

See It, Say It: Encouraging Citizen Reporting of Sustainability and Inclusivity Infrastructure Issues in Cities

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Abstract

Citizen reporting apps are becoming increasingly popular in smart cities to help local authorities identify, prioritize and resolve issues with public infrastructure faster and according to citizen needs. However, soliciting and sustaining high-quality incident reports is challenging since free riding is an attractive option. Another challenge is making such apps equally open and accessible to less affluent and vulnerable groups. We model citizen reporting as a public good game to investigate how two potential non-monetary, non-competitive interventions affect contributions: increasing the salience of the citizen's group identity, and increasing the salience of the expressive values. We conducted an online experiment to test our hypotheses. Our results reveal that neither salience of group identity nor expressive values increased contributions toward the public good.

Keywords: Smart city, Citizen reporting, Public goods game, Group identification, Expressive values

1. Introduction

Public administrations are increasingly interested in citizen-centric smart city solutions to help create sustainable, healthy living spaces in cities, and to improve inclusion of vulnerable groups in city planning and city life in line with the UN Sustainable Development Goals (UN, 2020). Citizen-centric smart city solutions put the needs of the citizens first, rather than the optimization of smart information and communication technologies towards the utility of the service provider (Grimsley & Meehan, 2007; Lee & Lee, 2014).

One such solution that is popular across the world is citizen reporting on faulty public infrastructure. Citizens use a mobile app to submit a photo and a short description of an infrastructure issue, which is then routed directly to the responsible authorities. The UK citizen reporting app FixMyStreet collected 1.1 million

reports between 2007 and 2017 (Matthews et al., 2018) and has been adopted in Sweden, Australia, France and Malaysia (Abu-Tayeh et al., 2018; Berntzen et al., 2018). Such reports can be used to great effect by public administrations. The city of Vienna, Austria, for instance reports that between 2017 and 2020, they were able to solve over 99% of the 100,000 cases reported through their app (OTS, 2020).

Citizen reporting apps promise many benefits to public administrations and citizens alike. They can provide (i) an easy, low-effort and low-cost way to participate for nearly all groups (requiring only a smartphone and a free app); (ii) they do not require long-term commitment or special expertise; (iii) they might even lead to citizens identifying more with the city they live in (e.g., Berntzen et al., 2018).

The main challenge for citizen reporting apps is how to engage citizens, and to motivate them to contribute useful, timely reports.

Previous literature on citizen reporting has mostly focused on examining outcomes and implementations of apps (e.g., Abu-Tayeh et al., 2018; Kopackova & Libalova, 2019). Our study aims to contribute to the literature by investigating how to motivate and increase reporting levels across different citizen groups and for different topics of interest.

Broadly, four sets of factors affect reporting behavior: *individual factors* (e.g., self-concern or prosocial desire to help others; Abu-Tayeh et al., 2018), the *spatial or social context* (e.g., affluence of neighborhood; Kontokosta & Hong, 2021; Matthews et al., 2018), *salience and importance of reported topic* (e.g., environmental or inclusivity issues), and the *design* of the app (e.g. gamification-based features like leaderboards; Susanto et al., 2017).

Our study focuses on investigating two factors relating to the *spatial and social context* and the *salience and importance of the topic* on which citizens report.

Prior research shows that contribution behavior in citizen reporting app varies by neighborhood (e.g., Kontokosta & Hong, 2021; Matthews et al., 2018). The introduction of digital channels for citizen reporting

(website and mobile app) does not necessarily reduce variation: it can actually exacerbate contributions disparity between communities (Wang et al., 2022). Social identity theory suggests that the degree to which a person identifies with a group affects contributions (e.g., Eckel & Grossman, 2005). Introducing digital channels might reduce this identification. Conversely, *emphasizing the group identity* in the app might increase contributions.

Regarding the topics citizens report on, the theory of planned behavior suggests that the importance of the value affected through contributions can further incentivize the behavior if it relates to one's self-identity (Alford, 2002). From a public administration standpoint, it is of particular interest to investigate whether making certain *values* (like environmental sustainability or social inclusivity) *salient* in the app would translate into an increase in contributions. Public administration could leverage these insights by running campaigns for soliciting reports on specific issues, for example.

