Environmental Degradation and Prosociality

Evidence from Lab-in-the-Field, Survey, and Online Experiments

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Abstract

I investigate how the experience of environmental degradation may impact social cohesion between victims and perpetrators. The first two chapters of my thesis investigate this by observing the behavior of real world pollution victims and polluters, while the last two chapters take the findings from the field and test the underlying behavioral mechanisms of having different types of information on the negative externality imposed in an online experimental setting.

Chapter 1 examines whether the experience of living in an environment degraded by artisanal and small-scale gold mining ("ASGM") activities erodes social cohesion between pollution victims and ASGM miners in Ghana. Using lab-in-the-field Dictator and survey experiments, I observe the prosocial behavior and attitudes of pollution victims to be higher towards ASGM miners compared to neutral individuals. In Chapter 2, I examine small-scale miners' knowledge and attitudes about ASGM mining and their intended environmental behavior following an informational intervention. While polluters' attitudes about the impact of ASGM on the local community became more negative following the intervention, their intended environmental behavior did not change. The findings from the first two chapters point towards the important role of (lack of) information in negative externalities on the behavior of victims and perpetrators.

Chapter 3 investigates whether providing more accurate information about a negative externality would lead victims to behave less prosocially towards perpetrators. I use a real effort encryption task with a payoff scheme that imposes an externality in an online experiment. Victims that were randomly assigned into an information treatment, which revealed the exact size of the negative externality imposed, behaved slightly less prosocial towards perpetrators. Finally, in Chapter 4, I further examine whether information on the intention to impose a negative externality will impact victims' behavior towards perpetrators. While victims punished perpetrators for imposing a negative externality, I found strong evidence of rewarding behavior towards potential perpetrators when a negative externality was intentionally prevented. Intentionally preventing a negative externality mattered more to potential victims than simply not experiencing the negative externality.

Contents

List of Figures

List of Tables

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Introduction

The experience of environmental degradation has led to both non-violent and violent conflict between pollution victims and polluters. For example, forest fires occurring due to decades of forest degradation in Indonesia cause a smoking choke haze that travels to downwind communities and diplomatic conflicts occur every year between the Association of Southeast Nations and Indonesia (Alisjahbana and Busch, 2017). Land and water degrading mining activities in Peru and Papua New Guinea have led to non-violent protests and blockades as well as violent conflict including the Bougainville Civil War (Economist Intelligence Unit, 2016)(Adamo, 2018). Despite this, there are also many examples of people having experienced environmental degradation without any reported social tensions between victims and perpetrators. In addition, the empirical evidence within the environmental conflict literature is mixed and largely based on macro-level analysis. In environmentally degraded settings, conflict is more likely to occur through decreasing prosociality between groups of individuals who are competing for natural resources. On the other hand, prosociality may not be so easily eroded within settings where there is already a foundation of high prosociality between groups of individuals competing for resources.

In this thesis, I explore whether the mixed behavioral evidence on the experience of environmental degradation could be due to the fact that people often have imperfect information and inaccurate perceptions about negative environmental externalities. For example, the widespread use of mercury in small-scale gold mining leads to contamination of the water and the soil, but the wider population does not always understand the consequences of mercury contamination since its negative health impacts may not be experienced for several years (Ha et al., 2017). One of the study settings is Ghana's gold mining districts. And, within this study context, the degradation of the land is directly related to competition for resources between small-scale gold miners and non-miners.

Environmental degradation can lead to decreased prosocial behavior between the perpetrators of the degradation and the victims through both the experience of inequality aversion and intention. Behavioral economics has shown that people have such a strong distaste for unfairness that they are willing to make costly sacrifices to promote equality, and this has been true across heterogeneous populations and settings through both lab and field experiments (Thaler, 1980; Andreoni, Harbaugh, and Vesterlund, 2003; Cardenas and Carpenter, 2008; Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000). Inequality aversion, alongside other measures of social preferences, is categorized as “prosocial” behavior. The term “prosocial” has a positive connotation, and a majority of the literature on such behavior shows positive local community outcomes. The literature on fairness and intentionality also demonstrates how peoples’ behavior changes when the inequality they have experienced has been imposed on them intentionally (Blount, 1995; Brandts and Solà, 2001; Charness and Rabin, 2002; Nelson, 2002; Offerman, 2002; Charness, 2004; Charness and Rabin, 2005; Charness and Levine, 2007a; Falk, Fehr, and Fischbacher, 2003; Falk, Fehr, and Fischbacher, 2008a). In general, people tend to punish bad intentions and and reward good intentions (Charness and Levine, 2007b; Falk, Fehr, and Fischbacher, 2008b).

Collective experiences of conflict have also been shown to lead to strong in-group social preferences (Grosjean, 2014; Satyanath et al., 2013). Experimental evidence from the lab has shown that in-group altruism coincides with out-group hostility (Abbink et al., 2012), and negative emotion has also been shown to be a driver of punishing behavior (Fehr and Gächter, 2000). If collective experiences of conflict initially nurture in-group prosocial behavior, then collective experiences of environmental degradation (in other words, experiencing an inequality) may also lead to nurturing this kind of behavior. This thesis sets out to investigate whether the experience of environmental degradation leads victims of pollution to behave less prosocially towards polluters. To deconstruct the causal link between environmental degradation and prosocial behavior, an experimental approach is used to test the behavior of pollution victims towards polluters in the field, along with gathering survey data on both victims’ and perpetrators’ knowledge and experiences of pollution. The findings from the field are then used as motivation for examining underlying behavioral mechanisms of being exposed to different types of information interventions in a more controlled online experimental setting.I observe the prosocial behavior of victims towards perpetrators, the intended environmental behavior of perpetrators, and the punishing (or rewarding) behavior of victims towards perpetrators who intentionally (or randomly) impose a negative externality. Using lab-in-the-field and survey experiments within Ghanaian gold mining districts, the first two chapters examine the behavior of real-world polluters and pollution victims in addition to their knowledge about negative environmental externalities stemming from small-scale gold mining activities.

The experiments in the field treat miners and non-miners as separate groups of people because non-miners are the group of people who are negatively impacted by miners' activities, and miners are the individuals imposing negative environmental externalities on non-miners. The Ghanaian gold mining districts are in rural settings, where non-miners are largely from farming communities separate from mining communities and within large enough distances that would be difficult to practically travel to and from. Furthermore, their occupational identity separates them both in terms of earnings potential and proximity to each other. Large tracks of farmland are usually lost to mining operations, so that a farming household would have to move further away from a mine in order to have productive farming activities (Assan and Muhammed, 2018).

In the first chapter, the prosocial behavior of pollution victims living in environmentally degraded regions within small-scale gold mining districts is observed in addition to what extent victims' knowledge and experiences of pollution had a role in this behavior. In the second chapter, polluters' knowledge about the negative environmental externalities they impose is collected along with their intended environmental behavior following an informational intervention. Based on the findings from the field, the last two chapters test the underlying behavioral mechanisms of having information on the exact size of a negative externality and on the intention of imposing a negative externality by using online experiments. In the third chapter, I ask whether reducing ambiguity in a negative externality impacts victims' prosocial behavior towards perpetrators by systematically varying information on the size of the negative externality. Finally, in the last chapter, I further test whether victims' information on intentionally preventing or imposing a negative externality impacts their behavior towards perpetrators.

Overall, the research findings demonstrate that the experience of environmental degradation does not lead to decreased prosocial behavior while the act of preventing a negative externality from being imposed is rewarded. The survey findings from the first two chapters also demonstrate that both polluters and pollution victims do not have full information about negative environmental externalities stemming from mining activities.

The rest of the thesis is organized as follows. In Chapter 1, I collect experimental evidence from Ghanaian artisanal gold mining districts. Developing countries have seen a surge in the small-scale mining sector at the cost of negative environmental externalities. I investigate whether these externalities have decreased prosocial behavior by examining the behavior and attitudes of potential pollution victims living in Ghanaian artisanal and small-scale gold mining ("ASGM") districts towards polluters. Using lab-in-the-field Dictator and prison sentence experiments, I measure the prosocial behavior and attitudes, respectively, of pollution victims towards ASGM community members and miners. I further exploit the natural variation in pollution victims' knowledge and experiences of ASGM pollution, as measured by our survey. Pollution victims were significantly more prosocial towards ASGM community members compared to community members more similar to themselves. Similarly, pollution victims' prosocial attitudes were higher towards an ASGM miner compared to an individual with an unidentified occupation. After ruling out alternative mechanisms for potential pollution victims' prosocial behavior and attitudes towards polluters, the results consistently showed that greater knowledge and experiences of ASGM pollution led victims to act more prosocially towards polluters. These results suggest an empathy mechanism amongst victims who have some knowledge and experience of ASGM pollution, and who may perceive ASGM miners and community members to also be victims of environmental poverty. Experiencing negative environmental externalities does not, by itself, lead to conflict or social tensions between groups of pollution victims and polluters.

The surge in ASGM has led to negative environmental and health outcomes largely due to the widespread use of mercury. In Chapter 2, I investigate whether having graphic information on mercury contamination through a video experiment will impact polluter attitudes and intended environmental behavior. Experimental and survey data were collected from 210 small-scale gold miners living in 21 different Ghanaian mining sites. I combined a video experiment with the following: a charity donation experiment and survey measures used as proxies for intended environmental behavior, and a survey experiment used as a proxy for a change in attitudes. In the video experiment, all miners were provided information on current ASGM practices, ASGM pollution, and cleaner technologies in video format, while treated miners were also provided with graphic images of Minamata Disease. In the charity donation experiment, all miners were asked whether they would like to donate any of their earnings to an NGO which was described in neutral terms, while treated miners received an additional description of the work focusing on environmental problems including health impacts from mining activities. Our small-scale miners were all from rural areas of Ghana, and had worked in this sector for an average of 8 years. 70% of the sample reported having some exposure to mercury, only 40% of them had knowledge about mercury contamination. However, while small-scale miners who were randomly assigned into watching the treated version of the video had a more negative attitude about the impact of ASGM on their local community, they did not show any positive changes in their intended environmental behavior.

In Chapter 3, I investigate how information about a negative externality may change victims' prosocial behavior. Inaccurate information about negative environmental externalities may lead to underestimation of their severity, which, in turn, can affect victims' behavior. The chapter answers whether reducing ambiguity in a negative externality impacts victims' prosocial behavior towards the individuals who impose them (the "perpetrators") by combining a real effort encryption task with a Dictator Game in an online experiment. Victims experienced a negative externality by their matched perpetrator through their payoff scheme, and were randomly assigned into an information treatment revealing the exact size of the negative externality imposed by their matched perpetrator. Victims then had to decide how much to give or take away from their matched perpetrator in a Dictator Game. A positive transfer amount was taken to indicate prosociality. Although victims assigned into the information treatment took away more tokens from their matched perpetrator compared to victims who did not receive this information, there was no significant difference in prosocial behavior between treated and untreated victims.

As shown in Chapter 1, pollution victims do not always behave in the same way towards polluters in different settings, and this discrepancy in behavior may be due to varying perceptions of whether the polluter made an intentional choice to pollute. Chapter 4 examines if intentions impact subjects' (victims') punishing or rewarding behavior towards the perpetrators of negative externalities. I assign victim and perpetrator roles and use a real effort encryption task with different payoff schemes that sometimes generate a negative externality onto the victim roles. I then systematically vary whether or not the victim roles' experience of a negative externality was due to the willful choice made by a matched perpetrator or a random choice made by the computer program. After victim roles experience their matched perpetrator roles' willful choice to impose or prevent a negative externality, victims then decide on how much they will give or take from their matched perpetrator in a Dictator Game. Victims who were randomly assigned into the treatment (Willful Choice) experienced the prevention or imposition of an externality by their matched perpetrator's intentional choice, while victims assigned into the control (Random Choice) experienced the prevention or imposition of an externality by the computer program. Subjects did not significantly differentiate between potential perpetrators willfully choosing to impose an externality and when the externality was imposed by the computer program. However, the willful choice of potential perpetrators to *prevent* an externality was significantly rewarded by subjects compared to when the externality was prevented by the computer program.

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Chapter 1

Environmental Degradation and Social Cohesion: Experimental evidence from Ghanaian artisanal gold mining districts*

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Abstract: Developing countries have seen a surge in the small-scale mining sector at the cost of negative environmental externalities. We investigate whether these externalities have decreased social cohesion by examining the behavior of potential pollution victims living in Ghanaian artisanal and small-scale gold mining ("ASGM") districts towards polluters. Using lab-in-the-field Dictator and prison sentence experiments, we measure the prosocial behavior and bias in justice views, respectively, of pollution victims towards ASGM community members and miners. We further exploit the natural variation in pollution victims' knowledge and experiences of ASGM pollution, as measured by our survey. Pollution victims were significantly more prosocial towards ASGM community members compared to community members more similar to themselves. Similarly, pollution victims had a a more positive bias towards justice for an ASGM miner compared to an individual with an unidentified occupation. After ruling out alternative mechanisms for potential pollution victims' prosocial behavior and biases in justice views towards polluters, the results consistently showed that greater knowledge and experiences of ASGM pollution led victims to act more favourably towards polluters. These results suggest an empathy mechanism amongst victims who have more knowledge and experience of ASGM pollution, and who may perceive ASGM miners and community members to also be victims of environmental poverty. Experiencing negative environmental externalities does not, by itself, lead to decreased social cohesion between groups of pollution victims and polluters.

Keywords: social cohesion, environmental degradation, Ghana, Artisanal and small-scale gold mining

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1.1 Introduction

The extractives resource industry plays an increasingly important role in the economic growth of developing countries, but negative environmental externalities stemming from this industry have given rise to local social conflicts occurring in resource extracting areas (Sexton, 2020). In these settings, incidences of non-violent protests, written petitions, and blockades (Temper et al., 2018) have occurred. For example, mining activities in Peru have led to both non-violent protests as well as violent conflict, stemming from livelihoods on farming communities being negatively impacted by mining activities (Economist Intelligence Unit, 2016). The Bougainville Civil War in Papua New Guinea occurred after copper production activities led to land and water pollution (Adamo, 2018). These social conflicts, however, have been targeted towards large-scale mining activities. Artisanal and small-scale mining ("ASM") has rapidly expanded in developing countries, employing an estimated 40.5 million people. At the same time, ASM is associated with very poor environmental practices that threaten livelihoods (IISD, 2014). Despite the negative externalities that the surge in ASM has imposed on local communities, research on how social cohesion between small-scale mining polluters and pollution victims has been impacted is scarce.

In this paper, we examine whether individuals living in environmentally degraded regions within artisanal and small-scale gold mining ("ASGM") districts in Ghana behave less favourably towards ASGM miners. Furthermore, we explore to what extent their knowledge and experiences of ASGM pollution will impact behavior. The study setting naturally lends itself to having distinct groups of polluters and potential pollution victims. The pollution victims in this research are largely made up of farming households ("non-miners"), while the polluters are small-scale miners. Using lab-in-the-field experiments, we first observe whether non-miners who live in ASGM districts are less prosocial towards ASGM community members. The prosocial behavior of non-miners towards ASGM community members is measured via a Dictator experiment, where the treatment identifies the recipient as a household living in a community with a large population of small-scale miners compared to a recipient in an unidentified community. Non-miners' bias in justice views towards ASGM workers are measured via a survey experiment, where a prison sentence recommendation is given for a hypothetical robbery. The treatment in the survey experiment identifies the robber as a small-scale miner, while the control does not identify the occupation of the robber. Surprisingly, we find that non-miners who were pollution victims donated more to mining communities and gave a lower prison sentence to small-scale miners.

Using survey responses, we further conducted exploratory analysis on how five different intervening mechanisms of knowledge and experiences of ASGM pollution influence prosociality by exploiting the natural variation in knowledge and experiences of mercury contamination, water pollution, and land degradation. How knowledge and experiences of ASGM pollution would drive non-miners' behavior towards miners was important to investigate because the direction of the potential impact was unclear. On the one hand, having more knowledge and experiences of ASGM pollution could lead to less prosocial behavior and a more negative bias in justice views towards miners because of a feeling of being victimized. On the other hand, it could lead to more prosocial behavior and a more positive bias in justice views because having awareness about ASGM pollution leads to a feeling of empathy towards miners who also live on the same degraded lands. For example, more knowledge and awareness about biases has been shown to reduce racial bias (Pope, Price, and Wolfers, 2018).

Natural variation in knowledge and experiences of ASGM pollution was expected because ASGM has both visible and immediate negative externalities as well as invisible and delayed ones. Mercury exposure and contamination are invisible and have delayed effects (Ha et al., 2017). ASGM is the largest mercury user and emitter (UNEP, 2020), and in ASGM regions the concentration of mercury in the air often exceeds typical industrial areas by a factor of 2000 (Gworek et al., 2017). However, evaporated mercury is colorless and odorless, and the health effects from mercury contamination may take a long time to show. It is also non-degradable, and bio-accumulates in the flesh of fish and other animals that eat contaminated food; and it can cause irreparable neurological damage (Zahir et al., 2005). The use of mercury has serious health implications for the wider population, which are currently not yet well understood by most citizens (Tschakert and Singha, 2007; Gibb and O'Leary, 2014). Evidence of elevated mercury exposure among the ASGM community (Basu, Renne, and Long, 2015) has been recognized as a serious health threat to surrounding community members (WHO, 2017). Mercury toxicity to crops and other plants is also well established, being detrimental to chlorophyll production, nutrient uptake, and water uptake (Zhou et al., 2007).

The more visible negative externalities from ASGM activities include water pollution and land degradation. The practice of dredging the riverbeds in search of the gold has led to silting up and additional pollution of river water (Hilson, 2002; S. O. Mensah et al., 2015). Cocoa farmers and downstream fishermen are among the groups most directly affected by inland ASGM and riverbed dredging, respectively (Aragón and Rud, 2016). Land degradation in ASGM regions is due to soil pollution and open-pit mining. Soil pollution may lead to decreases in the quality and/or quantity of crops being produced. ASGM workers also leave abandoned, open pits that further degrade the land and contribute to soil erosion (Seth Opoku Mensah, Okyere, and Author, 2014).

Out of 177 non-miner participants in our sample, experiences of environmental problems were reported in the following proportions: 50% reported polluted river water and/or seawater, 47% reported soil erosion, and 44% reported deforestation. Sixty percent of non-miners also believed that ASGM has led to pollution of the environment. As expected, experiences of negative environmental externalities were higher when they were more visible. Awareness and knowledge about mercury use and mercury contamination were low, with 30% being aware that mercury was used in ASGM and only 14% being able to answer a series of true-or-false questions about mercury contamination correctly.

Our findings suggest that the experience of environmental degradation has not led to decreased social cohesion between polluters and pollution victims. Non-miners actually behaved *more* prosocial towards ASGM community members compared to unidentified community members. Knowledge and experiences of ASGM pollution positively impacted pollution victims' prosocial behavior towards ASGM community members, and led to lower prison sentence recommendations towards small-scale miners. Pollution victims who had the following knowledge and experiences had a larger increase in prosociality towards polluters than non-miners who didn't: knowledge of mercury contamination, knowledge of mercury contamination combined with the experience of crop quality or quantity decrease due to water or soil pollution. The knowledge and experience mechanisms had a similar effect on non-miners' bias in justice views towards ASGM miners.

Overall, non-miners who had knowledge and experiences of ASGM pollution seemed to be more empathetic towards small-scale miners and ASGM communities. This may be true because non-miners perceive that local ASGM workers are experiencing the same (or even worse) negative environmental externalities. The study that most closely resembles this research utilizes lab-in-the-field experiments conducted in Namibia, with the finding that resource-dependence and scarcity are positively associated with anti-social behavior towards fellow commons users (Prediger, Vollan, and Herrmann, 2014). In the present research, environmental degradation is caused by the production processes of resource users who don't directly depend on the same natural resources they are degrading for their own livelihoods. ASGM miners in Ghana also have higher earning potential compared to non-miners. They are a distinct group of polluters within a high income generating industry who are imposing negative externalities on a distinct group of pollution victims in a low income generating industry. In this setting, it is also possible that miners may live in households with farmers, but this is controlled for in this research. Given this context, our findings are counter-intuitive and different from other studies.

This research contributes to the literature on environmental degradation and social cohesion by observing individual pollution victims' prosocial behavior and bias in justice views towards polluters. Furthermore, a focus on small-scale mining contributes to the literature on social tensions in the extractives industry in two ways. First, the polluters are not multi-national corporations but mostly individual citizens of Ghana. Although there have been reported disputes between farmers and ASGM operators over polluted land because of ASGM activities (McQuilken and Hilson, 2016), a large amount of the literature related to mining activities and social tensions is either between firms and communities or between large-scale miners and small-scale miners (Okoh, 2014). And, second, the ASGM sector is a significant driver of both development and negative environmental externalities that are more likely to lead to decreased social cohesion.

The imposition of negative environmental externalities on resource-dependent individuals may be perceived as an attack on their livelihoods. And, when individuals collectively experience grievances that threaten their livelihood, cooperation within this victimized group is necessary for survival. This type of cooperation naturally leads to more prosocial behavior towards the in-group (the "insiders" or "friends"), and more selfish behavior towards the out-group (the "outsiders" or "foes") (Grosjean, 2014). Theoretical models have shown that in-group altruism could have only evolved with out-group hostility (Choi and Bowles, 2007), and this has been evidenced in recent empirical work (Silva and Mace, 2014). Experimental economists have also observed that in-group altruism coincides with out-group hostility, and lab experiments in psychology have shown evidence of out-group discrimination (Ahmed, Mohammed, and Williams, 2007). Furthermore, micro-level empirical evidence shows that when collective action is spurred by victimization, this is also associated with erosion of social trust (Grosjean, 2014).

If we apply what we know about grievances and in-group/out-group behavior to how people might behave if they are experiencing negative environmental externalities, the expectation would be decreased social cohesion between pollution victims and polluters. However, negative environmental externalities are not always easily attributable to a source, and polluters are not always easily identified. When people have imperfect knowledge and experiences about negative environmental externalities, then the imposition of them does not clearly lead to distinct groups of pollution victims and polluters. The expectation that pollution victims will behave less prosocial towards polluters, therefore, is not an obvious one. This research demonstrated that pollution victims behaved more prosocially towards polluters, especially when they had more knowledge and experiences of pollution. However, pollution victims had limited knowledge about one of the most severe negative externalities in ASGM mining (mercury contamination). And, perhaps even viewed the polluters as pollution victims themselves. The results of the study, along with the fact that knowledge about ASGM pollution was limited amongst non-miners, point to pollution victims' favourable behavior towards polluters being driven by empathy.

Section 1.2 provides more details on the ASGM sector and its impacts in Ghana. Section 1.3 describes the data and research design, with the empirical strategy outlined in Section 1.4. Section 1.5 presents the results, with the discussion of the results in Section 1.6, and Section 1.7 concludes.

1.2 ASGM in Ghana

The estimated global value of ASGM is 25 billion USD, with over 70 countries participating and contributing up to 20% of the world's gold production (PlanetGOLD, 2020). At the same time, the ASGM sector contributes to "negative environmental, health, and social impacts" (Yankson and Gough, 2019). Residents of countries that have significant amounts of gold deposits often see ASGM as the only route out of poverty, and typically as a "get-rich-quick" scheme (Bonzongo et al., 2004). Rural communities, however, have experienced negative income and environmental impacts from ASGM activities despite the macroeconomic benefits accrued to the country as a whole (Hilson and Potter, 2003; Bulte et al., 2005; Pegg, 2006; Ayelazuno, 2014; Gamu, Billon, and Spiegel, 2015).

Ghana is a relevant country case study because it has a long history of ASGM (locally known as "galamsey") and industrial gold mining (Hilson and Potter, 2005), and is currently the largest gold producer in Africa. The large and sustained rise in global gold prices in the early 2010s led to a marked increase in ASGM activities, which accounts for around a third of Ghana's total gold production (Hilson, 2017). ASGM activities in Ghana have led to pollution of the air and water, degradation of the land, and negative health impacts. The areas in Ghana that have seen a surge in ASGM activities, such as around Pra River Basin (which includes parts of Ghana's Central, Western, and Ashanti regions), have seen encroachment on cocoa farmland and have been associated with significant levels of mercury contamination as evidenced by samples of water, soil, sediment, and human hair(Donkor et al., 2009). Alternative, cleaner production methods that do not rely on hazardous substances, e.g. direct smelting or the use of borax, already exist, but they are not yet widely used, in part because of a lack of knowledge and experience among informal mine owners (Amankwah et al., 2010; Appel and Na-Oy, 2014).

