 2 Sample 1	Charity donation	100	0.20	−0.12	[−0.51, 0.27]
Pfattheicher (2015) Study 2 Sample 2	Dictator game	123	0.18	−0.24	[−0.59, 0.12]
Pfattheicher and Keller (2015) Study 2	Charity donation	126	0.18	0.13	[−0.21, 0.48]
Vogt et al. (2015)	Dictator game	177	0.15	−0.10	[−0.39, 0.20]
White (2015)	Dictator game	80	0.22	−0.09	[−0.53, 0.35]

Note. ES = effect size, measured as Hedges' g; CI = confidence interval.

4.2. Conclusion

There is no doubt people behave differently when they know, or at least believe, that they are being watched by others. A growing literature has investigated whether people also behave differently when they are presented with artificial cues of being watched by others. The mixed results of studies involving various prosocial and antisocial behaviors fail to provide a clear answer. We reviewed the literature and conducted two meta-analyses which suggest that there is no effect of artificial surveillance cues on generosity, the most frequently studied behavior in this area of research. Our meta-analyses are not the final word on surveillance cues and generosity, but they show that skepticism is warranted.

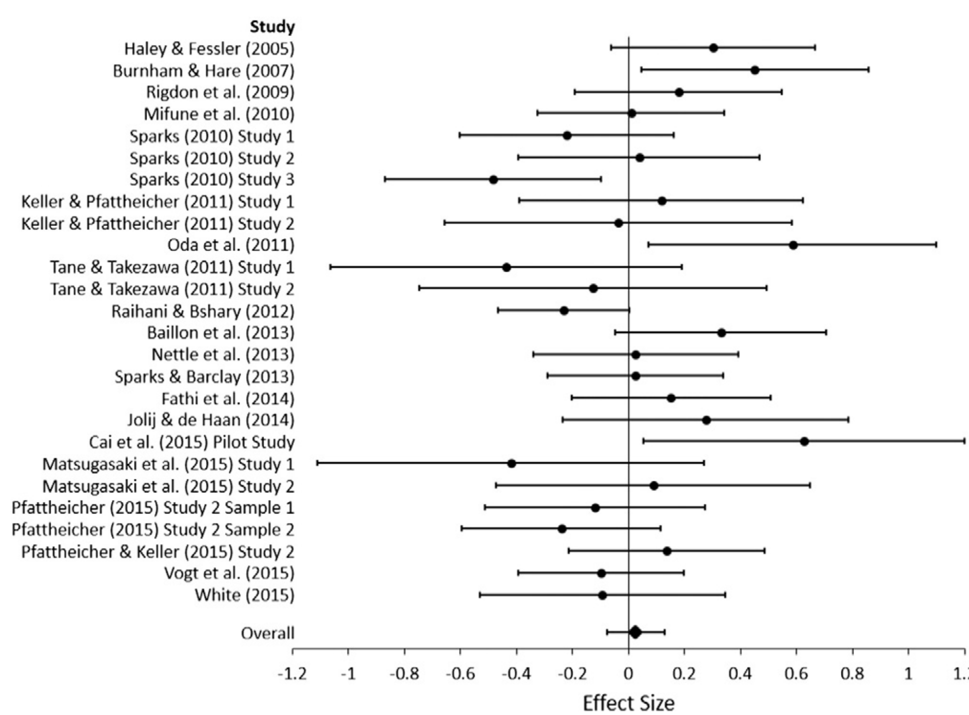

Fig. 1. Forest plot for 'amount given' meta-analysis: standardized mean difference effect size and 95% confidence interval for each study, and overall. A positive effect size indicates a greater amount of resources given in the surveillance cue condition; a negative effect size indicates a greater amount of resources given in the control condition.

Table 4
'Proportion who gave' meta-analysis statistics.