Our study uses an online public goods game experiment to investigate whether and how making group identity and expressive values, specifically environmental sustainability and social inclusivity, salient affects contribution behavior. Our results indicate that neither group identification nor expressive values increase contribution behavior. We derive implications for the design of citizen reporting apps and the likely effectiveness of various interventions to increase contributions that aim to increase environmental sustainability and social inclusivity.

2. Related work and hypotheses

2.1. Citizen reporting as a public good

Each citizen report on a public infrastructure issue corresponds to a contribution to the public good of a functioning public infrastructure. Like other public goods, the accrued benefits from an individual's contribution are non-excludable and non-rivalrous (Ledyard, 1995). In the citizen reporting context, if an issue is fixed due to a citizen report, other citizens who have not reported this (or other) issues still benefit from the resulting improvement to the public infrastructure.

This gives rise to the social dilemma inherent in public goods (Ledyard, 1995): some citizens might decide to maximize their benefit by refraining from spending own time and effort on reporting issues and free riding on other citizens' time and effort. If the other citizens notice this, they might decide to stop reporting issues in turn and become free riders themselves. In the long run, we might thus observe a situation where everyone would profit from the public good, i.e. a

functioning public infrastructure, but nobody is willing to invest their own resources in reporting because they expect everyone else to free ride.

The public goods game (Ledyard, 1995) captures this social dilemma. At least two players receive a private monetary endowment that they can either keep or contribute (partially) towards the public good. The sum of contributions multiplied by a factor greater than 1 and less than the number of players constitutes the public good and is shared equally between all players, regardless of their individual contribution.

The concept of (digital) public goods and the experimental abstraction of the public goods game have proven useful to explaining contribution behavior to online knowledge sharing platforms and communities like Wikipedia (e.g., Choi et al., 2010; Ducheneaut, 2005). A number of these studies investigate how changes to the platforms and incentives affect contributions and contribution quality on Wikipedia (Gallus, 2017), StackExchange (Chen et al., 2018), and e-commerce platforms (Dorner et al., 2020).

While monetary incentives have been shown to increase contributions in the short term in e-commerce settings (Dorner et al., 2020), they may crowd out intrinsic motivation (Gneezy & Rustichini, 2000) and decrease contributions in the long run (e.g., Ariely et al., 2009; Gneezy et al., 2011). For the purpose of the present study, we assume that citizen reporting will remain an instance of unpaid volunteering (Amazon reviews, Wikipedia and StackExchange are further examples), and do not consider monetary incentives further.

Non-monetary incentives, or interventions, often comprise competition-based gamification elements like leader boards (Susanto et al., 2017), helpfulness or productivity scores (Dorner et al., 2020). While effective for some groups (Dorner et al., 2020), non-monetary competition-based interventions have been shown to decrease contributions for other user groups (e.g., Huang et al., 2019). One study shows that non-monetary, non-competitive award badges increase contributions to Wikipedia significantly and sustainably (Gallus, 2017). Thus, we propose to investigate non-monetary, non-competitive interventions.

2.2. Social identity theory and group identification

One spatial and social factor that affects contribution behavior is *group identity*. Many studies show that people give more to others when they feel closer to them. One experiment in a city context showed that individuals give more money to strangers who lived in the same district than to strangers living in other districts (Falk & Zehnder, 2013). Another experiment

showed that individuals who were either primed to have higher neighborhood attachment or identified themselves as having higher neighborhood attachment behaved more cooperatively towards their neighbors (Gallier et al., 2019).

These findings are in line with social identity theory, which suggests that the degree to which a person identifies with a group affects contributions (e.g., Eckel & Grossman, 2005).

Membership in social groups and categories informs an individual's self-concept (Tajfel & Turner, 1979). The extent to which the social identity affects the individual's behavior depends on (i) how much the individual identifies with the in-group and (ii) how salient the social identity is (Terry et al., 1999). An individual that identifies strongly with a group will alter their individual behavioral intentions to match the group (Terry et al., 1999).

In addition, it is important to consider which social norms are tied to the group the individual identifies with. Social norms are behavioral standards held by individual group members based on their shared beliefs on how to act in a given situation (Bernhard et al., 2006; Hogg & Reid, 2006). They are tied to group identity through the group's perceived behavioral norms (Terry et al., 1999). Individual willingness to contribute to a public good strongly depends on the social norm of cooperation (Elster, 1989).