The importance of ASGM's income generation alongside its negative environmental externalities has been acknowledged in the United Nations Environment Programme's Minamata Convention on Mercury Pollution. Ghana signed on to the Minamata Convention in 2014 but has not yet ratified it. The recent boom in Ghana's ASGM activities along with the associated environmental pressures and challenges that came with the legalisation process of ASGM led policymakers to act urgently. The government of Ghana, therefore, implemented a ban on all ASGM activities, which was in effect from January 2017 to December 2018. The ban was subsequently lifted for ASGM sites with legal permits, but both legal and illegal ASGM activities resumed soon after. The government continues to grapple with illegal ASGM activities and has employed both military and police interventions to enforce regulations.

1.3 Data and Design

In this section, we describe the data collection strategy (Section 1.3.1), the experimental design (Section 1.3.2), and the survey design (Section 1.3.3).

1.3.1 Data Collection Strategy

In collaboration with Friends of the Nation (FoN), a Ghanaian socio-environmental advocacy NGO, the research team collected survey and experimental data from communities in Ghana living in small-scale mining districts. FoN ran a series of informal information workshops at mining sites they had not previously visited and allowed the research team to accompany them for data collection at and near mining sites. The data was collected between March and May 2019. Figure 1.1 below shows the map of ASGM districts visited in Ghana in dark grey.

The present paper uses a sample of participants that were randomly selected adult household members who lived within a 5-mile radius of an ASGM mining site. The sample was predominantly made up of households participating in farming activities, with 94% of them having reported farming as their main occupation. Since the sample of non-miners were all living in ASGM districts, they were all likely to have been affected by negative environmental externalities stemming from ASGM activities. Randomization was implemented as follows: upon arrival in a non-mining community, the research team went in opposite directions from where the group vehicle was parked and chose the second house on the left. If either no one was available at the second house or an adult member of the household was not available, the research team moved on to the third house from the left, and so on. Upon completion of the survey and experiments, the next respondent was sought from two houses further down the road. All subjects recruited agreed to participate. The research team administered the survey questionnaire and experiments to 177 participants from 6 different ASGM districts near 21 different mining sites. Local enumerators conducted the interviews and experiments on a one-to-one and face-to-face basis, in private.

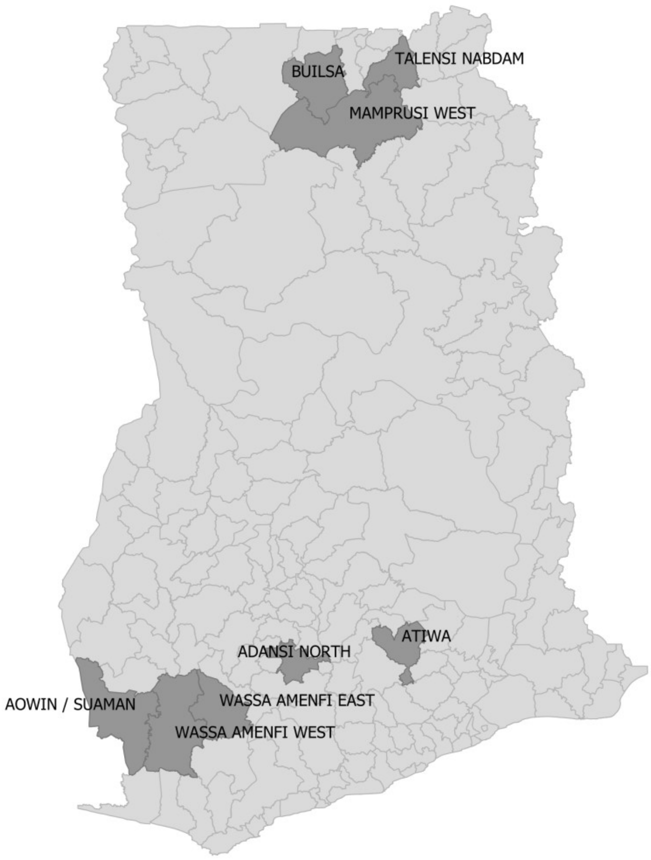

Figure 1.1: Map of Ghanaian ASGM districts visited by FoN for the first time, the same study areas of this research.

1.3.2 Experimental Design

The experimental design was pre-registered on the Open Science Framework on May 12, 2019.[1]. It includes two different, yet complimentary experiments that measure whether pollution victims act more or less favourably towards polluters. The Dictator experiment was designed to measure the outcome variable of prosocial behavior, where the treatment measured how prosocial non-miners were towards individuals living in small-scale miner

[1]https://osf.io/vh2af

communities compared to individuals living in an unidentified community. The Survey experiment was designed to measure the outcome variable of non-miners' bias in justice views towards an individual who was identified as a small-scale miner compared to an individual who had an unidentified occupation.

Although both outcome measures are complimentary, they are distinct in methodology and are measuring different types of responses from pollution victims by looking at both sides of the same coin. Measuring prosocial behavior captures an incentivized action towards ASGM community members, while measuring bias in justice views captures an unincentivized bias view towards individual small-scale miners. We use a between-subject design, where all subjects participated in both the Dictator and Survey experiments. The order in which the experiments were administered to subjects was randomized. Overall, 92 subjects were in the treated version of the experiments and participated in the Survey experiment first, while 85 were in the control group and participated in the Dictator Experiment first.

Prosocial Behavior

The Dictator Game has been well established in behavioral economics as being a good measure of prosocial behavior (Forsythe et al., 1994; Eckel and P. J. Grossman, 1996; Whitt and Wilson, 2007), and was used similarly in the present research. After responding to the main survey questions, each subject received 40 GHS in 5 GHS bills in an envelope. These were stated to be the subject's earnings for the main survey. Subjects were then asked whether they would like to share these earnings with an anonymous household, where the treatment consisted of varying the description of the receiver (see Appendix A.6 for the full script).

In the control group, participants were told that the receiver would be a randomly selected household from "a village in the next district similar to yours" (referred to as a "neutral household" from now on). The "unidentified" or "neutral" household in the control group is most likely to be made up of households that live in farming communities. Information on the occupation of non-miners in the sample also reveal that most non-miners living in ASGM districts are farmers. Participants in the treatment group were told the receiver would be a randomly selected household from "a village in the next district similar to yours, except that it also has a large population of small-scale (galamsey) miners" (the "ASGM Community Treatment").

In both the control and treatment conditions, we are providing more information than typical in a Dictator experiment since the recipient is usually a completely anonymous person. By stating that the recipient will be a household in a village similar to theirs, we are decreasing the social distance between the Dictator and the recipient. When providing additional information in a Dictator experiment that decreases social distance, Dictator offers become more generous (Goeree et al., 2010). The recipient in the control group is someone identified to be similar to the Dictator, while the recipient in the treatment group is someone identified to be living in a mining community. In this rural setting, mining communities are separated from farming communities and are physically and thus socially distant from one another.

While the enumerator turned away, the respondent placed any shared money in a second envelope with the respondent ID on it and put it in an opaque box that was pre-marked either "Miner" for the treatment, or left unmarked for the control. Since subjects are told that the money will be received by someone who lives in a community with small-scale miners, the likelihood that the money will be sent to a small-scale miner is high. It's not a direct proxy for prosocial behavior towards an individual small-scale miner, so the interpretation of non-miners' prosocial behavior will be towards small-scale miner communities rather than towards small-scale miners.[2]

In this Dictator Experiment, we examine whether non-miners' prosocial behavior is different towards households living in an ASGM community compared to a "neutral" household. The outcome variable is the *Money Amount Sent*, and Table 1.1 shows that the treated group sent more money to a household in a small-scale miner community compared to a neutral household. The summary statistics table also shows that the difference in the means between the treatment and control groups is significant.

Bias in Justice Views

The survey experiment is a variation of the experiment carried out by Goldberg (1968).[3] Although variations of this experiment have been used in gender research to reveal gender biases, it has also been replicated to show other biases such as religious bias or discrimination between different groups of people (Bertrand and Duflo, 2016).

In this research, victims' bias in justice views towards small-scale miners were measured through a survey experiment, where subjects were asked to recommend a prison sentence for a robber. The treatment provides an additional piece of information where the robber

[2]The measure needed to be more indirect since it would be difficult to ensure that the money would in fact be received by a small-scale miner given logistical complications in the field. A more direct proxy of behavior towards a small-scale miner is used in the prison sentence experiment described below.

[3]In the Goldberg experiment, only one piece of information on identity was manipulated in order to see whether this identity had an impact on how subjects evaluated peoples' performance. Students were asked to grade written essays that were identical except for the gender-specific name of their author. The results of this initial Goldberg experiment showed that a gender bias exists since authors with a female name were given lower grades.

is also identified as a small-scale gold miner, while the robber in the control group had an unidentified occupation. Specifically, subjects were given a robbery case scenario where the crime was having stolen a food vendor's earnings of the day, and were asked what prison sentence they would recommend if they had to issue a sentence ranging from 0 to 15 years. Since official crime rates are relatively low in Ghana (Macrotrends, 2022), an example of a small-scale crime that can plausibly occur in a rural setting in Ghana was used. The following vignette was presented to subjects in the treated version, with the wording in bold being the only difference in the treatment:

"We would now like to ask you to state what your decision might be in the following robbery case: Robbery cases are on the rise in Ghana. In the first quarter of 2018, 968 robbery cases were reported. Recently, a nearby food vendor was robbed. Crimes like this carry a maximum sentence of 15 years. Imagine you are asked to judge how much time this person should spend in prison for this crime. Here are the case details: A 28-year-old male, ***a small-scale miner*** *who lives in the community, was seen stealing all of the food vendor's earnings of the day (around 500 Cedis). He was unarmed, and this was his first criminal offense. Police officers arrested him shortly after the incident, but they were unable to recover the stolen cash. What sentence would you recommend? You can choose any number between 0 and 15."*

Before making a prison sentence recommendation, the treated subjects were told that a 28-year-old male robber was a "small-scale miner". The effect that occupational identity has is more directly tested in this experiment compared to the Dictator Game. The higher the prison sentence recommendation is in the small-scale miner treatment, the more negative non-miners' bias in justice views is towards individual small-scale miners compared to an individual who had an unidentified occupation.

Bias in justice views is measured by the variable *Prison Year Category* (described in Section 1.4.2 below). Table 1.1 shows that the treated non-miner group recommends a slightly larger prison sentence towards a robber who has been identified as a small-scale miner.

1.3.3 Survey Design

The survey consisted of the survey questionnaire, survey experiment, and Dictator experiment. Prior to administering the survey, a consent statement was read to participants where each individual was told that participation was purely voluntary, and that all data collected would be anonymous (see Appendix A.6 for full consent statement). Participants were also told they would receive a payment of 40 Ghanaian Cedis (GHS, equivalent to

£6.50 at the time) if they completed the entire survey. After consent was provided, the survey questionnaire was completed first. The survey questionnaire included questions on socio-economic characteristics, along with a series of questions on knowledge and experiences of pollution related to ASGM activities. The main purpose of the data collected from the survey was to see whether knowledge and experiences of ASGM pollution were important driving channels in the decisions made in the experiments. Upon completion of the main body of the survey, subjects participated in the Dictator and Survey experiments. The order of the experiments was randomized. Each time the experiment was administered first, participants received earnings prior to the last survey question. Receiving earnings earlier, however, did not interfere with the final questions being asked as all participants answered all questions.

Survey Questionnaire

The first section of the survey questionnaire consisted of socio-economic variables such as age, gender, education, living condition, whether an ASGM worker lived in the household, whether the respondent lived in an urban area, and how many years the respondent lived in the district. The second section of the survey consisted of questions related to the natural and physical environment and gold mining, which captured variables related to knowledge and experiences of ASGM pollution. The third section of the survey consisted of the Dictator and survey experiments, with a final section on attitudes. The data from the attitudes section were not used in the empirical analysis since there was little variation in self-reported attitudes towards different groups of people. A review of the characteristics of the study participants are presented by treatment and control in Table 1.1 below, and the summary statistics show that the demographic and socio-economic characteristics in both the treated and untreated groups are similar. In the sub-section below, the variables that measure knowledge and experiences of negative environmental externalities related to ASGM activities are described.

Knowledge and Experiences of ASGM Pollution

The two most direct questions about knowledge of ASGM pollution were concerning mercury use and mercury contamination. Survey statistics revealed that only 30% of non-miners had ***Awareness of Mercury Use***[4] in their local area, while 58% had ***Knowledge of Mercury Contamination (MC)***[5] in ASGM.

Respondents' experiences of the natural and physical environment in which they live

[4]A dummy variable equal to one when respondents answered yes to mercury being used for small-scale gold mining in their local area.

[5]A dummy variable equal to one was when respondents answered yes to the statement that mercury contamination can be caused by small-scale gold mining.

Table 1.1: Summary Statistics of sampled Ghanaian communities

	Treated	Untreated	Difference	Std. Error
Money Amount Sent	5.3297	4.4767	-0.8529*	0.4812
Prison Year Category	1.2283	1.0824	-0.1459	0.1095
Age	47.6484	50.1512	2.5028	2.0415
Male	0.7473	0.7558	0.0086	0.0654
Education	2.5385	2.5465	0.0081	0.2617
Living condition	2.5714	2.5698	-0.0017	0.1399
ASGM worker in HH	0.2527	0.2674	0.0147	0.0663
Urban	0.1758	0.2791	0.1032	0.0628
Years in district	27.3187	29.9186	2.5999	2.6225
Awareness of mercury use	0.3187	0.2674	-0.0512	0.0688
Knowledge of MC	0.5714	0.5930	0.0216	0.0746
High-likelihood of MC	0.7253	0.6279	-0.0974	0.0703
ASGM caused envprobs	1.3846	1.1744	-0.2102	0.1508
Ban improved water quality	0.5714	0.3953	-0.1761**	0.0744
Worsened water quality	0.2198	0.1977	-0.0221	0.0615
Observations	177			

* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

and work included ***Worsened water quality***[6] since it is one of the more visible negative environmental externalities of ASGM, with 21% of non-miners reporting this as an environmental problem.

Since mercury contamination could lead to decreases in crop yields, respondents were also asked whether there had been any noticeable changes in the quantity or quality of their main crop grown in the past two years. However, only 9% of non-miners reported ***Crop QQ Decrease***.[7]

We also collected information about the effects of ASGM on respondents' local community, and the impact of the government's ASGM ban on the environment. Responses were based on a 5-point Likert scale (from Strongly Disagree to Strongly Agree) to a series of statements. 49% of non-miners believed that the ***Ban Improved Water***.[8]

We then aggregated the most direct measures of ASGM caused pollution responses by combining reported deforestation in the community (25%), people who strongly agreed or agreed that ASGM has led to pollution of the natural environment (60%), and people who cited ASGM as the main cause of environmental problems in the community (25%) to construct the variable ***ASGM caused environmental problems***.

[6] A dummy variable representing was constructed for respondents who reported worsened quality of drinking/cooking water and/or river water/seawater.

[7] A dummy variable if respondents reported a decrease in quality or quantity of the main crop grown due to either soil or water pollution.

[8] A dummy variable equal to one if people strongly agreed or agreed that the ban on ASGM improved the quality of their drinking/cooking or river water/seawater.

We also measured less visible negative health externalities via a series of questions on health problems that are commonly associated with mercury contamination - whether or not they, or anyone in their household, had any of 10 different health problems in the past twelve months. These questions were asked to see if the results would still hold after controlling for the variable***High-Likelihood of Mercury Contamination (MC)***[9]. Approximately 68% of non-miners experienced a ***High-Likelihood of MC***[10].

1.4 Empirical Strategy

In this section, the empirical strategy for the experimental outcome variables of prosocial behavior and bias in justice views is described first (Sections 1.4.1 and 1.4.2). Next, heterogeneous treatment effects analysis is described and used to account for intervening mechanisms that should impact the outcome variables (Section 1.4.3). The purpose of the experimental analysis is to see how favourable non-miners are towards households living in ASGM community members and towards individual small-scale miners. The purpose of the heterogeneous treatment effects is to conduct exploratory analysis on whether real-world variation in knowledge and experiences of pollution impacts non-miners' behavior towards ASGM miners.

1.4.1 Prosocial Behavior

To evaluate whether the treatment in the Dictator Experiment had an effect on non-miners' prosocial behavior towards households living in ASGM communities compared to neutral households, the following Tobit regression model is run:

$$y_{i,j} = \begin{cases} y^*_{i,j} \text{ if } y^*_{i,j} & > 0 \\ 0 \text{ if } y^*_{i,j} & \leq 0 \end{cases}$$

$$\begin{aligned} y^*_{i,j} = \alpha &+ \beta ASGMCommunityTreatment_{i,j} \\ &+ \gamma BasicControls_{i,j} + \delta EnvironmentalControls_{i,j} + \epsilon_{i,j} \end{aligned} \tag{1.1}$$

where the dependent variable, $y_{i,j}$, is the money amount sent of individual i in community j to a randomly selected household in a similar district approximately two hours away.

[9]A dummy variable was constructed if respondents answered yes to one or more acute level mercury contamination symptoms (hearing loss, uncoordinated walking or movements, intense coughing and shortness of breath, muscle weakness, and any birth defects of children born in the household).

[10]Though non-miners experienced these symptoms, they were not associating them to mercury contamination. This is evidenced in the survey statistics, with only 24% knowing that mercury accumulates in fish, 19% knowing it can cause muscle twitching and tremors, and only 16% knowing that mercury enters a mother's breast milk. *High-Likelihood of MC* is thus only used as an environmental control variable, as it would be highly unlikely that non-miners will attribute these symptoms to ASGM activities. That being said, it is an important control variable to have in the regression analysis as non-miners in this study were living in ASGM districts and a high percentage of them had mercury contamination health symptoms that may impact decision making.

$ASGMCommunityTreatment_{i,j}$ stands for individual i in community j having received the ASGM community treated version of the Dictator Game, with the additional information of the household they are sending money to being in a village with a large population of small-scale miners. $BasicControls_{i,j}$ is a vector of individual and household level control variables captured in the survey including age, gender, education, the number of years an individual lived in the district, whether there's an ASGM worker in the household, living in a mostly urban area, and the household's living condition. $EnvironmentalControls_{i,j}$ is a vector of the following four correlates discussed in Section 1.3.3 above: *Awareness of Mercury Use*, *High-likelihood of MC*, *ASGM caused environmental problems*, and *Worsened water quality*. All observations are clustered at the community level.

1.4.2 Bias in Justice Views

To evaluate whether the treatment in the Survey Experiment led to a bias in justice views towards individual small-scale gold miners compared to individuals with an unidentified occupation, the following ordered probit regression model is run:

$$p_{i,j} = \begin{cases} 0 \text{ if } p^*_{i,j} = 0 \\ 1 \text{ if } 0 \leq p^*_{i,j} < 4 \\ 2 \text{ if } 4 \leq p^*_{i,j} < 9 \\ 3 \text{ if } 9 \leq p^*_{i,j} \end{cases}$$

$$\begin{aligned} p^*_{i,j} = \alpha + \beta MinerTreatment_{i,j} + \gamma BasicControls_{i,j} \\ + \delta EnvironmentalControls_{i,j} + \epsilon_{i,j} \end{aligned} \tag{1.2}$$

where the dependent variable $p_{i,j}$, is the prison year category that individual i in community j placed an individual committing a robbery based on the number of prison year(s) the individual recommended. *PrisonYearCategory* is the number of prison years recommended divided into four natural categories that formed based on the distribution of the data (see Figure A.1). $MinerTreatment_{i,j}$ stands for individual i in community j having received the *MinerTreatment* version of the Survey Experiment, with the additional information of the robber being a small-scale miner. $BasicControls_{i,j}$ and $EnvironmentalControls_{i,j}$ are the same control variables captured in the survey as mentioned in equation 1.1 above. Standard errors are clustered at the community level.

1.4.3 Treatment Effect Differences on Prosocial Behavior and Bias in Justice Views

Since individuals in the real-world have varying knowledge and experiences of pollution, the behavior of pollution victims towards polluters is not obvious. The survey data collected revealed that non-miners have imperfect information about ASGM pollution, and have varying levels of experiencing pollution stemming from ASGM activities. The empirical analysis of the main treatment effects is, therefore, insufficient on its own. The next step in the analysis was investigating how the natural variations in individual knowledge and experiences of ASGM pollution impacted the experimental outcomes of prosocial behavior and bias in justice views. The difference in the treatment effects of non-miners who have knowledge and experiences of ASGM pollution and non-miners who don't is calculated as follows.

The expected value of the outcome variables for non-miners who have been treated and have knowledge and experiences of ASGM pollution is given by the following interaction model:

$$E[Y_{i,j}|Z_{i,j} = 1, I_{i,j} = 1] = \alpha + \beta Z_{i,j} + \gamma \vec{I}_{i,j} + \delta Z_{i,j} * \vec{I_{i,j}} + \epsilon_{i,j} \tag{1.3}$$

where $Y_{i,j}$ is $MoneyAmountSent_{i,j}$ in the Dictator experiment or the $PrisonYearCategory_{i,j}$ in the Survey experiment. $Z_{i,j}$ represents a proxy for the $ASGMCommunityTreatment_{i,j}$ in the Dictator experiment, or the $MinerTreatment_{i,j}$ in the Survey experiment. $I_{i,j}$ is a proxy for a vector of the following variables: (1) *Knowledge of Mercury Contamination*, (2) *Awareness of Mercury Use* and *Knowledge of Mercury Contamination*, (3) *Knowledge of Mercury Contamination* and *Worsened water quality*, (4) *Knowledge of Mercury Contamination* and *Ban Improved Water*, and (5) *Knowledge of Mercury Contamination* and *Crop QQ Decrease.*

The expected value of the outcome variables for non-miners who have not been treated and have knowledge and experiences of ASGM pollution on the outcome variables is given by:

$$E[Y_{i,j}|Z_{i,j} = 0, I_{i,j} = 1] = \alpha + \gamma \vec{I}_{i,j} + \epsilon_{i,j} \tag{1.4}$$

The treatment effect for non-miners who have knowledge and experiences of ASGM pollution is therefore the difference between equations 1.3 and 1.4:

$$\tau = \beta + \delta \tag{1.5}$$

The expected value of the outcome variables for non-miners who have been treated and don't have any knowledge or experiences of ASGM pollution is given by:

$$E[Y_{i,j}|Z_{i,j} = 1, I_{i,j} = 0] = \alpha + \beta Z_{i,j} + \epsilon_{i,j} \tag{1.6}$$

The expected value of the outcome variables for non-miners who have not been treated and don't have knowledge and experiences of ASGM pollution is given by:

$$E[Y_{i,j}|Z_{i,j} = 0, I_{i,j} = 0] = \alpha + \epsilon_{i,j} \tag{1.7}$$

The treatment effect for non-miners who don't have any knowledge or experiences of ASGM pollution is therefore given by the difference between 1.6 and 1.7:

$$\tau = \beta \tag{1.8}$$

And, finally, the change in treatment effects for non-miners who have knowledge and experiences of ASGM pollution is thus given by taking the difference between equations 1.5 and 1.8:

$$\Delta\tau = \Sigma\delta \tag{1.9}$$

The change in treatment effects is needed to analyze the impact of having knowledge and experiences of ASGM pollution on the outcome variables of prosocial behavior and bias in justice views. In parallel to the main treatment effects analysis in Sections 1.4.1 and 1.4.2, Tobit regression models are run for the empirical analysis in the Dictator experiment, and Ordered Probit regression models are run for the empirical analysis in the Survey experiment. The same basic and environmental variables are added as controls.

If the change in TE leads to a larger positive effect on *Money Amount Sent*, non-miners who had knowledge and experiences of ASGM pollution behaved more prosocial towards

ASGM communities compared to non-miners who had no such knowledge or experience. And, if the change in TE leads to a larger negative effect on *Prison Year Category*, non-miners who had knowledge and experiences of ASGM pollution would have a more positive bias in justice views towards small-scale miners compared to non-miners who had no such knowledge or experience.

1.5 Results

1.5.1 Prosocial Behavior

Figure 1.2 shows a shift towards higher giving in the treatment group, with non-miners giving more to households living in ASGM communities compared to neutral households (as defined in Section 1.4.1). Table 1.2 displays the results of the Tobit regressions where the *Money Amount Sent* by non-miners (Y=0, 5, 10, 15, 20, 25, 30, 35, or 40 Ghanian Cedis) is regressed on *ASGMCommunityTreatment* (x=1 if non-miners received the treated version of the Dictator Game, as described in Section 1.3.2). At the 5% significance level, non-miners sent more money (an average of 5.33 GHS) in the treatment group compared to non-miners in the control group (an average 4.48 GHS sent). The significance level of the treatment effect remains unchanged, and the magnitude stays about the same even after adding basic and environmental controls. As discussed in the introduction, the literature on environmental grievances combined with the literature on in-group and out-group behavior suggest that non-miners should be less prosocial towards individuals living in ASGM communities. However, the results of the Dictator Experiment show that non-miners are significantly more prosocial towards households living in ASGM communities than towards neutral households.