Study	Design	*N*	*SE*	ES	95% CI
Haley and Fessler (2005)	Dictator game	124	0.41	1.21	[0.42, 2.01]
Burnham and Hare (2007)	Public goods game	96	0.84	1.19	[−0.46, 2.84]
Rigdon et al. (2009)	Dictator game	113	0.41	0.74	[−0.07, 1.55]
Mifune et al. (2010)	Dictator game	145	0.56	0.20	[−0.90, 1.30]
Sparks (2010) Study 1	Social discounting task	106	0.62	0.38	[−0.84, 1.60]
Sparks (2010) Study 2	Dictator game	83	0.57	0.25	[−0.87, 1.37]
Sparks (2010) Study 3	Social discounting task	107	0.39	−0.41	[−1.17, 0.35]
Keller and Pfattheicher (2011) Study 1	Charity donation	60	0.56	0.15	[−0.93, 1.24]
Keller and Pfattheicher (2011) Study 2	Charity donation	40	0.65	−0.44	[−1.71, 0.82]
Oda et al. (2011)	Dictator game	61	1.03	−0.04	[−2.06, 1.99]
Tane and Takezawa (2011) Study 1	Dictator game	40	0.89	−1.35	[−3.10, 0.40]
Tane and Takezawa (2011) Study 2	Dictator game	40	0.81	−0.64	[−2.23, 0.95]
Ekström (2012)	Charity donation	16,775	0.05	0.01	[−0.08, 0.11]
Raihani and Bshary (2012)	Dictator game	387	0.38	0.70	[−0.05, 1.45]
Baillon et al. (2013)	Dictator game	110	0.42	0.61	[−0.22, 1.44]
Nettle et al. (2013)	Dictator game	118	0.42	0.82	[0.00, 1.65]
Sparks and Barclay (2013)	Dictator game	188	0.61	−0.04	[−1.24, 1.17]
Fathi et al. (2014)	Charity donation	122	0.36	0.26	[−0.45, 0.98]
Jolij and de Haan (2014)	Dictator game	60	0.71	0.57	[−0.82, 1.95]
Cai et al. (2015) Pilot Study	Dictator game	49	1.52	2.42	[−0.56, 5.39]
Matsugasaki et al. (2015) Study 1	Dictator game	33	0.86	−0.29	[−1.97, 1.40]
Matsugasaki et al. (2015) Study 2	Dictator game	49	0.92	−0.83	[−2.63, 0.97]
Pfattheicher (2015) Study 2 Sample 1	Charity donation	100	0.48	−0.57	[−1.52, 0.38]
Pfattheicher (2015) Study 2 Sample 2	Dictator game	123	0.37	−0.40	[−1.12, 0.32]
Pfattheicher and Keller (2015) Study 2	Charity donation	126	0.38	0.12	[−0.62, 0.86]
Vogt et al. (2015)	Dictator game	177	0.31	−0.09	[−0.70, 0.52]
White (2015)	Dictator game	80	0.85	0.11	[−1.56, 1.77]

Note. ES = effect size, measured as the logged odds-ratio; CI = confidence interval.

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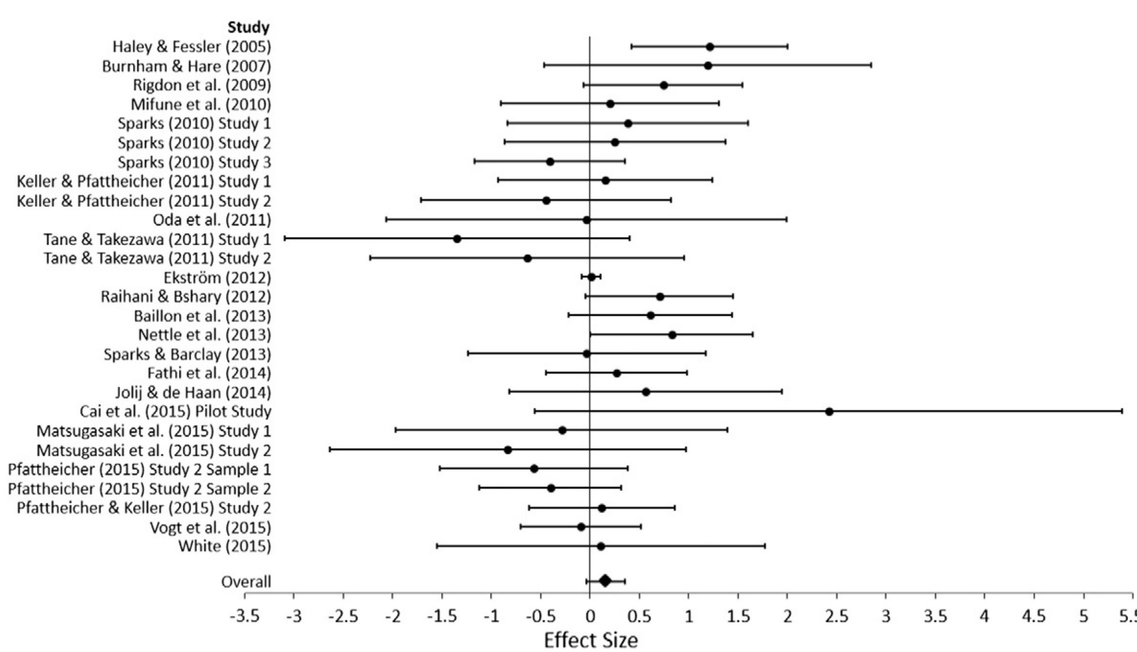

Fig. 2. Forest plot for 'proportion who gave' meta-analysis: logged odds-ratio effect size and 95% confidence interval for each study, and overall. A positive effect size indicates a greater proportion of participants in the surveillance cue condition gave something; a negative effect size indicates a greater proportion of participants in the control condition gave something.

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