A field experiment in a Tanzanian village showed how important the ties between norms and group identity are. Public good contributions were higher on the village level than on the sub-village level, although people were closer to each other on the sub-village level (Kok et al., 2020). But the group identity tied to the social norm of cooperation was the village identity, thus prompting higher contributions on that level only (Kok et al., 2020).

In terms of interventions, increasing the salience of being a part of an in-group can trigger stronger adherence towards group norms (Alford, 2002) and increase cooperation among in-group members (e.g. Balliet et al., 2014; Ben-Ner et al., 2009; Y. Chen & Li, 2009; Eckel & Grossman, 2005; Kramer & Brewer, 1984). For example, members of an online movie review community increased their contributions when informed that they were contributing less than the community median (Chen et al., 2018).

In a city context, some citizens might identify primarily as members of a neighborhood or district, some primarily as a member of the city as a whole; and the social norm of cooperation might be tied to either. Only if the salience of the "right" group identity, the one that the social norm of cooperation is tied to, is increased, can we expect to see a positive effect on

contributions to the citizen reporting app (Chen et al., 2018; Kok et al., 2020; Rimal & Lapinski, 2015).

Hypothesis 1 (H1—Group Identity) Increasing the salience of a group identity tied to the social norm of cooperation will lead to higher contributions to a citizen reporting app.

2.3. Theory of planned behavior and expressive values

According to the theory of planned behavior, the extent to which performing a behavior is important to one's self-identity is an important predictor of behavioral intention (Ajzen, 1991; Terry et al., 1999). Increasing the salience of expressive values, such as commitments to moral and social causes, are purposive incentives that are also useful in increasing public good contributions (Alford, 2002). In other words, citizens could be incentivized to contribute if they explicitly view the behavior as aligning with their self-identity. Citizen reporting apps can be used to collectively achieve meaningful causes such as the betterment of environmental sustainability and regulation (Conrad & Hilchey, 2011; Roy et al., 2012; Young et al., 2019) or improving the inclusivity of a city for vulnerable citizens (Hinckson et al., 2017; King et al., 2020; Makuch & Aczel, 2020). Increasing the salience of the expressive values can be done through labelling and social framing which make the social and moral causes explicit. Previous experiments using framing have increased cooperation amongst participants by labelling the name of the game to emphasize community (Lieberman et al., 2004). A PGG experiment labelled their game as an Environment game and observed a similar increase in contributions to their Community label (Bernold et al., 2015). However, the use of social framing to increase of cooperation has been inconsistent as the effect of framing is context-dependent (Atilgan & Markovsky, 2021). Within the context of citizen reporting, this study will investigate the effect of increasing the salience of moral and social causes towards citizen reporting contributions, specifically a sustainability cause and an inclusivity cause. The theory of planned behavior would predict that individuals who commit to sustainability causes or inclusivity causes as a part of their self-identity will increase contributions when those expressive values are made salient.

Hypothesis 2 (H2—Expressive Values) Increasing the salience of expressive values, specifically framing citizen reporting as tool for promoting sustainability or inclusivity, will lead to higher contributions to a citizen reporting app.

Figure 1 summarizes our research model.

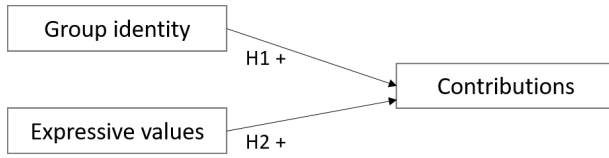


Figure 1. Research Model

3. Experimental Design

3.1. Treatments

For this experiment, a 2x3 full-factorial between-subject design is used (Table 1). The Group Identity factor has two levels: neighborhood identity (NEIGH) and city identity (CITY). For the neighborhood identity, participants are instructed to treat other group members as fellow neighbors and the infrastructure issues as occurring in their own neighborhood. For the city identity, participants are instructed to treat other group members as fellow citizens in their city and the infrastructure issues as occurring somewhere in the city. We also measure participant identification with their real-life neighborhood and city (Leach et al., 2008).

| | | Group Identity (GI) | |
|------------------------|---------|---------------------|------|
| | | NEIGH | CITY |
| Expressive Values (EV) | SUS | T1 | T4 |
| | INCL | T2 | T5 |
| | Control | T3 | T6 |

Table 1. Treatments

The Expressive Values factor has three levels: sustainability (SUS), inclusivity (INCL) and control (general infrastructure maintenance issues). Participants are informed that the purpose behind the local government introducing the citizen reporting app is to promote one of three topics: sustainability (by preserving green spaces in the city and reporting issues that have a negative impact on the environment); inclusivity (by ensuring that public infrastructure and spaces are well-maintained and do not exclude vulnerable citizens); or, in the control treatment, help resolve general issues with faulty public infrastructure (e.g., broken road signs). We also measure participants' general level of concern for sustainability, inclusivity, and general public infrastructure issues (Wesley Schultz, 2001).