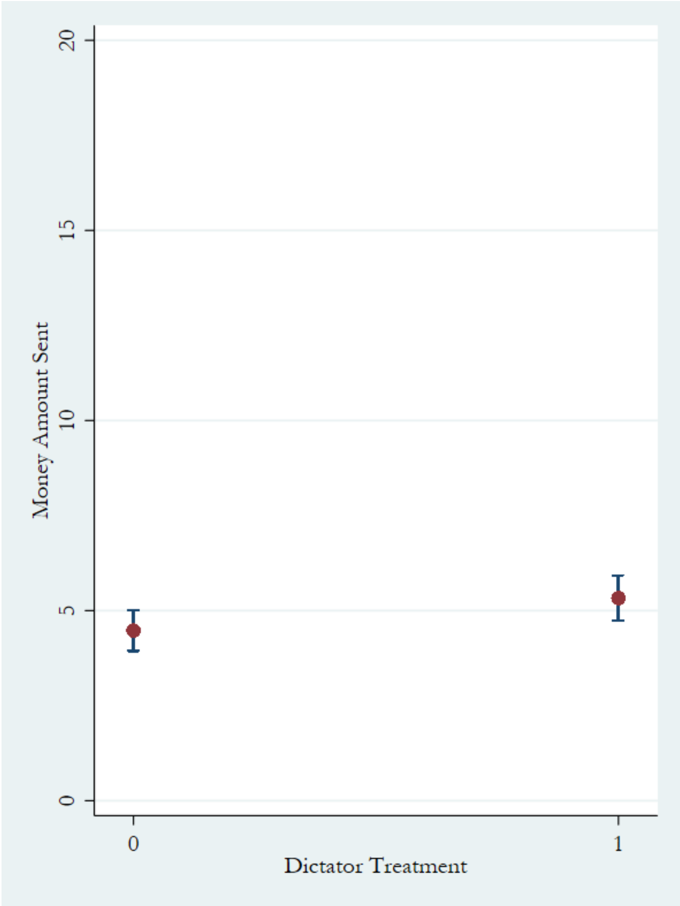

Figure 1.2: Mean of Money Amount Sent (Y=0, 5, 10, 15, 20, 25, 30, 35, or 40 Ghanian Cedis) in Control vs. ASGM Community Treatment with 90% Confidence Intervals.

Result 1: Non-miners behaved more prosocial towards small-scale mining communities than towards communities that were more similar to theirs.

Intervening Mechanisms

In this section, we explore the relationship between intervening mechanisms, namely knowledge and experiences of ASGM pollution, and *Money Amount Sent*. The results presented in this section provide correlational evidence, as any knowledge or experiences of ASGM pollution were not exogenous variables. The change in treatment effects ("TE") model given in Section 1.4.3 is used to observe any difference in prosocial behavior for those non-miners who have knowledge and experiences of ASGM pollution compared to those who don't. The knowledge channel alone is tested first by using *Knowledge of MC*, followed by *Knowledge of MC* and *Awareness of Mercury Use*. The knowledge and experience channel is explored by combining non-miners' *Knowledge of MC* with three different measures of pollution experienced related to ASGM activities. The following survey variables, as described in Section 1.3.3, are used as proxies for the experience of ASGM pollution: *Worsened Water Quality*, *Ban Improved Water Quality*, and *Crop*

Table 1.2: Tobit Regression Results of ASGM Community Treatment Effect on Money Amount Sent

Money Amount Sent (0 - 40 GHS, 5 GHS increments	(1) Main effect	(2) + Basic controls	(3) + Env. controls
ASGM Community Treatment	0.981**	0.943**	1.003**
	(0.464)	(0.474)	(0.475)
Age		0.0768**	0.0747**
		(0.0332)	(0.0310)
Male		-1.265*	-0.998
		(0.692)	(0.638)
Education		0.215	0.0607
		(0.175)	(0.226)
Living condition		0.341	0.420
		(0.368)	(0.281)
Years in district		-0.0517***	-0.0550**
		(0.0198)	(0.0229)
ASGM in HH		1.282*	1.172
		(0.690)	(0.807)
Urban		-0.984	-0.281
		(0.640)	(0.687)
Awareness of mercury use			0.298
			(1.025)
High-likelihood of MC			0.0749
			(0.534)
ASGM caused envprobs			-0.411
			(0.548)
Worsened water quality			2.831***
			(0.869)
Constant	4.103***	1.267	1.104
	(0.606)	(1.731)	(1.585)
Pseudo R^2	0.003	0.030	0.050
F	4.466	4.086	7.440
p_value	0.036	0.000	0.000
obs	177	177	177
left_censored	30	30	30
right_censored	0	0	0
uncensored	147	147	147

Standard errors in parentheses

* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Notes: The ASGM Community Treatment dummy equals one if non-miners were randomly chosen to play the treated version of the Dictator Game, with the receiver being from a household living in an ASGM community. Column (1) only includes the treatment effect, column (2) also includes the basic control variables, and column (3) includes both the basic and environmental control variables.

QQ Decrease. Sub-sample analysis was also conducted by knowledge and experiences of ASGM pollution (see see Appendix A.1), but this analysis was not powered enough to observe any significant effects. Nevertheless, knowledge or experiences of ASGM pollution are associated with more positive token transfers overall and decreased prison sentence recommendations in both treatment conditions.

Table 1.4 below displays the change in the TE on *Money Amount Sent* when non-miners have knowledge of mercury contamination, knowledge of mercury contamination and awareness of mercury use, and knowledge combined with experiences of ASGM pollution ($Worsened Water$ *Quality*, *Ban Improved* $Water$ *Quality*, and *Crop QQ Decrease*).

Knowledge Simply living in an environmentally degraded setting may not be enough to change pollution victims' behavior towards polluters if pollution victims have no knowledge about the cause of the degradation. Knowledge that mercury contamination can be caused by ASGM is the chosen proxy variable for knowledge, as it is the most direct knowledge measure related to ASGM pollution in this setting. Fifty-eight percent of non-miners in this study had *Knowledge of MC*. Table 1.3 below displays the Tobit regression results, on the interaction of the *ASGMCommunityTreatment* with *Knowledge of MC* (x=1 if the participant answered "True" to the statement that "Mercury contamination can be caused by ASGM"), and on other covariates. At the 10% significance level, giving non-miners the *ASGMCommunityTreatment* when they have *Knowledge of MC* leads to a 2.8 GHS larger giving effect compared to treated non-miners who don't have this knowledge. The effect stays positive and significant after adding basic and environmental controls.

Knowledge and Awareness. Since people may have knowledge about mercury contamination but not know whether mercury is being used in ASGM activities in their local vicinity, we test the impact both knowledge of mercury contamination and awareness of mercury use has on *Money Amount Sent*. Although mercury use is widely prevalent within the ASGM industry in Ghana, only about 30% of non-miners report having awareness of mercury use in ASGM activities in their local area. Since there is a low percentage of mercury use awareness among non-miners in this study, power is lost by including this variable in the interaction term. However, it's still important to see the direction of the effect because a non-miner may have awareness of mercury use but have no knowledge of mercury contamination or vice versa. Table 1.4 reports the change in TE on the money amount sent for non-miners who have knowledge and awareness. Although this interaction effect is insignificant, the direction of the change in TE is consistently positive in all estimations. In the main effect estimation, there is a 1.64 GHS larger treatment effect for non-miners

Table 1.3: Tobit Regression Results - Effect of *Treatment*Knowledge of MC* on Money Amount Sent

Money Amount Sent (0 - 40 GHS, 5 GHS increments	(1) Main effect	(2) + Basic controls	(3) + Env. controls
Treatment	-0.653	-0.121	-0.003
	(0.451)	(0.433)	(0.510)
Knowledge of MC	-0.338	-0.263	0.0645
	(0.728)	(0.715)	(0.763)
Treatment × Knowledge of MC	2.809***	1.833*	1.819*
	(1.058)	(0.997)	(1.018)
Age		0.068**	0.066**
		(0.033)	(0.030)
Male		-1.121*	-0.854
		(0.637)	(0.593)
Education		0.184	0.0422
		(0.198)	(0.230)
Living condition		0.318	0.354
		(0.375)	(0.289)
Years in district		-0.046**	-0.050**
		(0.0201)	(0.0212)
ASGM worker in HH		1.122*	1.064
		(0.676)	(0.708)
Urban		-0.850	-0.137
		(0.584)	(0.604)
High-likelihood of MC			0.110
			(0.582)
ASGM caused envprobs			-0.556
			(0.448)
Worsened water quality			2.816***
			(0.870)
Constant	4.318***	1.767	1.671
	(0.482)	(1.723)	(1.492)
Pseudo R^2	0.015	0.034	0.057
F	4.882	5.379	11.15
p_value	0.003	0.006	0.000
obs	177	177	177
left_censored	30	30	30
right_censored	0	0	0
uncensored	147	147	147

Standard errors in parentheses

* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Notes: The ASGM Community Treatment dummy equals one if non-miners were randomly chosen to play the treated version of the Dictator Game, with the receiver being from a household living in an ASGM community. The Knowledge of MC dummy equals one if non-miners answered "True" to the statement that mercury contamination can be caused by ASGM. Column (1) only includes the treatment effect, column (2) includes the basic control variables, and column (3) includes both the basic and environmental control variables.

who have both knowledge and awareness. The change in TE estimates for this interaction comes from the Tobit regression results displayed in Table A.4, where the *Money Amount Sent* is regressed on the interaction of the *ASGMCommunityTreatment* with *Knowledge of MC* and *Awareness of Mercury Use* (x=1 if the participant answered "yes" to being aware of mercury use in ASGM within their local area), and on other covariates.

Table 1.4: Change in treatment effect from knowledge and experience of pollution

	Main effect	Basic controls	Env controls
Knowledge of MC	2.809*	1.833*	1.819*
	(1.058)	(0.997)	(1.018)
Knowledge and Awareness	1.642	0.928	1.107
	(3.324)	(3.070)	(3.076)
Knowledge and Worsened Water	1.248	-0.024	0.063
	(3.039)	(3.006)	(2.790)
Knowledge and Ban Improved Water	1.299	0.426	0.672
	(2.313)	(2.384)	(1.986)
Knowledge and Crop QQ Decrease	0.299**	0.574*	0.571**
	(3.742)	(3.487)	(3.115)

Standard errors in parentheses

* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Notes: The change in TE is the difference between the treatment effect of non-miners who have knowledge and experiences of ASGM pollution and the treatment effect of non-miners who don't. The dependent variable is Money Amount Sent. Tables A.4-A.7 in Appendix A.3 show the full Tobit regression results.

Knowledge and Worsened Water. Although the quality of the ground and surface water in Ghana has worsened because of the surge in ASGM activities (Yeleliere, Cobbina, and Duwiejuah, 2018), 22% of treated non-miners reported worsened water quality. Table 1.4 reports the change in TE on the money amount sent for non-miners who have knowledge and experiences of worsened water quality. The main effect is positive but insignificant, and the magnitude decreases by a lot after basic and environmental variables are controlled for. The change in TE estimates for this interaction comes from the Tobit regression results displayed in Table A.5, where the *Money Amount Sent* is regressed on the interaction of the *ASGMCommunityTreatment*, $Worsened\ quality\ of\ water$ (x=1 if the participant reported a change that has worsened in the quality of the drinking/cooking and/or river water/seawater over the past 2 years), and $Knowledge\ of\ MC$ along with other covariates.

Knowledge and Ban Improved Water. About 49% of non-miners believed that the ASGM ban improved their water quality, suggesting they perceived ASGM was worsening their water quality. Table 1.4 reports the change in TE on the money amount sent for non-miners who have knowledge and experiences of an improvement in their water quality due to the ban on ASGM. Again, though the interaction effect is insignificant, the direction of the change in TE is consistently positive in all estimations. In the main effects estimation, there is a 1.3 GHS larger treatment effect on giving for non-miners who had knowledge and stated the ASGM ban improved their water quality. The change in TE estimates for this interaction comes from the Tobit regression results displayed in Table A.6, where the *Money Amount Sent* is regressed on the interaction of the *ASGMCommunityTreatment*, *Ban Improved Water Quality* (x=1 if the participant agreed or strongly agreed to the statement that "The ban improved the quality of the drinking and cooking water in my local community"), and *Knowledge of MC* along with other covariates.

Knowledge and Crop QQ Decrease. Out of the treated non-miners, 11% stated that the quality or quantity of their main crops grown decreased due to water or soil pollution. Though the percentage of non-miners who have this specific knowledge and experience of ASGM pollution interaction is quite low, the interaction of knowledge and *Crop QQ Decrease* is important because it is the most direct measure of ASGM pollution attacking livelihoods. Table 1.4 reports the change in TE on the money amount sent for non-miners who have knowledge and experiences of *Crop QQ Decrease.* At the 5% significance level, non-miners who have knowledge of mercury contamination and have experienced a decrease in the quality or quantity of their crops due to water or soil pollution leads to a larger giving treatment effect (.3-.6 GHS). The change in TE estimates for this interaction comes from the Tobit regression results displayed in Table A.7, where the *Money Amount Sent* is regressed on the interaction of the *ASGMCommunityTreatment*, *Crop QQ Decrease* (x=1 if the participant stated that the quality or quantity of the main crop grown in the household has decreased over the past 2 years because of water or soil pollution), and *Knowledge of MC* along with other covariates.

Result 2: Non-miners who have knowledge and experiences of ASGM pollution have an overall larger positive treatment effect on prosocial behavior compared to non-miners who don't have the same knowledge and experiences. This larger positive treatment effect is significant in two intervening mechanisms, *Knowledge of MC* alone, and *Knowledge of MC* interacted with *Crop QQ Decrease.*

Alternative Mechanisms

Identifiability. One explanation for positive giving in the treatment might be that giving non-miners additional information about the receiver in the Dictator Game makes the receiver more identifiable. In charitable contribution experiments, for example, it has been shown that people make higher donations when the receivers of the donation are more identifiable (Small, Loewenstein, and Slovic, 2007). For this reason to be true, however, there would have to be consistency in positive giving whether or not non-miners have knowledge and experiences of ASGM pollution. The data analysis within the heterogeneous treatment effects helps to eliminate identifiability as a driver of the treatment effect. For example, when non-miners don't have knowledge and experiences of ASGM pollution, they consistently send either about the same or less money to households in ASGM communities compared to neutral households.

Perceived Income of Miners. Another reason behind positive giving towards households living in ASGM mining communities may be because non-miners perceive ASGM miners to have less income. However, "the rapid growth of ASM in sub-Saharan Africa is, in large part, a response to the unviable state of smallholder farming" (Banchirigah and Hilson, 2009) so that the likelihood of ASGM miners being perceived as poor should be small. Additionally, income effects of ASGM activities in Ghana have shown to be positive towards households living very near ASGM sites but diminish quickly after a distance of 5km (Guenther, 2019). This means that non-miners living in farming communities are not likely to see benefit monetarily just because they live in ASGM districts, leading to the likelihood of non-miners still having less income than ASGM miners. Furthermore, within the sample of study participants, self-reported data on assets shows that non-miners in our sample have about 10% fewer high-value assets, such as a car and/or motorbike, than miners. Non-miners in the sample also commonly self-reported boreholes to be their water source, which is mainly funded by government/NGO resources. On the other hand, miners within the same districts commonly self-reported a protected dug well as their water source, which is typically a type of water source that is self-funded in Ghana. The type of water sources reported, therefore, also reveals that ASGM miners do have more income compared to non-miners with ASGM districts.

Solidarity. Social identity theory (Tajfel and Turner, 1986) posits that people are predisposed to have a positive bias towards individuals they identify as being affiliated within the same group(s) as them even if this is based on very minor commonalities. Lab-in-the-field experiments within rural Uganda (Baldassarri and G. Grossman, 2013) and postwar Bosnia (Whitt and Wilson, 2007) have empirically shown that preferential in-group treatment exists by observing people's prosocial behavior towards the in-group and out-group using Dictator Games. The theory and empirics on in-group/out-group bias may imply that non-miners identify ASGM miners as part of their in-group. In other words, solidarity with ASGM miners may be driving the positive result in giving. Solidarity is tested as a mechanism by using survey data on the occupational makeup of non-miners' households.

Approximately 26% of farming households reported having a household member who is an ASGM miner as a main occupation. Table A.3 in Appendix A.3 displays the Tobit regression results where *MoneyAmount* (Y=0,5, 10, 15, 20, 25, 30, 35, or 40 Ghanaian Cedis sent to a randomly chosen household living in an ASGM community) is regressed on the interaction of the *ASGMCommunityTreatment* and *ASGM_hh* (x=1 if anyone in the household has participated in ASGM as a main occupation over the past 2 years). The direction of the effect is negative, and the difference is not significant. Solidarity can thus be eliminated as a driving channel for positive giving.

1.5.2 Bias in Justice Views

Figure 1.3 below shows that non-miners in the control group gave on average a lower prison sentence category for a robbery crime, and that non-miners who were given the *MinerTreatment* gave on average higher prison sentence categories (about 8% less in the 1st category of 0 years) for a robbery crime committed by a small-scale miner.

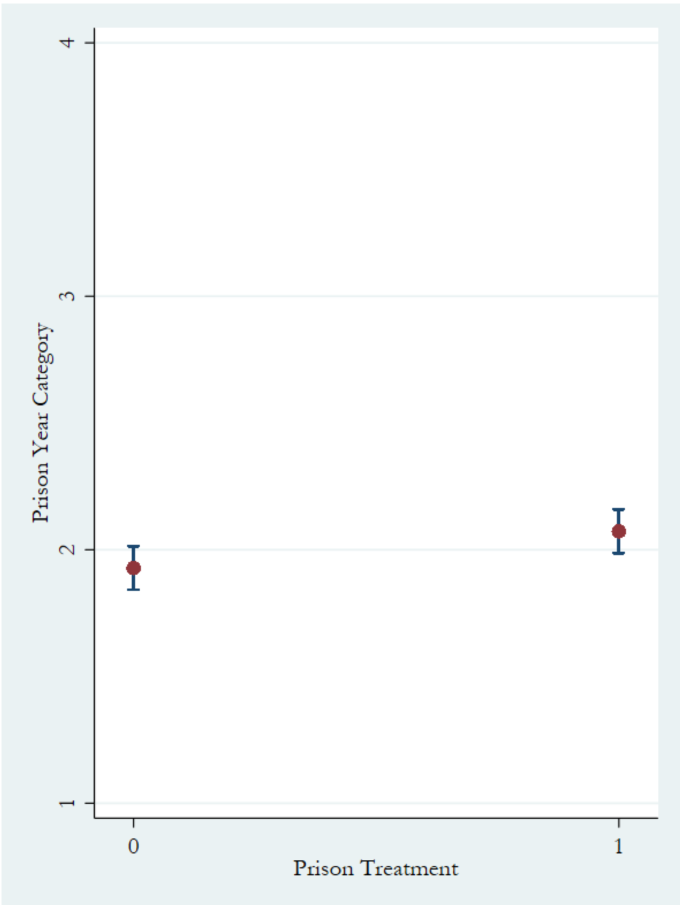

Figure 1.3: Mean of Prison Year Category (1=0 yrs; 2=up to 3.9 yrs; 3=4-8.9 yrs; 4=9-15 yrs) in Control vs. Miner Treatment with 90% Confidence Intervals.

Table 1.5 displays the results of the Oprobit regressions where *Prison Year Category* (Y= prison sentence recommendation given by non-miners within the following four categories: 0 years (first category), up to 3.9 years (second category), 4-8.9 years (third category), and 9-15 years (fourth category)) is regressed on *Miner Treatment* (x=1 if the participant made a prison sentence recommendation based on the treated version of a robbery case scenario where the only change in information is identifying the robber as a small-scale miner) along with the same basic and environmental control variables used in the Dictator Experiment. The *Miner Treatment* effect is positive yet insignificant in the estimation without controls, but is positive and significant at the 5% level with basic controls and at the 10% level with basic and environmental controls. Since non-miners behaved less favorably towards small-scale miners in the Survey Experiment, the main findings of the *MinerTreatment* effect is, at first, contradictory to the main findings of the *ASGMCommunityTreatment* effect in the Dictator Experiment. However, in the sub-section that follows, when the same intervening mechanisms used in the Dictator Experiment are analyzed in the Survey Experiment, the findings become complementary.

Result 3: Non-miners gave higher prison sentence recommendations towards an individual robber identified as a small-scale miner compared to an individual robber with an unidentified occupation.

Intervening Mechanisms

The impact of the same intervening mechanisms, knowledge and experiences of ASGM pollution (see Section 1.5.1 above), on *Prison Year Category* are presented in this section. The change in TE model given in Section 1.4.3 is used in the regression analysis to observe any difference for biases in justice views of those non-miners who have knowledge and experiences of ASGM pollution compared to those who don't. In parallel to the change in TE analysis used on prosocial behavior, the knowledge and experience channels are tested similarly.

Table 1.7 displays the direction and significance of the change in the TE on *Prison Year Category* for non-miners who have *knowledge*, *knowledge* and *awareness*, *knowledge* and *worsened water*, *knowledge* and *ban improved water*, and *knowledge* and *Crop QQ Decrease.* To fully interpret the results of the Ordered Probit regressions, however, the predicted treatment effect probabilities are calculated for each of the four categories within $Prison\ Year\ Category$. The estimates for the predicted change in TE are then calculated by taking the difference between the predicted treatment effect for non-miners who have knowledge and experiences of ASGM pollution and the predicted treatment effect for non-miners who don't have any knowledge or experiences of ASGM pollution (see Tables A.13-A.17 in Appendix A.5). Figure 1.4 is the graphical representation of the predicted change

Table 1.5: Ordered probit regression showing impact of Miner Treatment Effect on Prison Year Category

Dependent Variable: Prison Year Category	(1) Main effect	(2) + Basic controls	(3) + Env. controls
Miner Treatment	0.251	0.332**	0.317*
	(0.157)	(0.154)	(0.165)
Age		0.024**	0.0234**
		(0.010)	(0.011)
Male		0.163	0.189
		(0.254)	(0.226)
Education		-0.076	-0.0905
		(0.054)	(0.063)
Living condition		0.056	0.0783
		(0.142)	(0.130)
Years in district		-0.0160*	-0.0171*
		(0.008)	(0.009)
ASGM in HH		-0.184	-0.174
		(0.218)	(0.191)
Urban		0.432*	0.516**
		(0.240)	(0.261)
Awareness of mercury use			-0.0313
			(0.239)
High-likelihood of MC			0.280
			(0.322)
ASGM caused envprobs			-0.00495
			(0.102)
Worsened water quality			0.303
			(0.232)
Observations	177	177	177
Pseudo R^2	0.006	0.048	0.058

Standard errors in parentheses

* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Notes: The Miner Treatment dummy equals one if non-miners were randomly selected into the treated version of the Survey Experiment, with the receiver of a prison sentence recommendation being identified as a small-scale miner. Column (1) only includes the treatment effect, column (2) also includes the basic control variables, and column (3) includes both the basic and environmental control variables.

in TE estimates on each *Prison Year Category.* The Oprobit regression results and the predicted change in TE for each intervening mechanism are discussed in more detail below.

Knowledge. Table 1.6 displays the results of the Oprobit regressions where *Prison Year Category* is regressed on the interaction of the *MinerTreatment* with *Knowledge of MC* and other covariates. Although just the change in TE on *Prison Year Category* is insignificant as displayed in the first column of Table 1.6, the direction of the effect is consistently negative in all estimations. After accounting for basic and environmental controls [columns (2) and (3) of Table 1.6], at the 10% significance level, the change in TE for non-miners who had knowledge of mercury contamination led to a larger negative effect on *Prison Year Category* compared to those non-miners who did not have this knowledge and were treated. Figure 1.4 shows that for those non-miners who had knowledge of mercury contamination and were given the *MinerTreatment*, there is a positive shift in the probability of selecting the first and second categories, and a negative shift in the probability of selecting the third and fourth categories. For example, when non-miners had knowledge and were treated, there was an increase in the probability of selecting 0 years as a prison sentence by 13% (see Table A.13).

Table 1.6: Ordered probit regression showing impact of *Treatment*Knowledge of MC*

Dependent Variable: Prison Year Category (Y= 0, up to 3.9, 4-8.9, and 9-15 years)	(1) Main effect	(2) + Basic controls	(3) + All controls
Miner Treatment	0.508**	0.704***	0.661***
	(0.249)	(0.251)	(0.240)
Knowledge of MC	0.210	0.416	0.373
	(0.262)	(0.318)	(0.359)
Treatment × Knowledge of MC	-0.443	-0.627*	-0.581*
	(0.289)	(0.359)	(0.327)
Age		0.0275***	0.0262**
		(0.0105)	(0.0114)
Male		0.0553	0.128
		(0.292)	(0.257)
Education		-0.0820	-0.100*
		(0.0515)	(0.0591)
Living condition		0.0496	0.0729
		(0.136)	(0.113)
Years in district		-0.0171**	-0.0190**
		(0.00776)	(0.00867)
ASGM in HH		-0.195	-0.197
		(0.238)	(0.192)
Urban		0.430*	0.535**
		(0.260)	(0.272)
Awareness of mercury use			-0.0698
			(0.283)
HL_mercsymp			0.395
			(0.302)
ASGM caused envprobs			0.00379
			(0.112)
Worsened water quality			0.310
			(0.223)
Pseudo R^2	0.011	0.056	0.071

Standard errors in parentheses

* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Notes: The Miner Treatment dummy equals one if non-miners were randomly selected into the treated version of the Survey Experiment, with the receiver of a prison sentence recommendation being identified as a small-scale miner. The Knowledge of MC dummy equal one if non-miners answered "True" to the statement that mercury contamination can be caused by ASGM. Column (1) only includes the interaction effect, column (2) also includes the basic control variables, and column (3) includes both the basic and environmental control variables.

Knowledge and Awareness. The change in TE on prison sentence year categories for non-miners who have knowledge and awareness of mercury use is consistently negative and significant across all estimations. The change in TE estimates come from the Oprobit regression results displayed in Table A.9, where *Prison Year Category* is regressed on the interaction of the *MinerTreatment* with *Knowledge of MC* and *Awareness of Mercury Use.* Figure 1.4 shows that for those non-miners with knowledge and awareness who were given the *MinerTreatment*, there is a positive shift in the probability of selecting the first and second categories, and a negative shift in the probability of selecting the third and fourth categories. For example, when non-miners who had knowledge and awareness were treated, there was an increase in the probability of selecting 0 years as a prison sentence by 15% (see Table A.14).

Table 1.7: Change in treatment effect from interactions between *MinerTreatment* and *Knowledge and/or Experience of pollution impacts

	Main effect	Basic controls	Env controls
Knowledge	-0.443	-0.627*	-0.611*
	(0.289)	(0.359)	(0.340)
Knowledge and Awareness	-0.649*	-0.827**	-0.815**
	(0.356)	(0.391)	(0.388)
Knowledge and Worsened Water	-0.472	-0.620	-0.556
	(0.622)	(0.635)	(0.635)
Knowledge and Ban Improved Water	-0.545	-0.751*	-0.772**
	(0.355)	(0.386)	(0.371)
Knowledge and Crop QQ Decrease	-0.429*	-0.814***	-0.773***
	(0.259)	(0.293)	(0.298)

Standard errors in parentheses
* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Notes: The change in TE is the difference between the treatment effect of non-miners who have knowledge and experiences of ASGM pollution and the treatment effect of non-miners who don't. The dependent variable is Prison Year Category. Tables A.9-A.12 in Appendix A.4 show the full Oprobit regression results.

Knowledge and Worsened Water. The change in TE on prison sentence year categories for non-miners who have knowledge and experiences of worsened water quality is consistently negative, but with no significance. The change in TE estimates come from the Oprobit regression results displayed in Table A.10, where *Prison Year Category* is regressed on the interaction of the *MinerTreatment* with *Worsened water quality* and *Knowledge of MC*. Figure 1.4 shows that for those non-miners with knowledge and experience of worsened water quality were given the *MinerTreatment*, there is a positive shift in the probability of selecting the first category but close to no impact on the probability of selecting the second category. For example, when non-miners who had knowledge and experienced worsened water quality were treated, there was an increase in the probability of selecting 0 years as a prison sentence by 15% but close to 0 change in probability for the second category (see Table A.15).

Knowledge and Ban Improved Water. The change in TE on prison sentence year categories for non-miners who have knowledge and experiences of an improvement in the water quality due to the ASGM ban is also consistently negative across all estimations. The change in TE becomes significant at the 5% significance level after accounting for basic and environmental controls. The change in TE estimates come from the Oprobit regression results displayed in Table A.11, where *Prison Year Category* is regressed on the interaction of the *MinerTreatment* with *Ban Improved Water* and *Knowledge of MC*. Figure 1.4 shows that for those non-miners with knowledge and experienced ban improved water who were given the *MinerTreatment*, there is a positive shift in the probability of selecting the first and second categories, and a negative shift in the probability of selecting the third and fourth categories. For example, when non-miners who had knowledge and experienced ban improved water were treated, there was an increase in the probability of selecting 0 years as a prison sentence by 13% (see Table A.16). [11]

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[11] $eststomar : margins, dydx(prison_trt) atmeanspostlevel(90)$
$coefplotmar, vertyline(0) levels(90) coeflabels(1.\_predict = "0"2.\_predict = "0.1 - 3.9"3.\_predict = "4.0 - 8.9"4.\_predict = "9.0 - 15")$

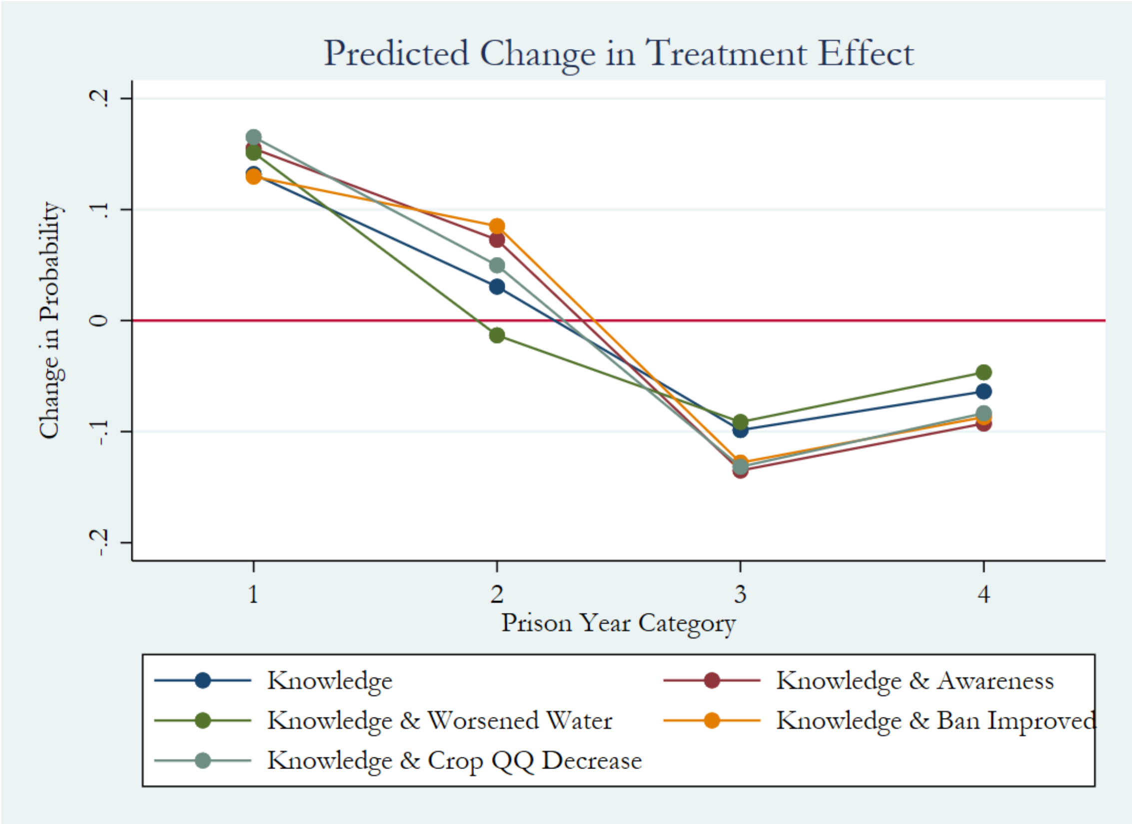

Figure 1.4: Predicted Change in Treatment Effects. The X-axis represents the categories of prison year sentence recommendations, while the Y-axis represents the change in probability of non-miners choosing a given prison sentence category. Overall, non-miners with knowledge and experiences of ASGM pollution being given the Miner Treatment shift to an increased probability of selecting lower prison sentence categories and decreased probability of selecting higher prison sentences.

Knowledge and Crop QQ Decrease. The change in TE on prison sentence year categories for non-miners who have knowledge and experiences of a decrease in the quantity or quality of their crops due to water or soil pollution is negative and significant across all estimations. The change in TE estimates come from the Oprobit regression results displayed in Table A.12, where *Prison Year Category* is regressed on the interaction of the *MinerTreatment* with *Crop QQ Decrease* and *Knowledge of MC*. Figure 1.4 shows that for those non-miners with knowledge and experienced ban improved water who were given the *MinerTreatment*, there is a positive shift in the probability of selecting the first and second categories, and a negative shift in the probability of selecting the third and fourth categories. For example, when non-miners who had knowledge and experienced *Crop QQ Decrease* were treated, there was an increase in the probability of selecting 0 years as a prison sentence by 17% (see Table A.17).

Result 4: Non-miners who have more knowledge and experiences of ASGM pollution give lower prison sentence recommendations compared to non-miners who don't have the same knowledge and experiences.

1.6 Discussion

Non-miners who were given the treatment in the Dictator experiment sent more money to households living in ASGM communities compared to neutral households, while non-miners given the treatment in the Survey experiment gave higher prison sentence recommendations towards robbers identified as small-scale miners. As evidenced by the survey data gathered in this research, non-miners living in environmentally degraded ASGM districts did not mean that all non-miners had the same knowledge and experiences of ASGM pollution. So, the next step in the analysis was to examine whether natural variation in non-miners' knowledge and experiences of ASGM pollution had any effect on behavior when interacted with the treatments in the experiments.

Five different intervening mechanisms for knowledge and experiences of ASGM pollution were tested on the outcomes variables of prosocial behavior and bias in justice views. Changes in treatment effects for non-miners who had knowledge and experiences of ASGM pollution were observed both on prosocial behavior and on bias in justice views. Overall, when non-miners with knowledge and experiences of ASGM pollution were given the *ASGMCommunityTreatment*, they were more prosocial towards households living in ASGM communities than to neutral households compared to non-miners who were treated and didn't have the same knowledge and experience. Similarly, non-miners given the *MinerTreatment* who had knowledge and experiences of ASGM pollution had a more positive bias in justice views towards ASGM miners compared to non-miners who didn't have this knowledge and experience. Although not all types of pollution experiences were consistently significant in the analysis, the direction of the effect was consistent both within and between the experiments. For all five intervening mechanisms, the overall direction of the change in treatment effect was positive on both outcome measures.

There were two intervening mechanisms that were consistent in both the direction and significance of the change in treatment effects, namely knowledge of mercury contamination (*Knowledge of MC*) and knowledge interacted with experienced decrease in quantity or quality of crops grown due to water or soil pollution (*Crop QQ Decrease*). *Knowledge of MC* and *Crop QQ Decrease* is also the most direct proxy for a negative impact on non-miners' livelihoods stemming from ASGM activities, with the most significant and consistent change in treatment effects across all estimations and in both experiments, thus strengthening and building on the results.

Having the two outcome measures of prosocial behavior and bias in justice views led to having both more robust results and being able to make a methodological comparison between an incentivized and non-incentivized experimental measures. Furthermore, in the treated version of the Dictator Game, a non-miner decides how much of his or her money to share with households living in ASGM communities. In the treated version of the prison sentence experiment, a non-miner decides how much to punish an individual robber who is also identified as a small-scale miner. Although the methods of the experiments differ, they compliment each other because one is positive giving behavior while the other is negative punishing behavior. Both outcome measures showed whether non-miners would behave more or less favorably towards small-scale miners. This research showed that the measures of prosociality towards ASGM community members and bias in justice views towards individual small-scale miners were complementary.

Any expectations of the experimental results were based on the assumption that non-miners will only view themselves as pollution victims. However, the findings in this paper suggest that non-miners with knowledge and experiences of ASGM pollution are more empathetic towards small-scale miners. Although small-scale miners are the perpetrators of the pollution, non-miners who experience ASGM pollution behave more favorably towards the perpetrators. One explanation for this might be that non-miners believe the polluters must also be experiencing the same or worse (whether or not this is true) than they are. The survey data collected shows that there is very little knowledge about mercury contamination among non-miners beyond basic information. For example, although 58% of non-miners knew that mercury contamination can be caused by ASGM, only 19% of non-miners knew that mercury accumulates in fish. Only having very basic information about mercury contamination may have led to non-miners overestimating the negative impact of mercury exposure on small-scale miners, and underestimating it in their own communities. Another explanation for non-miners acting more favorably towards small-scale miners might have been that they perceive ASGM activities to be good for their community as as whole, even though it is associated environmental costs that non-miners know and have experienced. However, the survey data collected showed that only 27% of non-miners either agreed or strongly agreed that ASGM had had a positive impact on their local community. Additionally, data collected on attitudes towards different groups of people showed that 98% of non-miners agreed that farmers mostly try to be helpful while only about 54% of non-miners agreed the same is true of small-scale miners.

1.7 Conclusion

This research demonstrates that living in an environmentally degraded setting does not always lead to decreased social cohesion between pollution victims and polluters. A majority of the research surrounding social tensions related to negative environmental externalities caused by the extractives industry focus on the polluters being large-scale miners. In this study, the focus is on small-scale gold mining because of the recent boom in this activity in over 70 countries, along with the high environmental costs that come from this. Within the Ghanaian ASGM districts, living in an environmentally degraded setting does not by itself lead to decreased prosocial behavior towards small-scale miners, even among resource-dependent individuals whose livelihoods are negatively impacted by this degradation. And, knowing about and experiencing environmental degradation did not result in decreased social cohesion between pollution victims and polluters.

Although extensive objective and scientific evidence exists on ASGM pollution as well as its negative impact within mining districts in Ghana, people's experiences are subjective and varied. The survey data on non-miners' knowledge and experiences of ASGM pollution also prove this to be correct. However, the results show that when non-miners had knowledge and experiences of negative environmental externalities stemming from ASGM activities, this led to more favorable decisions towards ASGM miners and community members. After ruling out alternative mechanisms such as identifiability, perceived income of miners, and solidarity, knowledge and experiences of ASGM pollution stood out as the channels driving both positive giving and lower prison sentences towards ASGM miners. This suggests an empathy mechanism exists in pollution victims' behaviour towards polluters.

The relationship between environmental degradation and conflict or social tensions in settings such as this may be overblown, where pollution victims are less likely to participate in collective action. That being said, there can also be a greater opportunity for collaboration between polluters and pollution victims. Within the ASM sector, it would be important for country governments to initiate the collaboration, and take ownership for the regulation of small-scale mining activities. Although the government of Ghana took some ownership by implementing a ban on all ASGM activities, a better strategy could have been to provide more incentives for collaboration between polluters and pollution victims in tandem with appropriate regulation.

The goal of this research was to see how real-world pollution victims would behave towards polluters, and to what extent knowledge and experiences of the pollution would impact this behavior. By using lab-in-the-field experiments, however, there were specific drawbacks that occurred. First, the timing of the ban on ASGM implemented by the government of Ghana was an unpredictable factor in the field. It is unknown how much the ban and the politics surrounding it may have influenced non-miners' decisions based on the data collected, although this exogenous policy shock was imposed equally on all regions of the country. Another drawback was that in using the natural variation in individuals' knowledge and experiences of environmental degradation, these were not determined randomly. It would be difficult, however, to find natural variation in a real-world setting that is exogenous. In future research, it would be interesting to experimentally vary knowledge and experience alongside manipulating the characteristics of the individuals imposing a negative externality (the "polluters") in a laboratory to see how pollution victims' perceptions of the polluter change their behavior towards them.

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Chapter 2

Can knowledge change minds? The impact of a video experiment on mercury contamination on attitudes and behavior of gold miners in Ghana*

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Abstract: The surge in artisanal and small-scale gold mining (ASGM) has led to negative environmental and health outcomes particularly due to the widespread use of mercury. We investigate how much knowledge about mercury pollution and its consequences small-scale miners in Ghana have, and whether having graphic information on mercury contamination through a video experiment will impact their attitudes and intended environmental behavior. Experimental and survey data were collected from 210 small-scale gold miners working in 21 different Ghanaian mining sites. We combined a survey experiment, video experiment, and charity donation experiment to measure attitudes towards ASGM and intended environmental behavior. In the main video experiment, all miners were provided with information on current ASGM practices, mercury pollution, and cleaner technologies in video format, while treated miners were also provided with graphic images of mercury poisoning (i.e., Minamata Disease). We find that 70% of our small-scale miners report having some exposure to mercury, though only 40% of them had good knowledge about mercury contamination and its health effects. Worryingly, most respondents were experiencing at least one health symptom compatible with mercury poisoning. Small-scale miners who were randomly assigned into watching the treatment video had a more negative attitude about the impact of ASGM on their local community, but they did not show any significant positive changes in their intended environmental behavior as measured by their donations to a relevant NGO.

Keywords: survey, lab-in-field experiment, video, gold mining, mercury, Ghana

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2.1 Introduction

An estimated 45 million people across 80 countries work in artisanal and small-scale gold mining (ASGM), with the number of workers in this sector more than tripling over 20 years. One of the challenges the sector's growth has brought lies in the environmental pressure due to the widespread use of mercury and other hazardous substances to separate the gold ore from other materials (UNEP, 2020b). ASGM is the largest worldwide mercury user and emitter (UNEP, 2020a), and the concentration of mercury in the air in ASGM regions often exceeds typical industrial areas by a factor of 2000 (Gworek et al., 2017). Mercury is relatively cheap to buy and easy to use, but the environmental pressures it causes include long-term contamination of the water and soil, and consequently the degradation of the environment for all wildlife and humans that depend on them (Clifford, 2017).

The use of mercury also has serious health implications for humans, which are currently not yet well understood by most citizens in mining areas (Tschakert and Singha, 2007; Gibb and O'Leary, 2014; UNEP, 2020a). Mercury pollution is invisible and non-degradable, and it bio-accumulates in the flesh of fish and other animals that eat contaminated food. It can cause irreparable neurological damage known as Minamata Disease, most tragically in unborn babies and newborns via contamination of the placenta and breast milk. While contaminated soil can be cleaned at a considerable cost, a more realistic option is the use of existing alternative, cleaner production methods that do not rely on mercury use, e.g. direct smelting or the use of borax. However, these are not yet widely used, in part because of a lack of knowledge and experience among informal mine owners (Amankwah et al., 2010; Appel and Na-Oy, 2014).

In this paper, we examine how much small-scale gold miners know about the dangers of mercury use, and whether their (intended) behavior can be changed by providing more information. We address these questions by analyzing a unique dataset gathered among 210 small-scale miners in six mining districts in Ghana in 2019. Ghana is currently the largest gold producer in Africa, and has a long tradition of both industrial and small-scale gold mining, with the latter seeing widespread use of mercury (Hilson, 2017). We undertake a series of surveys and lab-in-the-field experiments with small-scale gold miners to first understand the use of mercury and the levels of knowledge and experience of mercury poisoning and its health symptoms. We then examine whether providing information in video format about current ASGM practices, ASGM pollution, mercury poisoning, and cleaner technologies has an impact on miners' intended environmental behavior and attitudes about the impact of ASGM on the local community.

We combine a survey experiment, video experiment, and charity donation experiment to measure attitudes towards small-scale miners and intended environmental behavior. In the main video experiment, all miners were provided with information on current ASGM practices, ASGM pollution, and cleaner technologies in video format, while treated miners were also provided with graphic images of Minamata Disease. We find that 70% of our respondents report having some exposure to mercury, though only 40% of them had good knowledge about mercury contamination and its health effects. Worryingly, most respondents were experiencing at least one health symptom compatible with mercury poisoning. Small-scale miners who were randomly assigned into watching the treatment video subsequently show a more negative view of the impact of ASGM on their local community, but they do not demonstrate any positive changes in their intended environmental behavior as measured by their donations to a relevant NGO.

There is a sizable literature on the environmental impacts of small-scale gold mining in Ghana and elsewhere in Africa (e.g., (Donkor et al., 2009; Clifford, 2017; Hilson, 2017; Mensah et al., 2015)).[1] In Ghana, most policy suggestions have focused on improvements on the institutional side (Hilson, 2002) or on finding alternative, cleaner amalgamation methods (Amankwah et al., 2010; Appel and Na-Oy, 2014). Other studies have used quasi-experimental approaches with geo-coded third-party data to look at the impacts of small-scale and/or industrial gold mining on socioeconomic outcomes (Bazillier and Girard, 2020), conflict (Patel et al., 2016), or agricultural productivity (Aragón and Rud, 2016) in Ghana and other sub-Saharan African countries. The present is, to our knowledge, the first study that combines a detailed survey with lab-in-the-field experiments among small-scale gold miners to understand their knowledge and how to influence behavior regarding mercury use. The most closely related contribution uses a field experiment among Colombian small-scale gold miners to try to incentivize the adoption of alternative amalgamation technologies (Saldarriaga-Isaza, Villegas-Palacio, and Arango, 2015).

The rest of this paper is organized as follows. Section 2.2 briefly describes the small-scale gold mining sector in Ghana. Section 2.3 explains the data collection strategy and section 2.4 describes the survey information on small-scale gold miners. Section 2.5 outlines the experimental design; section 2.6 analyzes the experimental results; and section 2.7 concludes.

[1]See (Gibb and O'Leary, 2014) for a review.

2.2 Small-scale gold mining in Ghana

Ghana is an interesting country case study because it has a long history of both ASGM (locally known as "galamsey") and industrial gold mining (Hilson and Potter, 2005), and is currently the largest gold producer in Africa. In 1989, the government passed the *Small Scale Gold Mining Law* which effectively legalized the widespread ASGM activities, though they were still subject to a licensing scheme (Hilson, 2002). The large and sustained rise in global gold prices in the early 2010s led to a marked increase in ASGM activities, a sector that accounts for around a third of Ghana's total gold production (Hilson, 2017) and is estimated to employ up to 1 million people (Clifford, 2017).

The growth in the informal gold mining sector has brought several challenges with it. One of these lies in the environmental pressure due to the widespread use of mercury during the amalgamation process, i.e., the separation of the gold ore from other materials. Mercury is both cheap and easy to use.[2] It has been estimated that for every gram of gold produced, 1-2 grams of mercury are released into the environment (Telmer and Veiga, 2009). The United Nations Environment Programme (UNEP) believes that the ASGM sector is now the largest 'intentional' user of mercury worldwide (UNEP, 2020b). Mercury pollution is invisible and non-degradable; it leads to pollution of air, water, and soil directly and indirectly, via the rain that returns evaporated mercury back to the earth's surface. Mercury bio-accumulates in the flesh of fish and other animals that eat contaminated food, causing health problems not only to these animals but also to humans. In humans, mercury contamination causes kidney and autoimmune dysfunctions, and neurological damage which becomes irreparable over time (i.e., Minamata Disease), most tragically in unborn babies and newborns who absorb mercury through the placenta or breast milk (Gibb and O'Leary, 2014). Contaminated soil can be cleaned, but only at a considerable cost.

In recent years, ASGM activities in Ghana have led to the release into the environment of over 100 tons of mercury per year and the pollution of the air and water, degradation of the land, and negative health impacts.[3] The areas in Ghana that have seen a particular surge in ASGM activities, such as around the Pra River Basin (which includes parts of Ghana's Central, Western, and Ashanti regions), are experiencing the encroachment of mining on cocoa farmland and are associated with significant levels of mercury contami-

[2] At the time of the fieldwork, one 40-gram unit of mercury cost around USD40 in Ghana. A 40g unit could last between one week and one month, depending on the rock type and the amount of crushing and milling before amalgamation (Information from a conversation with NGO Friends of the Nation, September 2018).

[3] See Clifford (2017) and the literature cited therein for details on the measured mercury pollution in Ghana.

nation, demonstrated by traces found in samples of water, soil, sediment, and human hair (Donkor et al., 2009). Alternative, cleaner production methods that do not rely on hazardous substances, e.g., direct smelting or the use of borax and soda ash, already exist, but they are not yet widely used, in part because of a lack of knowledge and experience among small-scale miners (Amankwah et al., 2010; Appel and Na-Oy, 2014).