3.2. Experimental procedure

The procedure and payoff mechanism are modelled similar to the public goods game used by Dorner et al. (2020), which investigated the contribution behavior of product reviewers. Instead of product reviews, participants in our experiment will be writing incident reports. Both product reviews and incident reports can be considered public goods as benefits from contributions are non-excludable and non-rivalrous (Ledyard, 1995). The public goods game procedure by Dorner et al. (2020) uses written characters as a means of contributing to the public good which better approximates the nature of citizen reporting.

Following the setup of Dorner et al. (2020), our experiment consists of three parts. In part 1, participants receive a general briefing of the experiment, instructions on how to play the public goods game, and explanations on the payoff calculation. A series of comprehension questions ensures the participants' correct understanding of the experiment. Players are randomly assigned to one of the six treatments (Table 1).

Part 2, the treatment stage, begins with participants reading the instructions for their assigned treatment. Next, they are randomly assigned to groups of 5 players each. Then they play 4 rounds of the public goods game. Group membership remains constant for all 4 rounds. Each round consists of two phases: incident reporting and payoff information.

In the incident reporting phase, participants have the option of writing a report of up to 400 characters in length. Following Dorner et al. (2020), report length represents the amount contributed to the public good. The endowment (£0.8) and the conversion rate of characters to English pounds (£0.0005) are set such that participants can write full (400 character) reports in each round. Participants benefit from the contributions of the other members in their group: each character written by another group member increases the participant's payoff by £0.00025.

Participant i 's payoff thus depends on their endowment, minus their own contribution to the public goods game (characters written; c_i) plus their share from the public good (characters written by their group members; c_{-i}).

$$\pi_i = 0.8 - 0.0005c_i + 0.00025c_{-i} \quad (1)$$

Backward induction tells us that the Nash equilibrium would be for all the participants to not write a single incident report in any round.

After each round of reporting, participants are informed about their payoff for this round, including how much was deducted from their account for writing

the incident report, and how much was added for other group members writing incident reports, i.e. how high their share of the public good was.

In part 3, participants fill out the exit survey. At the end of the experiment, participants are informed about their total payout as the sum of payouts in all four rounds.

We conduct the experiment with oTree, an open-source HTML platform for designing online experiments (D. L. Chen et al., 2016).

3.3. Operationalization of treatments

In each round, participants receive a photo of a public infrastructure issue. Depending on whether they are in the neighborhood identity (NEIGH) and city identity (CITY) treatments, the issues are framed as occurring in the neighborhood or city.

In the sustainability treatment (SUS), photos show damaged green spaces and littering that damages the environment. In the inclusivity treatment (INCL), photos show issues that exclude vulnerable people, e.g. barricades and broken sidewalks that affect people with walking disabilities. In the control treatment (Control), photos show general public infrastructure issues, e.g. broken streetlights and broken road signs. Incident reports with nonsensical texts do not count towards the payoff.

The photos were chosen based on a pre-study with the aim of choosing photos that clearly focus on the treatment topic, to avoid conflating potential treatment effects. First, the authors collected 48 photos. 24 photos were pre-selected based on the quality of the photo and ease of interpretation. Next, each author separately gave each photo a score for each topic, depending on whether the depicted issue could be associated with that topic. We then aggregated the scores and chose the 12 photos that show issues that belonged to one topic only, or had the weakest ties to another topic.

3.4. Exit survey

We measure strength of in-group identification (Leach et al. 2008) on the neighborhood and the city level, depending on treatment. The questionnaire measures (dis)agreement with solidarity, satisfaction, centrality, individual self-stereotyping, and in-group homogeneity as constituting characteristics of in-group identification (Leach et al. 2008) (Appendix A).

To test whether the social norm of cooperation is present in their neighborhood or city, we use the questionnaire by Sampson et al. (1997). The five-item questionnaire is measured on a 5-point Likert scale and includes statements like “I live in a close-knit neighborhood/city” and “People in my

neighborhood/city do not share the same values” (Appendix A).

In order to explore effects of different value constellations on cooperation behavior, we use the Schwartz Human Values Scale to measure how important certain values are to participants (S. Schwartz, 1996; S. H. Schwartz, 2021).

A six-item question adapted from the Grant (2008) and Abu-Tayeh et al. (2018) measures the extent of prosocial and self-concern motivations for participating in citizen reporting (Appendix A).

We measure the level of concern for environmental, inclusivity and public infrastructure issues with Schultz’s environmental concern questionnaire (2001), which we adapt for the inclusivity and control treatments (Appendix A).

Finally, we collect sociodemographic information on income, age, gender, and employment.

4. Sample

We used Prolific (www.prolific.co) to recruit participants and conduct the experiment online. Participants were from European countries and possessed at least a good understanding of English. We took the necessary steps to ensure that ethical guidelines were met when recruiting participants for our experiment. Participants were ensured that participation was voluntary and could opt-out at any point. Anonymity was guaranteed to participants and experimental data did not contain any identifiable information. Using the screening filters from Prolific, we recruited individuals from a non-vulnerable population and gave fair compensation of at least £6 per hour. In order to ensure participants’ understanding of the task, a series of comprehension questions were asked after the detailed instructions.

We conducted 5 experimental sessions in March 2022, resulting in 294 participants across 60 groups. 6 participants had to be excluded due to missing demographic data. The number of groups was evenly distributed across treatments (Table 2).

| Treatment Groups | N |
|---------------------------------|----|
| T1: <i>NEIGH-SUS</i> | 12 |
| T2: <i>NEIGH-INCL</i> | 10 |
| T3: <i>NEIGH-Control</i> | 10 |
| T4: <i>CITY-SUS</i> | 9 |
| T5: <i>CITY-INCL</i> | 10 |
| T6: <i>CITY-Control</i> | 9 |

Table 2. Number of groups per treatment

Due to Prolific payout rules, participants received a fixed payout of £5 for completing the experiment. Their behavior in the reporting phases (i.e., contributions to the public good) determined the variable bonus payment they received in addition. The average experiment duration was 40 minutes. Participants received an average bonus of £1.215 ($SD = 0.295$). 57% of participants were male and the sample had an average age of 25.4 ($SD = 6.2$).

Table 3 shows the average contribution behavior by treatment and round. Round 1 is excluded since participants may have treated it as a practice round and exhibited systematically different behavior compared to the following rounds. This is standard practice.

| Treatment Groups | Round 2 | Round 3 | Round 4 |
|--------------------------|--------------------|--------------------|--------------------|
| T1: NEIGH-SUS | 217.84 (131.5) | 203.8 (123.29) | 177.82 (127.97) |
| T2: NEIGH-INCL | 238.82 (121.26) | 227.88 (128.27) | 216.72 (132.83) |
| T3: NEIGH-Control | 213.92 (121.72) | 206.32 (122.19) | 192.02 (128.92) |
| T4: CITY-SUS | 193.69 (104.14) | 174.11 (116.2) | 148.62 (105.69) |
| T5: CITY-INCL | 222.52 (115.87) | 212.72 (137.82) | 212.7 (124.58) |
| T6: CITY-Control | 212.63 (134.86) | 210.02 (135.94) | 217.51 (140.6) |

Table 3. Report length in characters per treatment and round (mean, standard deviation)

5. Results

5.1. Control variables

We found no systematic differences between treatment groups for age (Kruskal-Wallis rank sum test; $H(5) = 0.035, p = 0.85$), gender (Pearson's Chi-squared test, $X^2 = 3.036, p = 0.69$), income bracket (Pearson's Chi-squared test, $X^2 = 23.15, p = 0.57$) or employment (Pearson's Chi-squared test, $X^2 = 39.503, p = 0.28$).

We compared the strength of in-group identification (Leach et al., 2008) between the neighborhood ($M = 4.07, SD = 1.10, N = 156$) and city treatments ($M = 4.39, SD = 1.04, N = 138$). Response from the 14 statements were averaged to form a single score for in-group identification. Participants in the city treatment group identified significantly more strongly with their city than participants in the neighborhood treatment with their neighborhoods (unpaired sample t-

test, $t(292) = 2.54, p = .01$). We conclude that the framing worked to create a treatment effect.