Past efforts to encourage informal small-scale Ghanaian gold miners to seek a license and formalize their activities have not been very successful, due on the miners' side to the bureaucratic hurdles involved and the cost attached to the required investment in environmentally sound production technology, and on the government's side to a lack of resources.[4] Ghana is a signatory of the 2015 Minamata Convention on Mercury, which – among other areas – requires parties to monitor, regulate and phase out the use of mercury in the informal sector of ASGM. However, despite the efforts of government and local NGOs to disseminate information, formalization has remained low. In recognition of the difficult situation in the ASGM sector, the Ghanaian government in early 2017 enacted a ban on all activities in the sector until a new strategy could be designed. The ban was lifted in December 2018 with the announcement of the new ASGM policy, and both legal and illegal ASGM activities resumed soon after.[5] The government continues to grapple with illegal ASGM activities, and has employed both military and police interventions to enforce regulation (Reuters, 2021).

2.3 Data collection strategy

In collaboration with Friends of the Nation (FoN), a Ghanaian socio-environmental advocacy NGO, the research team collected survey and experimental data from small-scale gold mining workers in Ghana between March and May 2019. FoN ran a series of informal information workshops at mining sites they had not previously visited, and allowed the research team to accompany them for data collection. The workshops took place at the end of the workday upon previous agreement with the local mining site manager. Each FoN workshop lasted around 45 minutes and focused on health and safety issues related to small-scale mining, including personal safety equipment and the dangers of using mercury in the amalgamation process.

[4] In an interview with one District Minerals Commissioner (September 2018), the lack of funds and manpower was described and how this impacts the Minerals Commission's ability to police and enforce the ASGM law. In that particular region, one Commissioner was responsible for nine districts, with the support of only two assistants and one official vehicle.

[5] In practice, not all ASGM activities were in fact suspended during the ban, as a personal visit to an active small-scale gold mine in the Western region in September 2018 demonstrated. Nevertheless, some improvements in environmental quality were observed during the ban, most notably a decrease in water turbidity as measured by the Water Bodies Commission (from an interview with Prof Richard Amankwah, University of Mines and Technology, September 2018).

At the end of each workshop, the audience was given a brief explanation of who the research team was, what the survey and experiments were about, and the potential earnings of GHS40 (£6.50) for participating. Mining workers who were willing to participate in the survey and experiments were given lottery ticket stubs, and corresponding stubs were put in a bag. The appropriate number of stubs (ranging from 9-12 per site) were pulled out at random. The participants holding selected lottery numbers were assigned a time slot for their survey. Anyone not chosen was given a small gift worth GHS5 (£0.8), i.e. a small soap personalized with a sticker from the experimenters' institution. The mining worker surveys and experiments were carried out face-to-face using tablets and headphones (for the video) and took around half an hour each on average.

We collected data from 210 ASGM miners from 21 different mining sites within six different districts.[6] Figure 2.1 shows the map of ASGM districts visited in Ghana in dark grey.

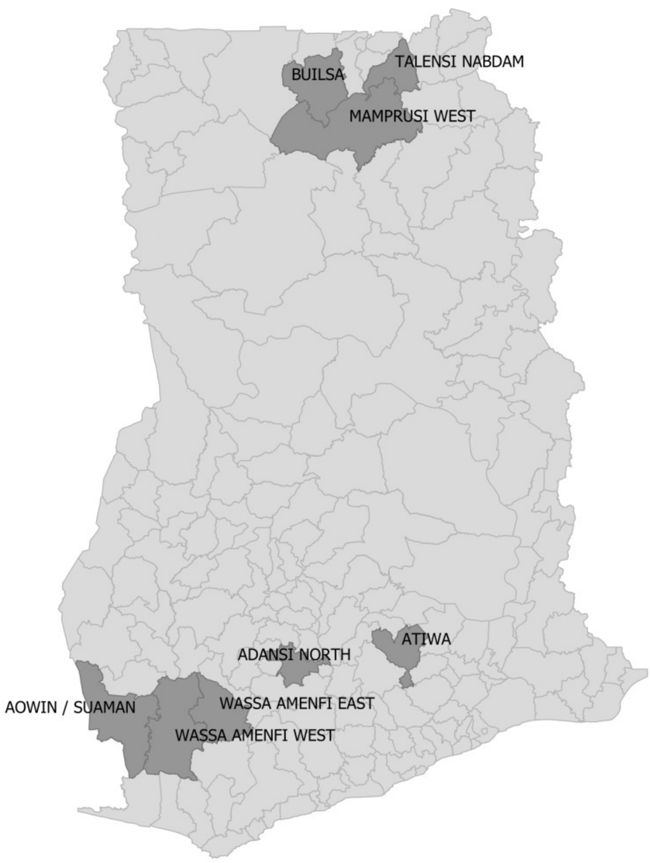


Figure 2.1: Map of Ghanaian ASGM districts visited for this research.

[6]The regions of Ghana constitute the first level of sub-national government administration within the Republic of Ghana. At the time of the fieldwork, there were ten regions, further divided for administrative purposes into 216 local districts.

2.4 Who are our small-scale gold mining workers?

Section 2.4.1 describes the personal and household details of our small-scale miners, while Section 2.4.2 looks at the extent of their knowledge and experience of mercury contamination.[7]

2.4.1 Personal and Household Details

Table 2.1 presents summary statistics of the personal and household details of our sample. Our small-scale gold miner sample was made up of 210 individuals, a majority of which were male (91%), between the ages of 17 and 70 years old (median 33 years old). Ninety-seven percent of the sample reported ASGM as their main occupation, compared with 3% for farming. On average, these individuals have worked in ASGM activities for eight years, with a minimum of six months and a maximum of 28 years. All individuals in the sample were from rural areas of Ghana, and have lived in the same district for an average of 10 years. Only 9% are classed as recent movers, i.e. those who have lived in the same district for less than two years. With respect to religion, the sample was fairly representative of Ghana as a whole, as the most common religion reported was Christianity, followed by Islam.

Table 2.1: Summary statistics of sampled Ghanaian communities

	mean	sd	min	max
age	34.45	9.51	17.0	70.0
gender (male=1)	0.91	0.28	0.0	1.0
years in district	9.87	10.70	0.1	64.0
recent mover (less than 2 years in district)	0.09	0.29	0.0	1.0
years worked in ASGM	7.79	5.35	0.5	28.0
living conditions	2.67	1.03	1.0	5.0
household size	4.61	3.74	1.0	30.0
main occupation in ASGM	0.97	0.17	0.0	1.0
no formal education	0.17	0.37	0.0	1.0
primary education	0.25	0.44	0.0	1.0
secondary education	0.51	0.50	0.0	1.0
tertiary education	0.07	0.25	0.0	1.0
car or motorbike owned in HH	0.51	0.50	0.0	1.0
livestock in HH	0.25	0.44	0.0	1.0
farmer or fisherman in HH	0.46	0.50	0.0	1.0
Christian	0.80	0.40	0.0	1.0
Muslim	0.14	0.35	0.0	1.0
political leader in HH	0.13	0.34	0.0	1.0
traditional leader in HH	0.05	0.22	0.0	1.0
other community leader in HH	0.10	0.31	0.0	1.0
treated miner	0.49	0.50	0.0	1.0

[7] The small number of 'don't know' answers were treated as missing.

Overall, the small-scale gold miners in our sample had lower levels of formal education compared to the national average, but this is in line with the gap in education between the rural and urban areas of Ghana (Anlimachie and Avoada, 2020).[8] Based on self-reported household living conditions on a 5-point Likert scale, 50% of the sample reported living conditions to be either very bad or fairly bad while only 27% reported them to be fairly good. However, when looking at reported assets, 51% of the sample owned either a car or a motorbike. Since owning a motor vehicle is typically a strong indicator of higher income, reported living conditions may be reflecting non-monetary conditions such as the state of the natural environment.

2.4.2 Knowledge and Experience of Mercury Contamination

In addition to personal and household details, we collected information on the following: how much our small-scale gold miners knew about mercury contamination, whether they experienced mercury contamination health symptoms, and their experience of ASGM pollution. We also asked participants whether they agreed with the following statement: "Overall, artisanal and small-scale gold mining (galamsey) has had a positive effect on the local community." Answers were given on a 5-point Likert scale, from strongly disagree to strongly agree. Unsurprisingly, agreement among our mining-site workers was very high, with a mean of 4.264 from the 208 valid responses.

Table 2.2 summarizes knowledge of mercury contamination with dummy variables equal to one if they had knowledge about each of the statements provided in this table. The first statement in Table 2.2 was a yes or no question, while the remaining statements were based on a series of six true-or-false questions. The majority of our sample had either read or heard about mercury pollution, and the median number of the six true-or-false questions answered correctly was 4. However, only 40% of the sample correctly answered all the questions, with the questions regarding health impacts answered correctly by the fewest respondents.

Table 2.3 summarizes the experience of health symptoms that could be related to mercury contamination. We collected information on negative health effects related to mercury exposure by asking whether or not they experienced any of 10 different health symptoms over the last 12 months.[9] The symptoms listed are dummy variables equal to one if a respondent answered yes to a symptom that may be related to mercury exposure. Symptoms of either prolonged or acute exposure to mercury when inhaled as a vapor

[8] https://www.statista.com/statistics/1131775/school-completion-rate-in-ghana-by-gender/

[9] The 10th symptom was birth defects, but no one in our sample reported this.

Table 2.2: Respondents' knowledge of mercury contamination

	mean
Read or heard about mercury pollution	0.96
Mercury contamination can be caused by ASGM	0.91
Mercury stays in the natural environment for a long time	0.90
Mercury accumulates in fish	0.71
Mercury contamination can cause muscle twitching and tremors	0.57
Mercury enters a mother's breastmilk	0.50
Mercury contamination can cause birth defects	0.49

Question 1 could be answered by yes (=1) or no (=0), while the remaining questions could be answered by true (=1) or false (=0).

can include frequent headaches and tremors[10], with 47% of our sample reporting frequent headaches and 11% reporting tremors. Symptoms of high exposure to mercury compounds can include muscle weakness and memory loss, with 60% of the sample reporting muscle weakness and 16% reporting memory loss. The median number of symptoms experienced was 2, with 10% reporting four or more symptoms.

Table 2.3: Respondents' experience of mercury contamination health symptoms

	mean
muscle weakness	0.60
frequent headaches	0.47
dizziness	0.22
intense coughing	0.19
memory loss	0.16
muscle twitching or tremors	0.11
mood swings	0.05
hearing loss	0.05
uncoordinated walking or movements	0.02

Notes: Questions could be answered by yes (=1) or no (=0).

Table 2.4 summarizes the experience of pollution both directly and indirectly related to ASGM activities. Due to the widespread use of mercury in ASGM, 70% of our sample reported either being exposed to mercury fumes or having direct contact with mercury. Each variable listed in Table 2.4 is a dummy variable equal to one if respondents reported the experience. ASGM activities have led to deforestation, land degradation, and water pollution in Ghana (Hilson, 2002; Mensah et al., 2015). In line with the evidence in the literature, our small-scale gold miners reported experiencing pollution because of ASGM activities. Furthermore, 61% of respondents believed that the ASGM ban had improved the quality of their local water sources, and 29% believed the ban had improved the quality of the soil for farming.

[10] https://www.epa.gov/mercury/health-effects-exposures-mercury

Table 2.4: Respondents' reported experience of ASGM pollution

	mean
Exposure to mercury fumes or direct contact with mercury	0.70
Polluted drinking and cooking or river sea and water	0.49
Deforestation	0.37
ASGM led to pollution of the natural environment	0.77
ASGM cited as a cause of environmental problems in community	0.59
ASGM ban improved quality of water	0.61
ASGM ban improved quality of soil for farming	0.29

Notes: Questions could be answered by yes (=1) or no (=0).

2.5 Experimental design

The experimental design was pre-registered on Open Science Framework.[11] It includes three different experiments: a prison sentence survey experiment, a video experiment, and a charitable donation experiment. The main treatment in this experimental design is the treatment in the video experiment, which is discussed in more detail in Section 2.5.2 below. The main outcome variable is intended environmental behavior, as measured by the charity donation experiment. Further outcomes are given by the prison sentence recommendation from the survey experiment; the level of agreement to a statement on the positive impacts of ASGM on the local community repeated from the pre-experimental survey questionnaire; and agreement to the introduction of a fine or prison sentence for the use of mercury in ASGM.

Figure B.1 in Appendix B.1 displays the original design. Since the software program utilized did not randomize all experiments independently as intended, Figure B.2 of Appendix B.1 shows the research design that was executed.[12] Of our total of 210 respondents, 108 were randomly allocated into the treatment group, and 102 into the control group.

[11] https://osf.io/ne92j

[12] We used Survey Solutions software from the World Bank. This software allows the definition of enabling conditions for questions within the survey. These enabling conditions can either be based on responses to other questions or on externally defined functions, known in this software as macros. Macros allow additional programmatic functions to be brought in, with the addition in 2015 of a random number generator. We proposed to use macros to create 3 separate randomization functions, which could be used to determine: (1) whether the prison sentence question was for a generic person (control) or an ASGM miner (treatment); (2) whether the video displayed was basic (control) or included detailed information on health effects of mercury (treatment); and (3) whether the donation experiment specified a generic human-rights charity (control) or a charity which emphasized health and environmental concerns (treatment). The experiments were to proceed as highlighted in Figure B.1 of Appendix B.1. However, during data analysis, it was discovered that only a single random number is generated for each survey, even when multiple randomization functions [e.g. $\$donation\_treatment = Quest.IRnd()$ and $\$video\_treatment = Quest.IRnd()$] are called. Consequently, there was no pooling of respondents between each treatment, and the same set of subjects experienced all three treatments. This led to the actual survey being executed as shown in Figure B.2 of Appendix B.1. More recently, the FAO has explicitly called this out in their Survey Solutions handbook (FAO and ADB, 2020). The Survey Solutions documentation now includes the best practice procedure for multiple randomizations within one survey, utilizing different digits within the single generated random number for each randomization.

2.5.1 Prison Sentence Survey Experiment

The first outcome or dependent variable is the number of *prison sentence years* recommended in a prison sentence experiment. The prison sentence experiment is a variation of the experiment carried out by (Goldberg, 1968).[13] The Goldberg experiment has also been replicated to show other biases such as discrimination between different groups of people (Bertrand and Duflo, 2016). To measure in-group bias amongst small-scale gold miners, we gave participants a hypothetical robbery scenario and randomly assigned[14] them into issuing a prison sentence recommendation either (a) towards a robber who lives in the community (prison sentence control), or (b) towards a robber who is a small-scale miner living in the community (prison sentence treatment). Participants were then asked what prison sentence they would recommend, ranging from 0 to 15 years. Since official crime rates are relatively low in Ghana (Macrotrends, 2022), an example of a low-level crime that can plausibly occur in a rural setting in Ghana was used. The treated version of the vignette presented to participants is in Appendix B.1.

2.5.2 Video Experiment

All participants were shown a video on the topic of mercury contamination in ASGM mining activities.[15] We varied between subjects whether they were shown (a) an informational video about mercury pollution from ASGM in Ghana depicting negative health effects of mercury use, including information about alternative technologies available to achieve the same or better results in the gold mining process (video control); or (b) the same video described above, with the addition of graphic images of the symptoms of Minamata Disease along with voice-over information about the disease (video treatment). The video experiment occurred after participation in the main sections of the survey. The script for the video experiment is provided in Appendix B.1.

Our treatment in the video experiment was providing original footage with graphic images of Minamata Disease symptoms, showing the severe and irreversible neurological effects that prolonged exposure to mercury has. The purpose of the treatment in the video experiment was to see whether information given in a manner that will elicit shock or fear would lead to a more positive impact on intended environmental behavior. In

[13] In the Goldberg experiment, only one piece of information on identity was manipulated in order to see whether this identity had an impact on how subjects evaluated peoples' performance. Students were asked to grade written essays that were identical, except for the male or female name of their author. The results of this initial Goldberg experiment showed that a gender bias exists since authors with a female name were given lower grades.

[14] Randomization occurs at the individual level, and is similar to a coin toss method.

[15] The video was produced by a local Ghanaian company following detailed instructions provided by the research team.

psychology literature(Epstein, 1994), two types of information processing modes exist – rational and experiential. Epstein states that "experientially derived knowledge is often more compelling and more likely to influence behavior than is abstract knowledge". Eliciting shock or fear via the graphic images of Minamata Disease symptoms would contribute to the experiential mode of information processing. Shocking images have also been used educational campaigns to promote better health behaviours, such as the graphic images used on cigarette boxes or video campaigns about the effects of smoking (a woman with a hole in her oesophagus) or crack use (this is your brain on drugs images). The role of imagery on climate change engagement, for example, has also been shown to be important (Leiserowitz, 2006; O'Neill et al, 2016).

2.5.3 Charity Donation Experiment

Following the video experiment, the main outcome variable measuring intended environmental behavior was the amount of *money donated* in a charity donation experiment. The long-term behaviour we inevitably want to change is for ASGM workers to stop using mercury, but this is behaviour that would have to be observed and monitored over a long period of time. Furthermore, in the Ghanaian setting, there is no one size fits all alternative. So, our outcome variable is a proxy for intention to change environmental behavior.

In this experiment, participants were asked whether they would like to donate any Cedi from 0 to 40 of their GHS 40 (£6.50) total earnings to an NGO (in GHS 5 denominations only).[16] We then varied between subjects whether or not they would like to donate to either (a) an NGO which is described in neutral terms (donation control), or (b) the same NGO but with an emphasis on its work focusing on environmental problems including health impacts from mining activities (donation treatment). Donations were made privately and anonymously into a box marked with the name of the NGO using an envelope that only had a participant ID number generated by the survey program. The dependent variable in this experiment is *money donated*, and the explanatory variable is assignment into treatment. The higher the amount of *money donated*, the more positive the association between the video treatment on our small-scale miners' intended environmental behavior.

2.5.4 Additional survey outcomes

In favor of fine and *In favor of prison sentence*. Following participation in the charity donation experiment, we had two additional outcome variables that measured intended environmental behavior. Participants were asked the following survey questions: (a) whether

[16] The chosen charity was WACAM, a Ghanaian community-based human rights and environmental mining advocacy NGO.

they would be *in favor of fine* in Ghana for small-scale miners who use mercury including how high the amount should be; and (b) whether they would be *in favor of prison sentence* including how severe the sentence should be for ASGM miners who use mercury in Ghana. Both outcomes were subsequently coded as dummy variables (with 1=in favor) and in absolute numbers (fine amount and prison sentence length, respectively).

Change in Attitude. We took advantage of our extensive pre-experimental survey questionnaire to explore whether treatment would affect the attitude about the impact ASGM has on the community. Participants had to answer if they agreed with the following statement (based on a 5-point Likert scale, from strongly disagree to strongly agree): "Overall, artisanal and small-scale gold mining (galamsey) has had a positive effect on the local community." This question was asked twice - once before participation in the video experiment and once after. The difference in attitude towards the overall positive effect of ASGM is measured by the *change in attitude* variable. A negative *change in attitude* variable denotes a decrease in the agreement to the statement, i.e. views or attitudes regarding the impact of ASGM become more negative; the opposite holds for a positive value for *change in attitude.* [17]

2.5.5 Empirical Methodology

We use OLS linear regression models to estimate: the effect of being assigned into the small-scale miner prison sentence treatment on the number of prison years recommended (Equation 2.1); the effect of the video treatment on intended environmental behavior and change in attitude towards ASGM impact on the local community (Equation 2.2).

$$Y_{1i,j} = \beta_0 + \beta_1 Z_{1i,j} + \beta_2 X_{i,j} + \epsilon_{i,j} \tag{2.1}$$

where the dependent variable, $Y_{1i,j}$, is the number of prison sentence years recommended by individual i in site j. $Z_{1i,j}$ stands for individual i in site j having received the prison sentence treatment (a dummy variable equal to one when the hypothetical robber is also identified as a small-scale miner). $X_{1i,j}$ stands for a vector of basic control variables captured in the survey such as age, gender, education, religion, occupation, years living in the district, household size, living conditions, and assets. The hypothesis for equation 2.1 depends on whether an in-group bias exists between small-scale gold miners in Ghana. If in-group bias exits, our small-scale gold miners would recommend a lower prison sentence to a robber identified as a small-scale gold miner compared to one that does not have an identified occupation.

[17] This in essence constitutes a within-survey difference-in-differences design.

$$Y_{(2-5)i,j} = \beta_0 + \beta_1 Z_{1,i,j} + \beta_2 X_{i,j} + \epsilon_{i,j} \tag{2.2}$$

where the dependent variables measuring intended environmental behavior, $Y_{2-4i,j}$, are as follows for individual i in site j: *money donated*, the money amount donated to an NGO, from 0 to 40 GHS; *in favor of fine (dummy)*, a dummy variable equal to one if answered yes to fine for mercury use in ASGM; *in favor of fine*, the amount of the fine from 0 to 5,000 GHS; *in favor of prison sentence (dummy)*, a dummy variable equal to one if answered yes prison sentence for mercury use in ASGM; and *in favor of prison sentence*, the amount of prison sentence given from 0 to 12 months. The dependent variable $Y_{5i,j}$, measuring a change in attitude, is the difference between agreement towards ASGM having a positive impact for the local community prior to and post video treatments. $Z_{1,j}$ is the treatment dummy.[18]

Since there are both direct negative health impacts from ASGM activities as well as direct economic benefits to ASGM miners, the hypotheses for equation 2.2 are exploratory. On the one hand, ASGM miners' use of mercury is a quick and easy way of extracting gold from the auriferous ore. On the other hand, the use of mercury has negative health impacts on ASGM miners themselves, as well as negative environmental impacts on their communities. Furthermore, there's the possibility of the graphic/shocking nature of the video leading to participants either not trusting the information we provided to them about mercury pollution, or just being defensive about their own practices. The effect of the treatments in equation (2.2) can lead to either a positive or negative change in small-scale miners' intended environmental behavior and attitudes about ASGM.

2.6 Results

Section 2.6.1 reviews the main results of the video and prison sentence experiments, while Section 2.6.2 describes the results from sensitivity analyses and extensions. Since the prison sentence experiment was the first to be randomized by the software program and was conducted prior to the video and charity donation experiments, the results from this experiment will stand independently from the other two experiments. The effect of the video treatment in equation 2.2 will instead be confounded since being assigned into one treatment will have led to being assigned into all treatments in all experiments. This led to only having two groups - one group which was only assigned to the treated versions of all experiments and one group only assigned to the control versions of all experiments.

[18]As mentioned above, due to randomization issues, assignment to treatment occurred only once before the prison sentence survey experiment instead of independently before each experiment.

In effect, we have a 'compounded' treatment effect and we cannot disentangle the separate treatment effects. The results presented for the post-video experiment outcomes in Tables 2.5 and 2.6 are therefore to be interpreted with great caution.

2.6.1 Main Results

Table 2.5 gives an overview of the outcome variables by treatment group. Treated mining site participants do not recommend significantly different prison sentences for a small-scale miner than for a robber described in neutral terms. Though treated subjects call for a slightly higher sentence, both groups recommend around one-and-a-half years of prison on average. For the post-video outcomes, there is no significant difference in the mean money donated (though treated subjects donate slightly more) or the support for a prison sentence for miners who use mercury (though treated subjects are slightly less in favor and would give slightly shorter sentences). However, we do find significant differences in the attitudes towards the contributions of ASGM to the local community, with treated subjects becoming more skeptical; and in the support for a fine for mercury use, with treated less in favor of a fine and suggesting a lower amount.

Table 2.5: Summary of outcomes

	Mean Treated	Mean Control	Obs	Diff.
Prison sentence recomm. (length)	1.672	1.45	210	0.17
Change in attitude	-0.089	0.131	208	0.22**
Money donated	6.127	5.694	210	0.764
In favor of fine (amount)	2.049	2.5	210	0.203**
In favor of fine (dummy)	0.431	0.62	210	0.068***
In favor of prison sentence (length)	1.667	1.787	210	0.16
In favor of prison sentence (dummy)	0.304	0.389	210	0.066

Summary statistics for outcome variables in treatment and control groups. Differences between treatment and control groups and their significance levels are shown in the final column.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 2.6 presents the main estimation results, without (Panel A) and with (Panel B) district controls. Column (1) shows the results of the initial survey experiment: treated mining site participants do not recommend different prison sentences whether or not they are told that the robber is a small-scale miner. Columns (2)-(7) show results for outcomes after the main video experiment. In column (2) we see small-scale mining site participants who were assigned into the video treatment group now have a less positive attitude towards the impact of ASGM on the community. The change in attitude is significant at the five-percent level. Figure 2.2 graphically displays the difference in the *change in attitude* of participants who just watched an informational video about the negative effects of ASGM practices (video control) and the participants who watched the same informational video with graphic images of Minamata Disease. We can see that the treated group shows a small but highly significant negative change in attitude (right side of the figure), i.e. treated subjects become more skeptical towards the impact of ASGM on the local community, with less agreement that ASGM is positive after wrt before treatment.

Table 2.6: Main estimation results

	(1) prison sentence recomm. (length)	(2) change in attitude	(3) money donated	(4) in favor of fine (amount)	(5) in favor of fine (dummy)	(6) in favor of prison sentence (length)	(7) in favor of of prison sentence (dummy)
Panel A							
Treated	0.222	-0.220**	0.433	-0.451**	-0.189***	-0.120	-0.0850
	(0.417)	(-2.597)	(0.626)	(-2.689)	(-2.967)	(-0.712)	(-1.125)
District controls	no	no	no	no	no	no	no
Observations	210	208	210	210	210	210	210
R-squared	0.002	0.024	0.002	0.023	0.036	0.003	0.008
Panel B							
Treated	0.181	-0.215**	0.299	-0.326**	-0.152***	0.0135	-0.0275
	(0.419)	(-2.495)	(0.479)	(-2.361)	(-2.835)	(0.0869)	(-0.406)
District controls	yes	yes	yes	yes	yes	yes	yes
Observations	210	208	210	210	210	210	210
R-squared	0.047	0.048	0.117	0.081	0.092	0.125	0.138

All estimations contain a constant term (not shown). Robust standard errors (clustered by mining site) in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Treated in column (1) refers to the prison sentence treatment in the survey experiment. Treated in columns (2) - (7) refers to the Minamata disease graphic images treatment in the video experiment.

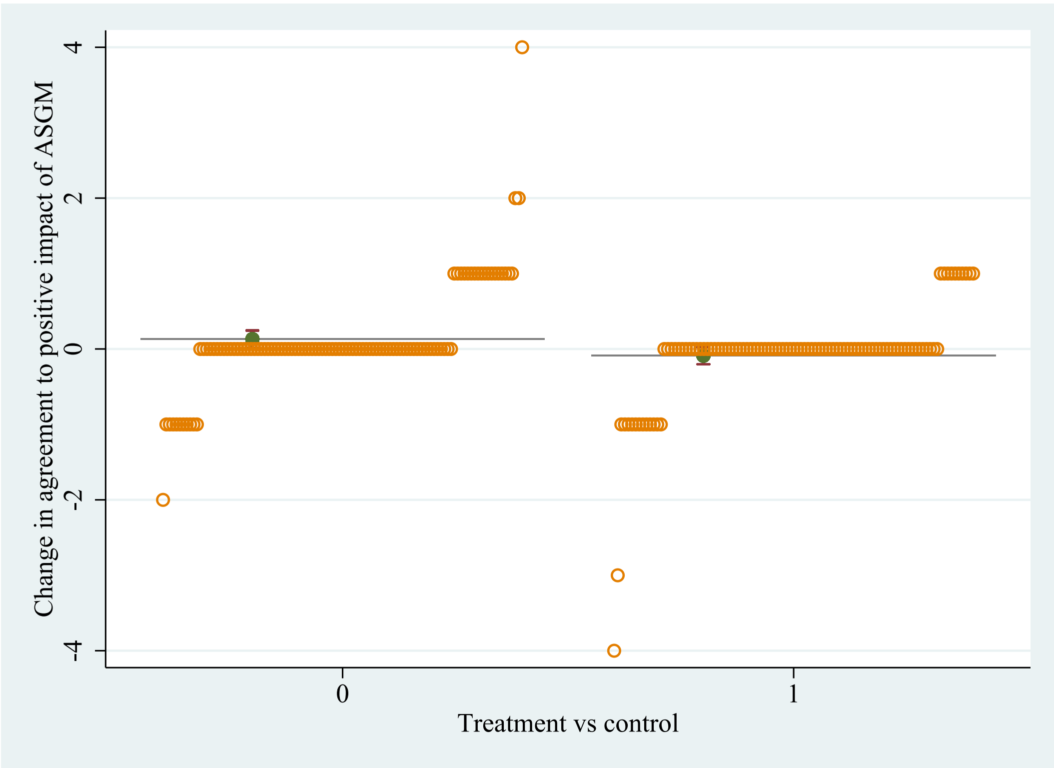
Column (3) of Panel A in Table 2.6 shows that there was no significant difference in the *money donated* of ASGM miners who received the video treatment and were assigned into the donation treatment compared to ASGM miners who received the video control and were assigned into donation control. Figure B.3 in Appendix B.2 displays the difference between subjects who watched the graphic images of Minamata Disease and were asked to donate to an NGO described with an emphasis on its environmental work compared to those who just watched the informational video and donated to the NGO without an emphasis on environmental work.

Columns (4) and (5) of Table 2.6 show that ASGM miners who received the video treatment are less in favor of the introduction of a fine for mercury use and would give a lower fine, at the 1% and 5% significance levels, respectively. Figure B.3 in Appendix B.2 displays ASGM miners' lower support for a mercury use fine after having watched the informational video with graphic images of Minamata Disease compared to the ASGM miners who just watched the informational video.

Although columns (6) and (7) of Table 2.6 show no significant difference between treatment and control groups for *in favor of prison sentence*, treated ASGM miners were slightly less likely to be in favor of a prison sentence for mercury use and gave a shorter sentence. The direction of the coefficients is similar to the *in favor of fine* variables, so that ASGM miners were less likely to support either a fine or a prison sentence after having watched the treated version of the video. Figure B.4 in Appendix B.2 displays ASGM miners' lower support for a mercury use prison sentence after having watched the informational video with graphic images of Minamata Disease compared to the ASGM miners who just watched the informational video.

We also controlled for any difference between districts in all estimations in Panel B, and show that the estimations are robust to district effects.

Figure 2.2: Treatment effect on attitude of the impact of ASGM on the local community



Note: Treatment and control groups are given on x-axis, and change in attitudes on y-axis. Yellow dots show the frequency of responses, the solid lines show average response value, and the green dots show average effects on control (left) and treated (right) with 90% confidence intervals. Attitudes are measured by answers to the question "Overall, artisanal and small-scale gold mining (galamsey) has had a positive effect on the local community." Answers are given on a scale from 1 (strong disagreement) to 5 (strong agreement). The change in attitudes is computed by subtracting the post-treatment value from the pre-treatment value. Negative (positive) values imply increasing disagreement (agreement) with the statement; zero values imply no change.

2.6.2 Further Results

Although assignment into treatment was randomly determined by the survey program for each participant, our control group was significantly older, more educated, and had better living conditions. Table 2.7 below provides the summary statistics in demographic variables by treatment and control. To see whether the results are robust to additional controls, we also control for demographics, household variables, knowledge and experience of mercury contamination, and health symptoms related to mercury contamination. Table B.1 in Appendix B.2 presents the results with demographic controls, and shows that the impact on the variables *change in attitude* and *in favor of fine (dummy)* remain robust. The demographic controls also provide us with additional significant effects. At the 5% significance level, higher educated individuals and women had more favorable attitudes towards the impact of ASGM on the local community. Having someone in the household who is an elected Unit Committee (UC) or District Assembly (DA) member also leads significantly to (a) a higher amount of *money donated* to the NGO, and (b) being more in favor of a fine and prison sentence for mercury use (dummy). Finally, the longer someone has lived in a district, the less they favor a prison sentence for mercury use.

Table 2.7: Summary statistics

	(1)			
	Treated	Untreated	Difference	Std. Error
Age	32.5149	36.2385	3.7237***	1.2912
Male	0.9010	0.9266	0.0256	0.0388
Education	2.4059	2.9450	0.5390**	0.2369
Living condition	2.5149	2.8165	0.3017**	0.1413
Years in district	8.9663	10.6982	1.7318	1.4768
Urban	0.0099	0.0000	-0.0099	0.0095
Observations	210			

* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Table B.2 in Appendix B.2 presents the results with household controls, and shows that only the impact on the *change in attitude* remains robust. The following household control variables had some significant impacts: those who had a car or motorbike in their household donated more money at the 5% significance level; those with self-declared better living conditions were more in favor of a fine (at the 1% significance level) and/or prison sentence for mercury use (at the 5% significance level); those with farming or fishing in their household were more in favor of a prison sentence for mercury use (at the 1% significance level); and those with livestock in the household had a more positive change in attitude (at the 1% significance level).

Table B.3 in Appendix B.2 presents the results with mercury knowledge and experience controls, and shows that the impact on the *change in attitude* and agreement to a fine for mercury use (both measures) remain robust. The following control variables had significant impacts: having heard or read about mercury contamination improves ASGM attitudes (at the 5% significance level), and knowing that ASGM can cause mercury contamination worsens attitudes (at the 5% significance level) and decreases the amount of money donated (at the 5% significance level).

Table B.4 in Appendix B.2 presents the results with health controls, and shows that the impact on the *change in attitude* and agreement to a fine for mercury use (both measures) remain robust. The following control variables had some significant impacts: memory loss increases agreement to a fine (at the 5% significance level) or prison sentence (at the 10% significance level) for mercury use; muscle weakness decreases agreement to fine (at the 1% and 5% significance levels for both measures) or prison sentence (at the 10% and 5% significance levels for both measures); severe coughing slightly decreases the money amount donated and agreement to a fine or prison sentence (at the 1% significance level) for mercury use.

2.7 Conclusions

The surge in artisanal and small-scale gold mining ("ASGM") has led to negative environmental and health outcomes, especially due to the widespread use of mercury. The ASGM sector is now the main emitter of mercury worldwide (UNEP, 2020b). Ghana is currently Africa's main gold producer and it has a long history of both industrial and small-scale gold mining, with the latter seeing common usage of mercury during the amalgamation process. We investigate how much knowledge about mercury pollution and its consequences small-scale miners in Ghana have, and whether receiving graphic information on the consequences of mercury poisoning through a video experiment impacts their attitudes and intended environmental behavior. Experimental and survey data were collected from 210 small-scale gold miners working in 21 different Ghanaian mining sites in six mining districts throughout the country, providing a unique insight into a good-sized sample of ASGM workers. We combine a survey experiment, video experiment, and charity donation experiment to measure attitudes towards small-scale miners and intended environmental behavior. In the main video experiment, all miners are provided with information on current ASGM practices, ASGM pollution, and cleaner technologies in video format, while treated miners are also provided with graphic images of Minamata Disease.

We find that our small-scale miners had worked in this sector for an average of eight years, and that 70% report having some exposure to mercury, though only 40% of them had good knowledge about mercury contamination and its health effects. Worryingly, most respondents were experiencing at least one health symptom compatible with mercury poisoning. Small-scale miners who were randomly assigned into watching the treatment video had a more negative attitude about the impact of ASGM on their local community, but they did not show any positive changes in their intended environmental behavior as measured by their donations to a relevant NGO.

Our results at this point remain suggestive of the impact that better knowledge can have on attitudes and behavior of polluters due to issues with treatment randomization in the field. A more systematic evaluation of the effect on behavior of greater information provision on the dangers of mercury contamination, ideally combined with a demonstration of alternative technologies, is left to future research.

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Chapter 3

Ignorance is Bliss? The effect of reducing ambiguity in negative externalities on victims' behavior towards perpetrators

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Abstract: Inaccurate information about negative environmental externalities may lead to underestimation of their severity, which, in turn, can affect victims' behavior. We investigate whether reducing ambiguity in a negative externality impacts victims' prosocial behavior towards the individuals who impose them (the "perpetrators"). We combine a real effort encryption task with a Dictator Game in an online experiment. Victims experience a negative externality by their matched perpetrator through their payoff scheme, and were randomly assigned into an information treatment revealing the exact size of the negative externality imposed by their matched perpetrator. Victims then had to decide how much to give or take away from their matched perpetrator in a Dictator Game. A positive transfer amount was taken to indicate prosociality. Although victims assigned into the information treatment took away more tokens from their matched perpetrator compared to victims who did not receive this information, there was no significant difference in prosocial behavior between treated and untreated victims.

Keywords: online experiment, Dictator Game, information treatment, negative environmental externalities

3.1 Introduction

People often have inaccurate information about negative environmental externalities. When environmental externalities are imposed on individuals, those who are most affected by them can have varied perceptions about their impact. Varied perceptions may be due to imperfect understanding of environmental facts, or simply because of a temporal lag between the cause of the environmental externality and its manifestation. Mercury contamination is a good example of a negative environmental externality that is directly caused by human activity, but the effects of which are not always known or understood by the wider population (Tschakert and Singha, 2007; Gibb and O'Leary, 2014). Since mercury contamination is invisible and the negative health impacts from it may only be experienced after several years, varied perceptions about the severity of this type of externality are more likely. Climate change is another example of a negative externality with a scientific consensus on the threat it poses to humans (Cook et al., 2013), but with slow dissemination of this information to the wider population (Donner and McDaniels, 2013; Lee et al., 2015).

Negative environmental externalities are often associated with ambiguous risks because of limited scientific knowledge and negative outcomes becoming visible only after several years. Ambiguity can thus lead to the severity of negative externalities being over- or under-estimated. Within formal institutions, persistent underestimations in the severity of a negative environmental externality would lead to a sub-optimal Coasian bargaining approach. Similarly, within informal institutions, motivations such as other-regarding preferences that would typically mobilize individuals to collective action (Narayan and Deepa, 1999; Goeree, Holt, and Laury, 2002; Karapetyan and d'Adda, 2014) may not be triggered whenever there is an underestimation in the severity of the externality. The literature on the relationship between the experience of environmental degradation and more anti-social behavior is mixed, and mainly focused on macro-level evidence (Bernauer, Böhmelt, and Koubi, 2012; Salehyan, 2014). However, individuals living environmentally degraded settings may not all experience or perceive the degradation in the same way. Ambiguity and uncertainty about the imposition of negative environmental externalities, such as mercury contamination, could help better explain the mixed results. Experimental literature on the topic of ambiguity has shown that people tend to be ambiguity averse (Machina and Siniscalchi, 2014), and prefer precise gambles or known probabilities over ambiguous gambles or unknown probabilities. While people are willing to pay for knowing probabilities related to gains, they are less willing to pay for knowing probabilities related to losses (Eckel and

Moore, 2006).

In this paper, we examine whether reducing ambiguity in a negative externality impacts victims' prosocial behavior towards the individuals who impose them (the "perpetrators"). Since it is difficult to systematically vary information on the size of a negative externality in the real world, the experimental approach of this paper can help to determine whether there is a causal relationship between the reduction of ambiguity on a negative externality and social cohesion. We investigate this by combining a real effort encryption task with a Dictator Game in an online experiment. Subjects were randomly assigned into victim and perpetrator roles at the start of the experiment and earned money with the same piece-rate and task. The victims' knew, however, that their payoff scheme depended on the effort their matched perpetrators exerted in the task. The information treatment provided victims with the exact size of the negative externality their matched perpetrator imposed prior to participation in the Dictator Game. Prior to the information treatment and after completion of the real effort task, victims were also asked to state their beliefs on the size of the negative externality imposed. Treated victims decided how much to give or take away from their matched perpetrator after they had also been given the information treatment, and their decision was used to measure prosocial behavior.

The information about the negative externality becomes more salient in the treatment so that simply stating the exact amount of the negative externality provides victims with more emphasis on the loss they experienced. That being said, when we reduced ambiguity, we also gave victims a chance to update their prior beliefs about the amount of the negative externality imposed. If there was any discrepancy between the belief in the externality amount and the actual externality amount, this may have led to a change in victims' behaviour towards perpetrators. As an example, initial overestimation is more likely to be correlated with greater generosity towards the perpetrator once they are given more exact information. Information on deservingness has been shown to be important in common fairness models (Heuer et al., 2016), and prosociality has also been shown to be greater when there is greater perceived deservingness (Doesum et al., 2022). Thus, we would also expect a reduction in ambiguity in the negative externality amount to change victims' prosocial behavior towards perpetrators based on their prior beliefs.

The majority of victims in our sample underestimated the externality amount. We would thus expect that victims in the treatment group would give less to their matched perpetrators. Overall, victims assigned into the treatment group took away more tokens from their matched perpetrator compared to victims assigned into the control group. Underestimating the amount of the externality was associated with taking away 2.5 tokens from perpetrators amongst treated victims, while untreated victims gave 1.2 tokens to perpetrators. Overestimating the amount of the negative externality was associated with giving 3.5 tokens to perpetrators amongst treated victims, while untreated victims took away .74 tokens from perpetrators. Reducing ambiguity in the negative externality did decrease victims' prosocial behavior towards perpetrators, and changed victims' prosocial behavior depending on the prior beliefs they had about the amount of the externality. However, these effects were insignificant due to a small sample size of participants. We cannot conclude within this study whether reducing ambiguity did or did not have an impact on victims' behavior towards perpetrators.

Section 3.2 describes the experiment, Section 3.3 reviews the results, and Section 3.4 concludes.

3.2 The Experiment

3.2.1 Design

We utilize an *encryption task* in combination with a *give or take option Dictator Game*, and systematically vary between the subjects the information that they receive on the size of the negative externality they experience. We also control for beliefs about the amount of the negative externality, whether subjects believed the encryption task to be fair, and demographic characteristics. Subjects were assigned into either a victim or perpetrator role[1]. The following were common knowledge: role assignment prior to the start of the encryption task[2]; the earnings rate of 2 tokens per word, with the same rate applied to all players; and the number of tokens the perpetrator could take away from the victim each time the perpetrator encoded a word correctly (1 token).

Figure 3.1a represents the sequential stages of the experiment for perpetrators. At the encryption task stage, perpetrators knew that they would earn 2 tokens (£0.05) for every word encoded correctly while taking away 1 token from their paired victim. Once all perpetrators completed the experiment, victims were then randomly assigned into treatment versus control groups and randomly paired with perpetrator outcomes. Each victim had a 50% chance of being assigned into the treatment versus the control group. Figure 3.1b represents the sequential stages of the experiment for victims.

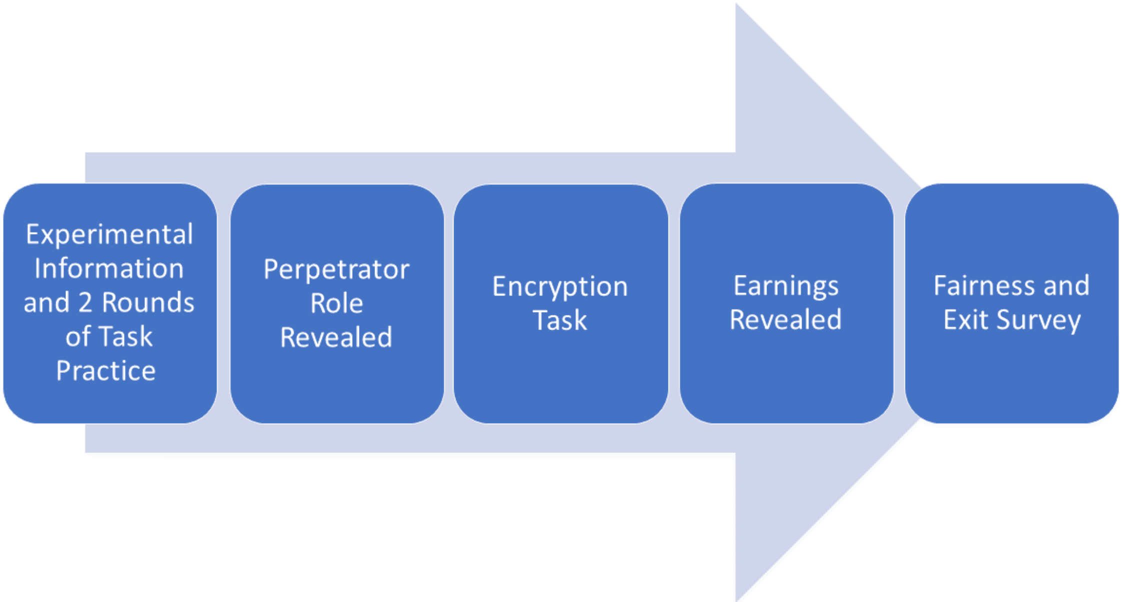
The *encryption task* used in this experiment was borrowed from Erkal, Gangadharan,

[1]When the experiment was conducted, a victim was assigned to be a "yellow player" and a perpetrator was assigned to be a "blue player" in order to avoid framing effects

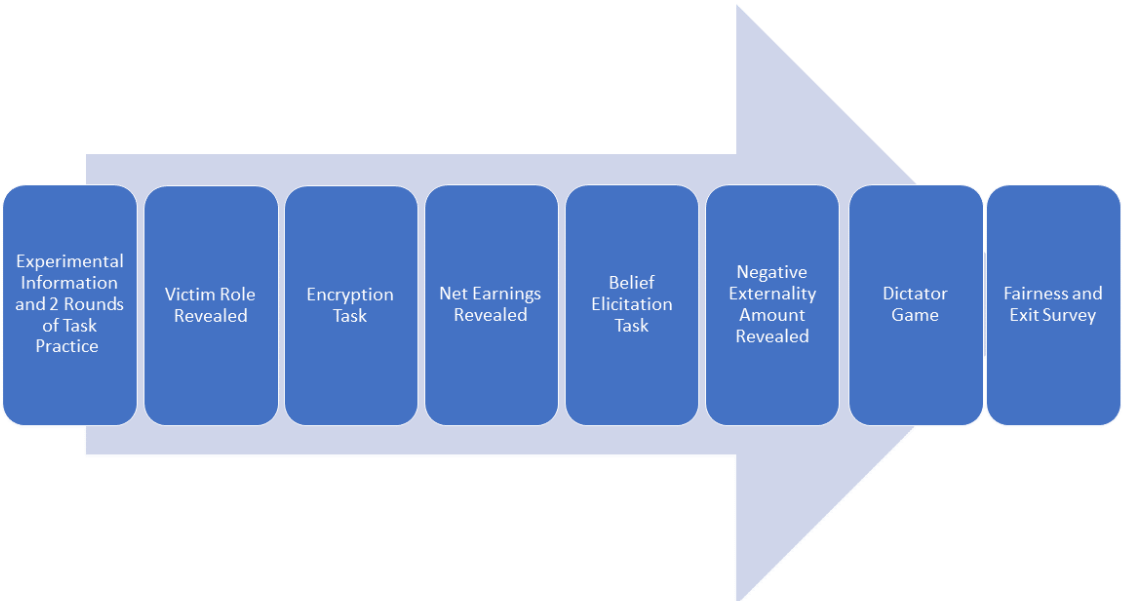
[2]Since the experiment had to be conducted online without real-time interactions, blue players had to participate first. At the start of yellow player participation, the blue player outcomes were randomly paired with yellow players along with random application of the information treatments.

and Nikiforakis (2011), and consists of subjects encrypting combinations of letters into numbers. A table that allocates numbers to letters is provided for subjects, where a number is assigned to each letter of the alphabet in random order. An example screenshot of the task in this experiment is provided in Figure C.1. In order to have effective information treatments in this experiment, it was important for subjects to have varied estimated earnings calculations. This real effort task was chosen so that subjects had more incentive to exert effort without calculating exact earnings. Additionally, the *encryption task* is recommended when the experimenter is not concerned with task performance as an outcome variable but needs endowments to be endogenous (Benndorf, Rau, and Sölch, 2018).

In this experiment, the encryption task lasted 360 seconds, and all players earned 2 tokens (£0.05) for each word encoded correctly. The average player encoded just under 3 words per minute, with the best performing subject encoding over 4 words per minute. In previously conducted encryption tasks, the best performing subjects encoded just under 6 words in 60 seconds (Erkal, Gangadharan, and Nikiforakis, 2011).



(a) Perpetrators



(b) Victims

Figure 3.1: Sequential Stages of Experiment

3.2.2 Information Treatment: Externality Amount

The purpose behind the information treatment was to see whether victims' behavior towards perpetrators changes when they know the exact amount of the negative externality imposed on them. While the control group knew a negative externality would be imposed each time their matched perpetrator encoded a word correctly, they didn't have information on the size of the externality. The treatment, therefore, was providing additional information on the exact amount of the negative externality imposed. All victims were told their net earnings immediately after completion of the encryption task. Victims who were randomly assigned into the information treatment were told exactly how much perpetrators negatively impacted their gross earnings.

The messages to victims were varied as follows, with the information treatment message in boldface:

- *Treatment Message - Full Information*:

  Recall that your matched Blue player completed the same Encryption task as you, but that for every word the Blue player encrypted correctly, you lost 1 token from your earnings.

  Your matched Blue player decreased your additional earnings by [XX] token(s) when exerting effort in the Encryption task.

  Therefore, your earnings for the Encryption task are [XX] tokens.

- *Control Message - Limited Information*:

  Recall that your matched Blue player completed the same Encryption task as you, but that for every word the Blue player encrypted correctly, you lost 1 token from your earnings.

  Your earnings for the Encryption task are [XX] tokens.