We checked whether the social norm of cooperation (Sampson et al., 1997) was higher in the neighborhood or city treatment groups. Responses from the five items were averaged to form a score. We found no significant difference in the social norm of cooperation for the neighborhood ($M = 3.21, SD = 0.68, N = 156$) and city ($M = 3.20, SD = 0.63, N = 138$) group identities (Wilcoxon rank sum test, $W = 10628, p = 0.85$).

We asked which level of concern participants had for the respective issue, on a scale from 1 (low) to 7 (high). For general public infrastructure issues, mean concern was 5.19 ($SD=1.29$), for sustainability 5.73 ($SD=1.23$), and for inclusivity 5.23 ($SD=1.32$).

5.2. Treatment variables

We used a mixed effects regression model with standard errors clustered by participant in order to investigate the treatment effects (Table 4).

| Effect | Estimate | SE | 95% CI | | p |
|-------------------------------------|----------|-------|--------|-------|------------------|
| | | | LL | UL | |
| (Intercept) | 151.63 | 21.46 | 109.52 | 193.8 | <0.001 |
| Contribution of others in the group | 0.09 | 0.02 | 0.06 | 0.12 | <0.001 |
| Round 3 | -12.00 | 5.84 | -23.46 | -0.53 | 0.040 |
| Round 4 | -20.64 | 5.86 | -32.13 | -9.15 | <0.001 |
| GI: NEIGH | -10.72 | 22.58 | -55.03 | 33.59 | 0.635 |
| EV: INCL | 0.78 | 22.58 | -43.53 | 45.09 | 0.972 |
| EV: SUS | -35.09 | 23.18 | -80.57 | 10.40 | 0.130 |
| GI: NEIGH * | 16.87 | 31.33 | -44.62 | 78.36 | 0.590 |
| EV: INCL | 32.30 | 31.35 | -29.23 | 93.82 | 0.303 |
| GI: NEIGH * | | | | | |
| EV: SUS | | | | | |

N = 294, Obs. = 882

Random Effects

$\sigma^2 = 5011.47$; τ_{00} Participant id = 10112.42

ICC = 0.67; Marginal $R^2 = 0.058$; Conditional $R^2 = 0.688$

Table 4. Mixed effects model (DV participant contribution length)

The dependent variable was report length, measured by the number of characters contributed to the incident reports.

We controlled for characters written by other group members in the previous round (Contribution of others

in the group) and the round number (Round 3, Round 4). Participants contributed more when their group members contributed more ($\beta = 0.09, p < 0.001$), and contributions decreased over time.

We used the city identity as the baseline. There is no significant difference in contribution compared to the neighborhood identity. However, this might be due the social norm of cooperation not being tied to the group identity that was made salient in the treatment. In order to check for that, we repeated the previous analysis for the relevant subset of participants only. This subset includes only those participants who (i) identify strongly with their group and (ii) for whom the social norm of cooperation is indeed tied to this group. We operationalize these two conditions by including only participants who had (i) an in-group identification score (Leach et al. 2008) higher than the mean score plus one standard deviation and (ii) a social norm of cooperation score (Sampson et al. 1997) above the median.

The relevant subset includes 106 participants, on which we reran the mixed effects regression model, with the same parameters as before (Table 4). The result, in terms of size and directions of the effects, remained the same. To check for robustness, we varied the cutoff points for the social norms of cooperation score by including only the 25% participants with the highest scores for this measure. The results remained stable: group identity was not associated with changes in contributions.

We compared the effect of making the expressive values of sustainability and inclusivity salient with the baseline of public infrastructure maintenance. Neither treatment increased contributions significantly. Next, we included interaction effects between group identity and expressive values. We did not observe significant differences.

As a robustness check, we ran a Tobit regression with the dependent variable being the participant contribution length, censored to be between 0 and 400, maximum report length. The independent variables remained unchanged compared to Table 3. The results remained stable.

In summary, our results do not support our hypotheses. Increasing the salience of a group identity tied to the social norm of cooperation did not lead to higher contributions (H1). Increasing the salience of expressive values, specifically framing citizen reporting as tool for promoting sustainability or inclusivity, did not lead to higher contributions (H2).