3.2.3 Outcome Variable: Prosocial Behavior

Following assignment into treatment, a give or take option style Dictator Game (List, 2007) was played with the dictator role being given to victims. By using this version of the Dictator Game, a more accurate preference for prosocial behavior will be measured because context matters (List, 2007; Zhang et al., 2012), and having a symmetric action space minimizes the experimenter demand effect (Zizzo, 2010). In this task, victims were told that they are now endowed with 20 tokens, and their counterparts have been endowed with 10 tokens. Using a slider, victims had to then choose to give up to 20 tokens to their counterpart or take away up to 10 tokens from them in 1 token increments. Figures C.2-C.3 provide the screenshots of the instructions and the decision screen for the Dictator Game.

3.2.4 Control Variables: Belief Discrepancy and Fairness

Belief Discrepancy. Victim role players were asked to state their beliefs on the amount of the negative externality. After participation in the encryption task and having only received information about their net earnings, victims were asked how much they thought their matched perpetrator reduced their earnings by. Figure C.4 provides the screenshot of the beliefs survey taken on the negative externality amount. We then construct the belief discrepancy variable by using the difference between the belief in the amount of the negative externality and the actual amount the matched perpetrator imposed.

Fairness. To control for participants' fairness perception of the encryption task, victims answered how fair the task was from very unfair to very fair using a drop-down menu. Figure C.5 provides the screenshot of the fairness survey taken on the encryption task.

3.2.5 Procedures

The experiment was conducted online using the Prolific platform and was programmed in o-Tree (Chen, Schonger, and Wickens, 2016). Since real-time interactions couldn't be conducted via the online platform, 61 participants were recruited into the perpetrator roles first. A total of 62 participants were recruited into victim roles. The sample was balanced by gender and included individuals who resided in the US, UK, and Ireland. Two sessions were run in October 2021, with each session lasting from 12 to 49 minutes. Participants received detailed written instructions, and were given both attention and understanding checks. If a participant failed more than one attention check, they could not move forward with the experiment (see Figure C.6 for an example). Understanding checks were used to test for comprehension of roles and payoffs in the experiment. If a participant answered an understanding check question incorrectly, the computer program redirected them back to the instructions. All understanding check questions needed to be answered correctly for a participant to move on to the next section (Figure C.7 provides the understanding check questions). The payoff for each victim role was the summation of their participation fee, net earnings from the encryption task, and money from the Dictator Game.

3.2.6 Empirical Strategy

To analyze how prosocial victims of negative externalities will behave towards perpetrators after they have been assigned into the information treatment, we run the following OLS regression model:

$$\begin{split} TokensTransferred_i = \alpha + \beta InformationTreatment_i + \gamma BeliefDiscrepancy_i \\ + \delta Fairness_i + \zeta BasicControls_i + \epsilon_i \end{split} \tag{3.1}$$

where the dependent variable, $TokensTransferred_i$, is the token amount transferred by individual victim player i, from -10 to 20 tokens in 1 token increments. $InformationTreatment_i$

stands for individual player i having received the treatment about the exact amount of the negative externality the matched perpetrator imposed. $BeliefDiscrepancy_i$ is the amount of the negative externality player i believes the matched perpetrator player imposed, subtracted by the actual externality amount imposed. $Fairness_i$ is how fair individual player i felt the encryption task was on a 5-point Likert scale from very unfair to very fair (-2 to 2). $BasicControls_i$ is a vector of control variables including age, gender, student status, and the externality amount imposed from the encryption task.

Hypothesis 1: *Providing salient information about the negative externality will lead victims to behave less prosocial towards perpetrators.*

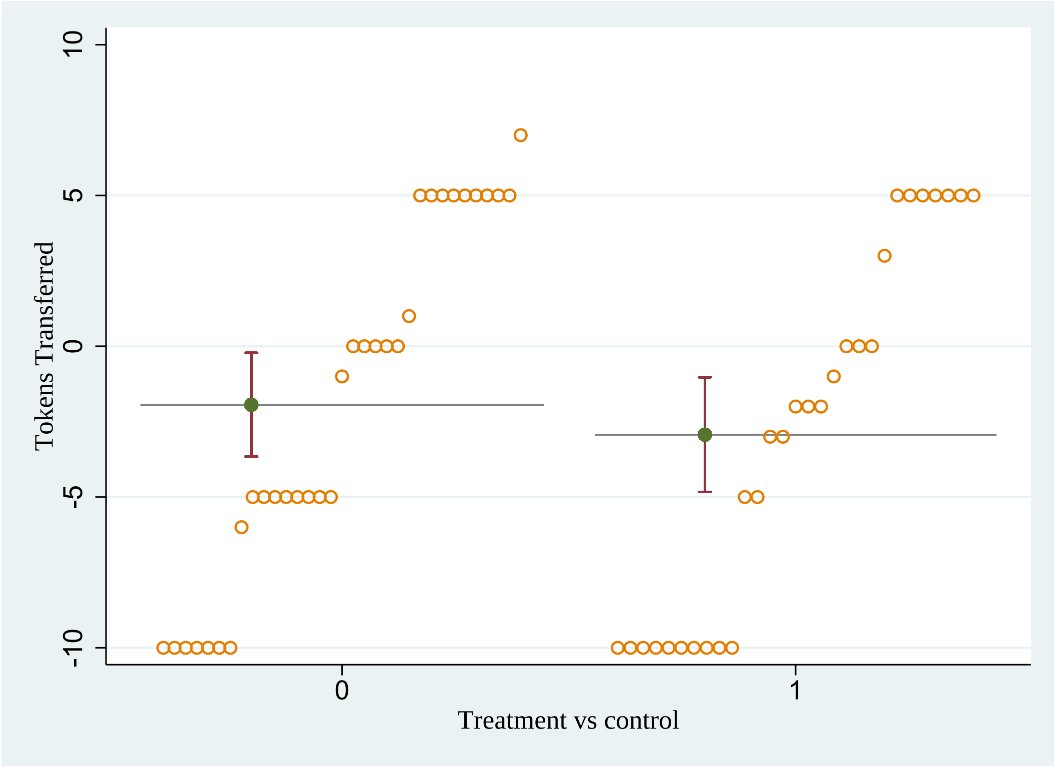
Hypothesis 2: *Treated victims will behave less prosocial towards perpetrators if their beliefs about the negative externality were underestimated.*

Hypothesis 3: *Treated victims will behave more prosocial towards perpetrators if their beliefs about the negative externality were overestimated.*

3.3 Results

Table C.1 displays the summary statistics of victims assigned into the treatment versus control group, with no significant differences between the two groups. Both treated and untreated victims significantly underestimated the externality amount at the 1% significance level. Figure 3.2 displays the difference in victims' prosocial behavior towards perpetrators when having limited information about the negative externality versus having full information. On average, victims' prosocial behavior towards perpetrators was lower when they were told the exact size of the negative externality imposed compared to victims who did not have this information.

Figure 3.2: Treatment effect on Tokens Transferred



Note: Treatment and control groups are given on x-axis, and tokens transferred on y-axis. Orange dots show frequency of responses, the solid lines show average response value, and the green dots show average effects on control (left) and treated (right) with 90% confidence intervals.

Table 3.1 displays the OLS regression results of the information treatment effect on the number of tokens transferred. The direction of the effect is negative in all estimations and supports our hypothesis. However, the effect is insignificant and standard errors are large. Both columns (2) and (3) also show that at the 1% significance level, older victims also gave a significantly more positive transfer amount to their matched perpetrator.

Table 3.1: OLS Regression Results of Information Treatment Effect on Dictator Game

	(1) Main effect	(2) + Basic controls	(3) + Additional controls
treated victim	-0.992	-0.738	-0.450
	(1.071)	(0.678)	(0.706)
externality amount		-0.396	-0.345
		(0.381)	(0.425)
age		0.124***	0.146***
		(0.00565)	(0.00903)
female		1.665	2.003
		(2.898)	(3.192)
employed		-1.706	-1.664
		(2.135)	(1.955)
student		-0.441	-0.370
		(2.192)	(2.480)
belief discrepancy			-0.0232
			(0.0379)
fairness			0.620
			(0.456)
Constant	-1.939	0.405	-1.163
	(0.839)	(7.432)	(8.360)
Observations	62	61	61
R^2	0.007	0.146	0.162

Standard errors in parentheses

* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Notes: The treated victim is a dummy variable equal to one if a victim was randomly assigned into the information treatment, which revealed the exact size of the negative externality imposed by the matched perpetrator. Column (1) shows the main treatment effect, column (2) adds basic control variables, and column (3) also adds victims' belief discrepancy in the externality amount and how fair victims believed the encryption task to be based on a Likert-scale from very unfair to very fair.

Figure C.8 displays the number of tokens that victims transferred to perpetrators in the treatment group versus the control group, with a greater proportion of treated victims making the maximum negative transfer amount of 10 tokens. Based on the distribution of *Tokens Transferred*, we created the following four categories of victims: (1) takers, victims who took away any number of tokens from their matched perpetrator; (2) givers, victims who gave any number of tokens to their matched perpetrator; (3) extreme takers, victims who took away 10 tokens from their matched perpetrator; and (4) extreme givers, victims who gave 5 or more tokens to their matched perpetrator. Table C.2 displays the proportions tests for each category of victim in the treatment versus control group, and shows that the biggest difference between treatment and control is with the extreme takers. However, the difference is again insignificant. Figure C.9 graphically displays the difference in extreme taking between victims in the treated versus control groups, supporting our hypothesis that victims who receive the information treatment will behave less prosocial towards their matched perpetrator.

We also explore to what extent either the externality amount or net encryption earnings had any impact on the number of tokens transferred. Figures C.10 and C.11 graphically display the relationship between the externality amount and tokens transferred, and victims' net encryption earnings with tokens transferred by treatment versus control groups. There's no evidence to suggest that either of these variables had any impact in victims' decisions to give or take away tokens from their matched perpetrator.

Finally, we analyze if treated victims' prosocial behavior towards perpetrators was different compared to untreated victims because treated victims were given the chance to update their beliefs once they were given exact information on the negative externality amount. Table C.3 displays the OLS regression results of how underestimating or overestimating the negative externality amount imposed was associated giving behavior. Our data showed that 66% of the sample underestimated the externality amount, while 26% of the sample overestimated it. Underestimating the amount of the externality was associated with taking away 2.5 tokens from perpetrators amongst treated victims (p-value=.3), while untreated victims gave 1.2 tokens to perpetrators (p-value=.6). Overestimating the amount of the negative externality was associated with giving 3.5 tokens to perpetrators amongst treated victims (p-value=.16) while untreated victims took away .74 tokens from perpetrators (p-value=.76). While our sample was not powered enough to show significant effects that beliefs had on behavior, victims' behavior towards perpetrators was different after victims updated their beliefs about the negative externality amount.

3.4 Conclusion

Information on negative environmental externalities is not always well understood by the wider population, especially when there is a time lag in the negative outcomes stemming from an externality. Victims of negative externalities who have imperfect information will therefore have varied perceptions and behavior toward the perpetrators. This research aimed to see whether experimentally varying victims' information on the exact size of a negative externality leads to a significant difference in the prosocial behavior of victims towards perpetrators. Although there was a decrease in the prosocial behavior of victims who had this information treatment, reducing ambiguity in the precise size of a negative externality did not significantly impact victims' behavior towards perpetrators.

We believe having a larger sample size would have contributed to a stronger treatment effect, especially because the direction of the coefficients for all estimation results relevant to treated victims are consistent. Again, though the results were not significant, there was a difference in victims' behavior towards perpetrators with a reduction in ambiguity about the negative externality amount. Among treated victims, underestimation of the negative externality imposed was associated with lower prosocial behavior towards perpetrators while overestimation was associated with greater prosocial behavior. By leaving the amount of the negative externality imposed more ambiguous for untreated victims, there was no chance to update beliefs and thus exhibit the same type of prosocial behaviors as the treated victims exhibited.

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Chapter 4

Punishing Naughty and Rewarding Nice: On the effects of willful choice in imposing negative externalities

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Abstract: Pollution victims do not always behave in the same way toward polluters in different settings. We propose that polluters' choices matter and examine whether a willfully chosen or randomly allocated (negative) externality affects victims' behavior towards the perpetrators. We assign victim and perpetrator roles in online experiments, and use a real effort encryption task with different payoff schemes for perpetrators that can generate a negative externality on the victims. We vary whether or not victims' experience of a (negative) externality was due to the willful choice made by a matched perpetrator or to a random choice by an algorithm. After victims experience their matched perpetrators' (negative) externality, they decide the allocation to their matched perpetrator in a Give-or-Take Dictator Game. We find that victims take away from perpetrators similarly whether they are subjected to a willfully or randomly imposed negative externality. However, (potential) victims give to (potential) perpetrators who choose to prevent a negative externality, but take away from perpetrators who randomly do not impose the externality. Most interestingly, victims' behavior overall changes significantly in the willful choice treatment compared to the random choice control: deliberate good (bad) behavior by perpetrators is rewarded (punished), while we see no difference in victims' behavior towards perpetrators in the random choice scenarios – they always take away from them. This suggests that choices of potential polluters matter for the responses of potential pollution victims.

Keywords: negative externalities, choices, Dictator Game, punishment, rewards, pollution victims

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4.1 Introduction

In September 2019, Malaysian and Singaporean authorities issued a warning of extremely poor air quality conditions as a consequence of slash-and-burn farming practices in Indonesia, calling on the Indonesian government to take action (Yeung, 2019). The situation has been recurring for several years, despite Indonesian authorities trying to halt the illegal practice (Alisjahbana and Busch, 2017); yet, it has not led to serious tensions in the region. In many situations around the world, economic actors engage in activities with limited knowledge of the extent of the negative externalities they cause. Sometimes environmental degradation can lead to conflicts between perpetrators and victims, but other times it does not.

Why there should be such different responses by victims to negative externalities is an open question in the literature. Evidence for the causal relationship between the experience of environmental degradation and conflict is mixed and mostly based on macro-level analysis (Bernauer, Böhmelt, and Koubi, 2012; Salehyan, 2014). When individuals experience a negative environmental externality, their behavior from this experience varies - from non-violent protests and diplomatic conflicts to violent conflict and civil war (Adamo, 2018). Even when faced with the same type of negative environmental externalities, such as polluted water bodies, victims' behavior towards the perpetrators of the pollution varies. For example, Ghana saw an increase in social conflict during an influx of Chinese miners in the country's small-scale gold mining sector, which greatly aggravated existing issues with environmental degradation due to the heavy use of mechanized equipment.[1] However, Karapetyan (2022) recently found that pollution victims living in farming communities in gold mining areas acted more prosocially towards small-scale gold miners than towards other people. The difference in behavior of pollution victims towards polluters may be due to the perception of the polluting activity being an intentional choice in one case, and unintentional in the other.

In this paper, we examine whether victims' knowledge that a negative externality was intentionally chosen or intentionally prevented by their matched perpetrator, compared to being randomly chosen or prevented by a computer program, makes a difference in victims' giving/taking behavior towards their matched perpetrator. In an online experiment, we combine a real-effort encryption task and two treatment conditions. Subjects are assigned into "victim" or "perpetrator" roles, with both roles earning money via the real-effort task. Perpetrators engage in three rounds of the real-effort task, two of which could generate a

[1] See Guardian, "Influx of Chinese goldminers sparks tensions in Ghana", 23 April 2013.

negative externality on their matched victims. In the first two rounds of the effort task, perpetrators are forced into a payoff scheme chosen by the computer program - one with a lower piece rate per word encrypted and no reduction in the matched victim's earnings, and one with a higher piece rate and a reduction in the matched victim's earnings. In the final round, perpetrators are instead given a choice between the two different payoff schemes.

Victims engage in the same real-effort task, knowing that there is a chance some of their earnings may be reduced by a negative externality. Victims are randomly assigned into two different treatment conditions: the Random Choice control condition or the Willful Choice treatment condition. In the Random Choice condition, victims know that there is a randomly imposed chance their earnings will be reduced by their matched perpetrator's performance in the same real-effort task. In the Willful Choice treatment condition, victims know that there is a chance their matched perpetrator intentionally chose (not) to participate in a task that reduces the victim's earnings. After the real-effort task, all victims receive information about whether the negative externality they experienced (or not) was an intentional choice or randomly imposed. Finally, victims engage in a give-or-take option Dictator Game with their matched (potential) perpetrator as the recipient.

We show four main results. First, we find that victims take away from perpetrators similarly whether they are subjected to a willfully or a randomly imposed negative externality. Second, (potential) victims give to (potential) perpetrators who choose to prevent a negative externality, but take away from perpetrators who randomly do not impose the externality. Third, (potential) victims take away less when there is no negative externality – regardless of its origin – than when an externality is imposed on them. Fourth and most interestingly, victims' behavior overall changes significantly in the willful choice treatment compared to the random choice one: willful externality prevention by the (potential) perpetrator is answered by the victim giving a positive amount in the Dictator Game, while willful externality imposition is met with taking away. We see no such significant difference in victims' behavior towards (potential) perpetrators in the random choice scenarios – the former always take away from the latter. We interpret this as showing that while self-interest manifests across victims, they reward deliberate good behavior of (potential) perpetrators, and punish deliberate bad behavior. In the environmental pollution context described at the outset, this suggests that choices of potential polluters matter for the responses of potential pollution victims.

The paper contributes to the literature on the importance of intention. Many experimental studies show that intentions matter: people tend to punish bad intentions (Blount, 1995; Brandts and Solà, 2001; Charness and Rabin, 2002; Nelson, 2002; Offerman, 2002; Charness, 2004; Charness and Rabin, 2005; Charness and Levine, 2007a; Falk, Fehr, and Fischbacher, 2003; Falk, Fehr, and Fischbacher, 2008a) and reward good intentions (Charness and Levine, 2007b; Falk, Fehr, and Fischbacher, 2008b). A recent paper on third party punishment and intentionality also shows that intentions are a significant factor in third party punishment of perpetrators (Bicchieri and Maras, 2022). Our paper is consistent with these studies, but we extend the setting to capture an environmental context of victims' behavior towards perpetrators of negative externalities. Looking at equity as well as intentions, Nelson (2002) finds that intentions matter more than equity, and Charness and Levine (2007a) shows that intentions drive behavior rather than the experience of the inequity itself. However, there is also evidence that distributional fairness matters more than intentions (Stanca, 2010; Bone and Raihani, 2015). The evidence presented in the present paper suggests that good intentions matter more than distributional fairness.

We also contribute to the literature on environmental conflict and the reaction to environmental pollution. In particular, the present paper relates to the experiment by Knobe (2003) who showed that randomly chosen respondents were much more willing to blame a hypothetical company chairman for bad environmental behavior than to praise them for good behavior. This has become known as the "Knobe effect" and confirmed in numerous settings, though Utikal and Fischbacher (2014) use a laboratory experiment to find situations where the effect instead vanishes. The present paper shows that people are willing to punish others for deliberately imposing negative externalities on them, and reward others for deliberately preventing a negative externality.

The remainder of the paper is organized as follows: Section 4.2 below provides the experimental design, Section 4.3 presents the results, and Section 4.4 concludes.

4.2 Experimental Design

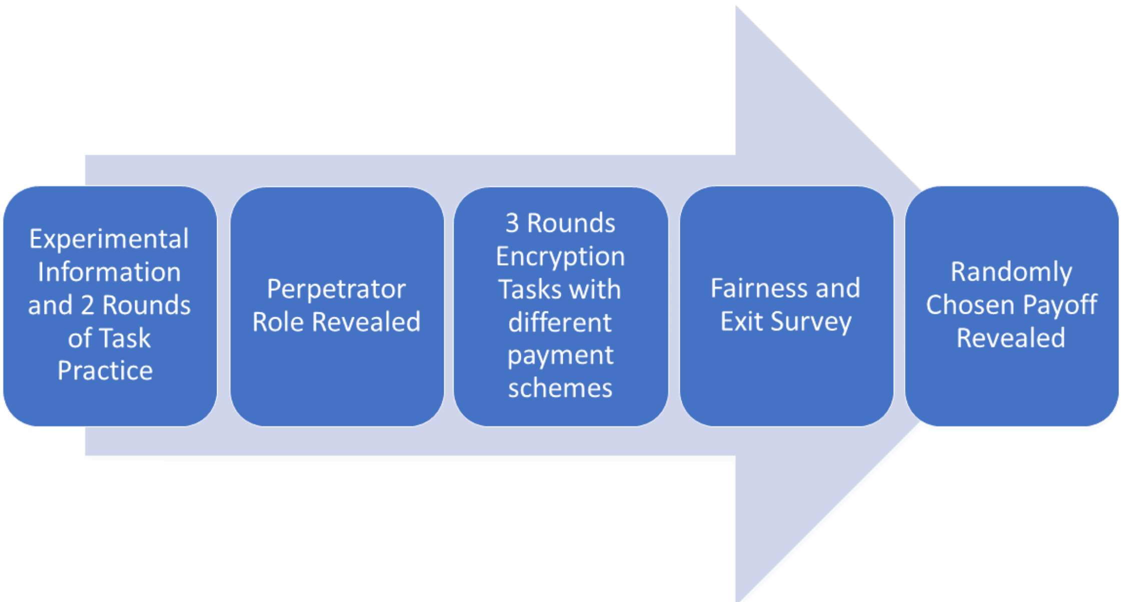
The overall study consists of two distinct parts involving an effort task, and two treatments. The experiment involved two types of players, "perpetrators" and "victims". Perpetrators engaged in an effort task which could generate a negative externality on the victims. The victims engage in an identical effort task, but can have some of their earnings reduced by the negative externality. Victims then engaged in a dictator task with a perpetrator as the recipient. Both victims and perpetrators engage in the same effort task to reflect the idea that most individuals need to earn their living, and some individuals' efforts in earning a living may negatively impact the earnings of others. For example, both a small-scale miner and a farmer are individuals who are trying to earn a living. However, small-scale gold mining is an economic activity that could negatively impact the quality or quantity of crops farmers produce.

The experiment was conducted entirely online, using oTree (Chen, Schonger, and Wickens, 2016) and the Prolific subject pool. As the experiment was online-only, perpetrators and victims did not engage in the experiment simultaneously. We ran sessions with subjects in the perpetrator role (N = 61), followed by sessions with subjects in the victim role (N=300), two weeks apart. Subjects were fully informed about this, with perpetrators acknowledging that they may receive bonus payments at the end of the study period (which they did receive in their Prolific accounts). The sample was balanced on gender, and subjects were recruited from US, UK, and Ireland subject pools.

In what follows, we describe each of these player types separately, the treatment and control, followed by the effort task, our key outcome measure, and additional controls.

4.2.1 Perpetrator Task

A total of 61 subjects were recruited into the role of perpetrator. These subjects were provided instructions on an effort task (described below), and then were asked to undertake the task for three rounds. The sequential stages of the experiment for the perpetrator is shown in Figure 4.1a.



(a) Experimental Stages for Perpetrators

The first round had subjects either:

- undertake the task with a piece rate of 1.5 tokens for each word encrypted, or
- a piece rate of 2 tokens for each word encrypted and a reduction of 0.5 tokens in a victims' payoff.

The contract for the first round was randomly determined so as to reduce the impact of round order. The second round was simply the contract that was not used in the first round. Finally, the third round consisted of a choice: subjects could freely choose between the two contracts they had been exposed to earlier.

This method has two interesting properties. First, as mentioned in Banuri and Keefer (2016), this introduces subjects to the two contracts, and since they experience each, the contract choice in the final round makes the trade-offs to the subjects clear. Second, by randomizing the order of the contract presented in the first round, we avoid anchoring the subjects on either contract type. This is especially important since one of the contracts generates a negative externality on other subjects. We use the data generated by the subjects in the victims' task, where one treatment (Willful Choice) uses the data from round 3 (where subjects can choose not to impose an externality, at a cost to themselves), while the control (Random Choice) uses the data from either round 1 or 2. This is because in either rounds 1 or 2, the externality is imposed, but not because of the choice of the perpetrator. We discuss this in more detail in the next subsection.

The main drawback to this method is that learning may be taking place, which would mean that output in the third and final round can be higher (independent of the impact of choice) than in the first two rounds. This is indeed the case, as we observe higher output as the task progresses. In the results section, we discuss how we account for this in the regressions.

4.2.2 Victim Task

The task for subjects in the role of victim (N=300) consisted of two parts. The first was an effort task (using the encryption task described below). Subjects were informed that they would be participating in this task with a matched partner (a perpetrator). We use a neutral label ("Blue players") to distinguish perpetrators from victims ("Yellow players") to avoid priming the subjects. Subjects were informed that they would be paid 2 tokens (£0.05) for each word correctly encrypted. They were also informed that their earnings would potentially be impacted by their matched ("Blue") partner, who had previously participated in this study. Subjects were first asked to complete an effort task for pay. Once they completed the task, the amount that they earned was displayed, along with any reductions from the effort of their matched counterpart.