6. Discussion and Conclusion

Our results indicate that both in-group identification and expressive values did not increase contributions. Increasing the salience of expressive

values also did not increase contributions and this could be due to the framing of the citizen reporting being weaker than expected. Our research contributes to social identity theory as we see that despite participants in the city treatment having a higher in-group identification, the lack of the social norm of cooperation in that group identity did not increase contributions. Social norm scores were overall rather low, with a mean of 3.208 (SD=0.657) on a scale of 1 to 7. This result is in line with social identity theory that predicts an increase only if the social group has that social norm of cooperation. Our research also contributes to the use of social framing in PGG which has been shown to be effective only in certain contexts. Increasing the salience of social and sustainability causes may not be well-aligned with citizen reporting. Our research also has practical implications of the developers of citizen reporting apps. Our research shows that group identity and expressive values do not appear to increase contributions and citizen reporting as a tool might benefit more by highlight the contributions of others. For example, citizen reporting apps could notify users of resolved issues in their area which could better signal the contributions of others.

This study has several limitations. Firstly, participants were endowed with £0.8 for all four rounds of the report writing stage which might be considered low compared to the fixed payoff. However, due to the payment requirements mandated by the platform, Prolific (www.prolific.co), the majority of the payoff had to be fixed. Despite the low endowment, our results are consistent with PGG research where participants in the final rounds contribute less.

Secondly, our participant sample was geographically heterogeneous. Due to our participants being located all over Europe, there could have been cultural differences that affected the in-group identification and social norm of cooperation between city and neighborhood groups. It is possible that the social norm of cooperation might be present in neighborhoods in some countries while in cities for others.

Next, the low scores for social norm of cooperation in both city and neighborhood treatment groups affect the efficacy of in-group identification increasing cooperation. As previously mentioned in Hypothesis 1, a salient group identity that does have the social norm of cooperation will not increase cooperation behavior. Future research could explore using more homogenous subject pools to further test the effects of in-group identification on cooperation behavior in citizen reporting. Lastly, the lack of salience of expressive values may have reduced the efficacy of the treatment. Future research could also test other means of priming

expressive values in order further explore its effects on cooperation behavior.

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Appendix A

Strength of in-group identification (Leach et al., 2008)

Please rate several statements reflecting general feelings and experiences that may or may not apply to you. (7-point Likert scale; 1 – Disagree strongly, 7- Agree strongly)

1. I feel a bond with people in my neighbourhood.
2. I feel solidarity with people in my neighbourhood.
3. I feel committed to people in my neighbourhood.
4. I am glad to be in my neighbourhood.
5. I think that my neighbourhood has a lot to be proud of.
6. It is pleasant to be in my neighbourhood.
7. Being in my neighbourhood gives me a good feeling.
8. I often think about the fact that I am a part of my neighbourhood community.
9. The fact that I am part of my neighbourhood community is an important part of my identity.
10. Being a part of my neighbourhood community is an important part of how I see myself.
11. I have a lot in common with the average person in my neighbourhood.
12. I am similar to the average person in my neighbourhood.
13. People in my neighbourhood have a lot in common with each other.
14. People in my neighbourhood are very similar to each other.

Social norm of cooperation (Sampson et al., 1997)

Please rate several statements reflecting general feelings and experiences that may or may not apply to you. (5-point Likert scale; 1 – Disagree strongly, 5- Agree strongly)

1. People around my neighbourhood are willing to help their neighbors.
2. I live in a close-knit neighbourhood.
3. People in my neighbourhood can be trusted.
4. People in my neighbourhood generally don't get along with each other. [reverse coded]
5. People in my neighbourhood do not share the same values. [reverse coded]

For **Schwartz Human Values Scale** refer to S. H. Schwartz (2021). Due to space constraints, we cannot add it fully here.

Motivations for participating in citizen reporting (Grant, 2008; Abu-Tayeh et al., 2018)

“Why would you be motivated to do citizen reporting?” (7-point Likert scale; 1 – Disagree strongly, 7- Agree strongly)

1. Because I care about benefiting others through my reports
2. Because I want to help others through my reports
3. Because I want to have positive impact on others
4. Because it is important to me to do good for others through my reports
5. Because I can report issues that concern me personally
6. Because I can report issues that prevent me from fulfilling my needs

Level of concern (Schultz, 2001)

(7-point Likert scale; 1 – Not important, 7- Supreme importance)

Sustainability treatment:

"How concerned are you about environmental issues?"

Inclusivity treatment:

"How concerned are you about inclusivity issues?"

Control treatment:

"How concerned are you about public infrastructure issues?"