As stated earlier, subjects participated under two conditions, a control condition (Random Choice) and a treatment condition (Willful Choice). In the Random Choice condition, subjects were informed that there is a chance their matched ("Blue") partner engaged in a task that would reduce the victims ("Yellow") earnings. The exact wording used is as follows:

> "Recall that your matched Blue player completed the same Encryption task as you, but that the computer program assigned a payoff scheme that would have either decreased your earnings or the earnings of your matched Blue player."

The program then drew a random number indicating whether an externality was imposed or not. <u>If the externality was imposed</u>, the program used data from the appropriate round (either round 1 or 2 of the perpetrators' task). At the end of the effort task, subjects were informed of the following:

> "The computer program assigned the payoff scheme that WOULD decrease your earnings. This means the Blue player decreased your Encryption task earnings by XX token(s) while exerting effort in the task. Therefore, your earnings are XX tokens."

As the above description makes clear, the program selected the payoff scheme which resulted in earnings being reduced by the actions of the perpetrator ("Blue" player).

<u>If the externality was not imposed</u>, the program used data from the appropriate round (either round 1 or 2 of the perpetrators task). At the end of the effort task, subjects were informed of the following:

> "The computer program assigned the payoff scheme that WOULD NOT decrease your earnings. This means the Blue player decreased your Encryption task earnings by 0 token(s) while exerting effort in the task. Therefore, your earnings are XX tokens."

To summarize, in the Random Choice condition, the instructions make clear to the subjects (victims) that any externality imposed was due to the program. Once the program selected the payoff scheme, the perpetrators actions then yielded either a reduction in earnings or not. Moreover, the extent of the reduction is also revealed to the subjects.

In the treatment condition (Willful Choice), subjects were informed that their matched counterparts ("Blue" players) were given a choice between two incentive schemes: one with a high piece rate (2 tokens per encrypted word) which imposed a negative externality on the victims ("Yellow" players), or one with a lower piece rate (1.5 tokens per encrypted word), but which imposed no negative externality. Importantly, the negative externality was lower than the cost to the subject, hence depending on whether victims focused on individual or joint payoff maximization, the choice of imposing the externality would seem unfair.

If victims were matched with a perpetrator that chose to impose the externality, they were informed in the following way:

> "The Blue player CHOSE the payoff scheme that WOULD decrease your earnings. This means the Blue player decreased your Encryption task earnings by XX token(s) while exerting effort in the task. Therefore, your earnings are XX tokens."

Similarly, if victims were matched with a perpetrator that chose not to impose the externality, they were informed in the following way:

> "The Blue player CHOSE the payoff scheme that WOULD NOT decrease your earnings. This means the Blue player decreased your Encryption task earnings by 0 token(s) while exerting effort in the task. Therefore, your earnings are XX tokens."

To summarize, in the Willful Choice condition, the instructions make clear to the subjects (victims) that any externality imposed was a result of a choice made by their counterpart. Once the perpetrator made their contract choice, the perpetrator's actions then yielded either a reduction in earnings or not. As before, the extent of the reduction is also revealed to the subjects.

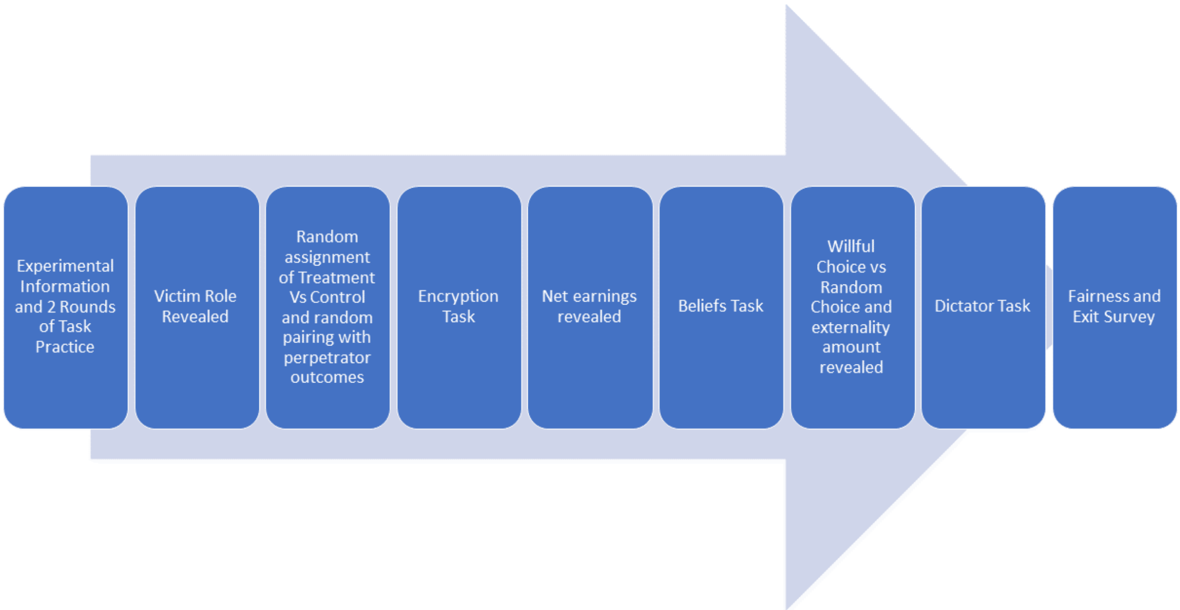
The difference between treatment and control is straightforward. By virtue of the design, the choice of implementing the externality is either made by the program itself, or by the perpetrator. The victim is informed about the state of the world in which they are in: one where perpetrators either had a choice or not in imposing the externality.

4.2.3 Key Outcome Variable

Once victims completed the effort task, and the manner and reduction in earnings was revealed to them, they moved on to the second task, a Give or Take Dictator Game (List, 2007). This Dictator Game is played with the dictator role being assigned to the victim, with the perpetrators as recipients. Victims are informed that they are endowed with 30 tokens, while their matched counterpart (the same player as in the first task) is endowed with 15 tokens. In 1 token increments, the Dictator/victim can choose to transfer up to

30 tokens to, or up to 15 tokens away from, their counterpart. As in standard dictator games, dictators have a higher endowment compared to the potential receivers to observe whether the dictators will make endowment levels more equal. The amount that subjects (victims) give or take from their matched counterparts are of interest.

The sequential stages of the experiment for the victims is given in Figure 4.2a below.



(a) Experimental Stages for Victims

The key point here is that the choices made by perpetrators matter. Subjects are more likely to take money away from perpetrators who wilfully chose to impose the externality, relative to those that did not. Furthermore, this difference in taking is also significantly higher than the difference arising from when this choice was implemented by a computer.

4.2.4 Control Variables

Since our online subject pool had varied demographic characteristics, we controlled for age, gender (a dummy variable equal to one if the subject was female), and student status (a dummy variable equal to one if the subject was a full-time student). We also controlled for the externality amount, fairness of the encryption task, and subjects' (victims') belief discrepancy in the amount of the negative externality. The externality amount, measured in the number of tokens perpetrators decreased victims' earnings by, is used as a control since we would expect a higher externality amount to cause subjects (victims) to give less/take more from their matched counterpart in the dictator task.

Subjects (victims) who both experience a negative externality and know that the program/experimenter generated this externality via the forced externality payment scheme are more likely to think that experimenter's setup of the encryption task was unfair rather than their matched partner's efforts in encrypting as many words as possible. Thus, we control for subjects' reported fairness of the encryption task by asking them to rate how fair the encryption task was on a 5-point Likert Scale, from very unfair to very fair (-2, -1, 0, 1, 2).

Belief discrepancy in the amount of the negative externality was measured from subjects' (victims') belief of what externality amount their matched counterpart imposed subtracted by the actual externality amount imposed. Subjects (victims) were asked to state their beliefs about the negative externality. After the net encryption task earnings were revealed but before the externality amount was revealed, subjects (victims) answered the following questions:

> "Note that your earnings in this task were based on your performance and the performance of your matched Blue player only if the Blue player chose the payoff scheme that would decrease your earnings. Remember that if the Blue player chose this payoff scheme, your earnings were reduced by 1 token for each word your matched Blue player encrypted correctly. Now, please answer the following question. Do you think your matched Blue player chose the payoff scheme that would decrease your earnings? Y/N"
>
> **If yes**: "Since you answered yes, please answer also answer the following questions. We would like to know how much you think you would have earned if the Blue player's performance had no impact on your earnings. Please express the amount in tokens:
>
> Now, we would like to know how much you think your matched Blue player reduced your earnings by. Please express the amount in tokens: "

Table 4.1 below provides the summary statistics for the outcome variable of tokens transferred, along with the control variables listed above. There's a significant difference in the externality amount between the Willful Choice treatment group and the Random Choice control group. This difference is largely due to learning and randomization differences, which are discussed in more detail in Section 4.3.2 below. Furthermore, when the externality amount is controlled for in the regression analysis presented in Section 4.3 below, the results still hold.

Table 4.1: Summary Statistics

	(1)			
	Willful Choice	Random Choice	Difference	SE
Tokens Transferred	-1.4338	-2.3659	-0.9320	0.7659
age	38.6194	32.4224	-6.1970	11.1495
female	0.5147	0.4756	-0.0391	0.0581
student	0.2279	0.2195	-0.0084	0.0485
externality amount	9.9265	6.2500	-3.6765***	1.0056
externality imposed	0.5809	0.4512	-0.1297**	0.0577
belief externality imposed	8.2426	6.5732	-1.6695	1.3632
belief discrepancy	-7.6618	-6.1220	1.5398	1.3709
encryption performance	15.1397	15.5305	0.3908	0.5362
fairness of encryption task	-0.1176	-0.0244	0.0933	0.1457
Observations	300			

$^{*}\ p < 0.1$, $^{**}\ p < .05$, $^{***}\ p < 0.01$

4.2.5 Encryption Task

We implemented the encryption task used by Erkal, Gangadharan, and Nikiforakis (2011), which consisted of participants encrypting combinations of letters into numbers. A coding rubric (a table that allocates numbers to letters) is provided for participants, where a number is assigned to each letter of the alphabet in a random order (see Figure 4.3). Each round of the encryption task lasted 360 seconds (6 minutes). In previously conducted encryption tasks, the best performing participants encrypted just under 6 words per minute (Erkal, Gangadharan, and Nikiforakis, 2011).

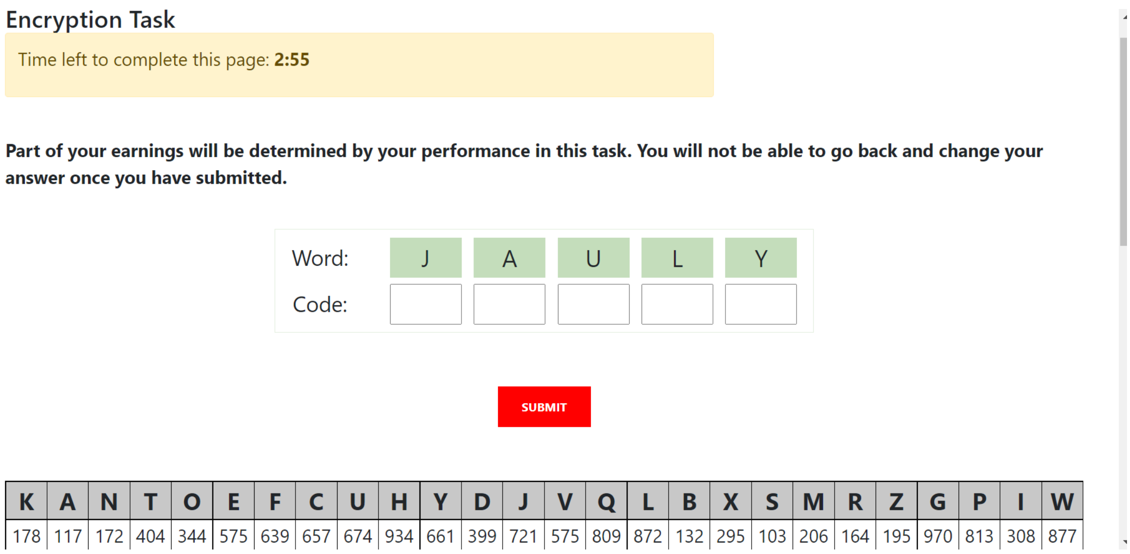


Figure 4.3: Screenshot of Encryption Task

4.2.6 Procedures

Ten online experimental sessions were conducted from October to November 2021. Subjects received detailed online instructions, and were given both attention and understanding checks. The full experimental instructions are provided in Appendix D.3. If a subject failed more than one attention check, they could not move forward with the experiment (the majority of subjects did not fail the attention checks). If a subject answered an understanding check question incorrectly, the computer program redirected them back to the instructions. All understanding check questions needed to be answered correctly for a subject to move on to the next section.

The payoff for each subject was the summation of their participation fee (£2.50), net earnings from the encryption task (based on either 2 tokens (£0.05) or 1.5 tokens per word encrypted depending on the payment scheme), and money from the Dictator Game based on the decision the victims made (from 0 to 40 tokens). At the end of the experiment and survey, the total payoff is revealed for victim roles. The payoff revealed for perpetrator roles was based on the same participation fee and money earned in one randomly chosen encryption task round. Perpetrator roles received money from the Dictator Game only after the victim roles completed their experiment.

4.2.7 Empirical Methodology and Hypotheses

In this section, the empirical strategy for the experiment is described. The purpose of the analysis is to see (i) how much victims of negative externalities will punish perpetrators after they receive information on whether or not the negative externality they experienced was a willful choice and (ii) how much potential victims will reward potential perpetrators after they receive information on whether experiencing the negative externality was willfully prevented by the potential perpetrator.

To evaluate the above, the following OLS regression model is run:

$$\begin{aligned} TokensTransferred_i = \alpha &+ \beta WillfulChoiceTreatment_i * ExternalityImposed_i \\ &+ \gamma BeliefDiscrepancy_i + \delta Fairness_i + \zeta BasicControls_i \\ &+ \epsilon_i \end{aligned} \tag{4.1}$$

where the dependent variable, $TokensTransferred_i$, is the money amount transferred by victim player i, from -15 to 30 tokens (in one token increments) to its matched perpetrator player. $WillfulChoiceTreatment_i$ is a dummy variable equal to one if individual victim player i received the treatment of experiencing (or not experiencing) an externality because of their counterpart player's willful choice. $ExternalityImposed_i$ is a dummy variable equal to one if victim player i experienced an externality. $BeliefDiscrepancy_i$ is the amount of the negative externality player i believes the matched perpetrator player imposed subtracted by the actual externality amount imposed. $Fairness_i$ is how fair player i felt the encryption tasks were on a 5-point Likert scale, from very unfair to very fair. $BasicControls_i$ are the demographic control variables of age, female, student, and externality amount (the amount of externality the perpetrator imposed on the victim in tokens).

To evaluate the impact of the Willful Choice treatment under different externality conditions, the following equation is used:

$$\begin{aligned} TokensTransferred_i = \alpha + \beta_1 WillfulChoiceTreatment_i + \beta_2 ExternalityImposed_i \\ + \beta_3 WillfulChoiceTreatment_i * ExternalityImposed_i + \epsilon_i \end{aligned} \tag{4.2}$$

Hypothesis 1: *Victims knowing that a negative externality was willfully imposed by their matched perpetrator should lead to a larger negative token transfer than if it was randomly imposed.*

Hypothesis 2: *Victims knowing that a negative externality was willfully prevented by their matched potential perpetrator should lead to a larger positive token transfer than if it was randomly prevented.*

4.3 Results

As stated, we are primarily interested in how victims increase or reduce the earnings of their matched perpetrators in the Dictator task. We interpret the act of increasing perpetrator earnings by victims as rewards, while the act of decreasing earnings is motivated by a combination of income maximization and punishment. Importantly, however, as subjects are randomly assigned into treatment, any observed differences would not be attributable to income maximization but to an increase in punishment. Section 4.3.1 examines victims' punishment/rewards behavior towards their matched perpetrators. Section 4.3.2 investigates the significant difference in the externality amount between the treatment and control, and provides robustness checks showing that the perpetrators' behavior did not jeopardize the results of the experiment.

4.3.1 Victims' Punishing/Rewarding Behavior

Figure 4.4 below displays the punishing/rewarding behavior across the two treatments, split by whether an externality was not imposed (left) versus when it was imposed (right). We observe an average of -1.34 tokens transferred under Random Choice, and 1.3 tokens transferred under Willful Choice, when an externality was not imposed (p-value=0.02 based on a two-tailed t-test). We observe an average of -3.6 tokens transferred under Random Choice, and -3.4 tokens transferred under Willful Choice, when an externality was imposed (p-value=0.8 based on a two-tailed t-test). Under Willful Choice, subjects transferred 4.7 tokens less when an externality was imposed, relative to when it was not (p-value=0.00 based on a two-tailed t-test). This difference in transfer is not observed under Random Choice: subjects (victims) transferred 2.26 tokens less when an externality was imposed by the computer program relative to when it was not (p-value=0.02 based on a two-tailed t-test). The difference in difference is therefore 2.4 tokens (p-value<0.05).

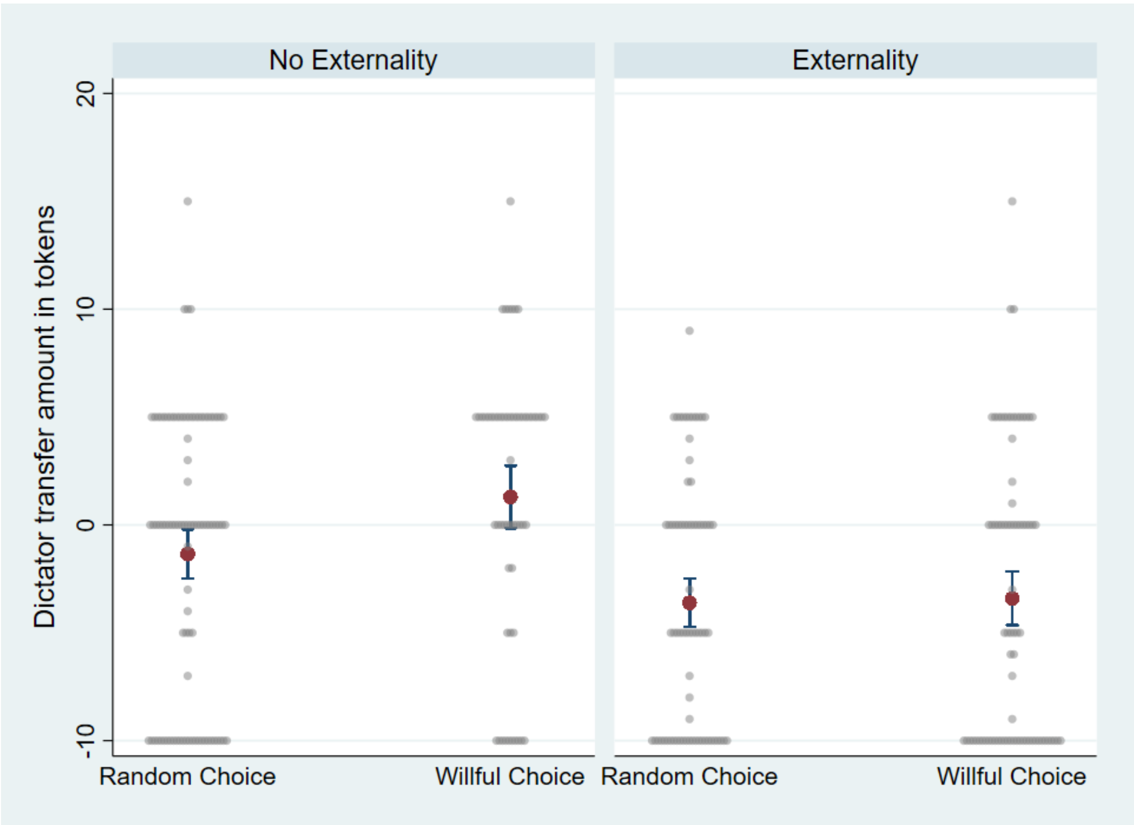


Figure 4.4: The Y-axis displays the number of tokens transferred in the Dictator Game. On the left-hand side of the figure, the mean difference in tokens transferred is shown between treatment (Willful Choice) and control (Random Choice) when victims do not experience a negative externality. On the right-hand side of the figure, the mean difference in tokens transferred is shown between treatment (Willful choice) and control (Random Choice) when victims experience a negative externality. This graph displays 90% Confidence Intervals.

Table 4.2 below displays the OLS regression results, where *Tokens Transferred* (Y= -15 to 30 tokens) by victims to perpetrators is regressed on the interaction of *Willful choice* (x=1 if victim was randomly assigned into the Willful Choice treatment group) and *Externality imposed* (x=1 if the negative externality was imposed). At the 5% significance level, the Willful Choice treatment increases the impact of an externality being imposed on the number of tokens transferred by 2.4 tokens. The OLS regression results presented here are similar to the results graphically presented in Figure 4.4 and are robust to basic and additional controls. The following control variables had significant impacts: older subjects transferred fewer tokens (at the 1% significance level) [2], subjects who were full-time students transferred fewer tokens (at the 5% significance level), and subjects who perceived the encryption task to be fairer transferred more tokens (at the 5% significance level).

We further analyzed whether the Willful Choice treatment also impacted victims decision to give, take away, or do nothing. While the main analysis focused on the size of tokens transferred and treated the outcome as a continuous variable, this analysis assumed the outcome variable to be an ordered categorical variable. So, instead of using *Tokens Transferred* as the dependent variable, we used *Token Transfer Categories*. Table D.1 in Appendix D.1 displays the results of the Oprobit regressions where *Token Transfer Categories* (Y= ordered categories of giving by victims within the following three categories: 1 (dummy variable=1 if victims gave > 0 tokens), 2 (dummy variable=1 if victims gave 0 tokens), and 3 (dummy variable=1 if victims gave < 0 tokens)) is regressed on *Willful Choice Treatment*Externality Imposed*. The effect of Willful Choice treatment interacted with an externality being imposed is negative and significant at the 10% level without controls but loses its significance with basic and environmental controls. The direction of the coefficients, however, are consistent with how we expected victims to behave towards perpetrators. Although the direction of the effects are consistent with the OLS estimations above, we believe that the OLS estimations are the best ones to use and present in this section for the outcome variable of interest. Since the outcome variable was collected via a question that was was answered on a sliding scale, an immediate decision had to be made on the amount of transfer rather than whether the transfer should be positive or negative. Treating the outcome variable as a continuous choice instead of a single choice of giving or taking is thus more appropriate. Furthermore, it's important to distinguish between giving or taking 5 tokens vs giving or taking 15 tokens.

[2]significance level is not due to outliers

Table 4.2: OLS Regression Results of Willful Choice*Externality imposed

Dependent Variable: Tokens Transferred	(1) Main effect	(2) + Basic controls	(3) + All controls
willful choice	2.643*	2.826*	2.691*
	(1.324)	(1.415)	(1.466)
externality imposed	-2.264**	-1.854	-1.662
	(0.875)	(1.224)	(1.279)
willful choice × externality imposed	-2.440**	-2.617**	-2.638**
	(0.902)	(1.040)	(1.101)
age		-0.008***	-0.008***
		(0.001)	(0.001)
female		0.489	0.858
		(1.157)	(1.130)
student		-1.440**	-1.394**
		(0.550)	(0.570)
externality amount		-0.0277	-0.00103
		(0.0726)	(0.0756)
fairness of experiment			0.682**
			(0.277)
belief discrepancy			-0.0459
			(0.0275)
Constant	-1.344	-1.026	-1.726
	(0.858)	(1.039)	(1.037)
Observations	300	295	295
R^2	0.077	0.101	0.122

Standard errors in parentheses

* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Notes: Willful Choice is a dummy variable equal to one if a victim was randomly assigned into the treated version of the experiment, where the perpetrator was able to willfully choose whether a negative externality would be prevented or imposed. Externality imposed is a dummy variable equal to one if a negative externality was imposed on a victim, whether or not it was randomly assigned or willfully imposed. The interaction effect between willful choice and externality imposed is therefore needed in order to determine the treatment effects both with and without the negative externality imposed. Column (1) only includes the interaction effect, column (2) also includes the basic control variables, and column (3) includes additional control variables.

4.3.2 Perpetrator Behavior/Externality Amount Robustness Check

As shown in Table 4.1 above, the externality amount experienced by the Willful Choice treatment group was 59% more than the Random Choice control group. Largely, this is due to 13% more (at the 5% significance level) victims experiencing a negative externality in the Willful Choice treatment group. However, the amount of the externality imposed was 23.4% higher when it was imposed willfully than when it was imposed randomly. We show that the difference in the externality amount can be explained by both learning and randomization differences.

First, we look at any differences in either ability or performance levels between those who chose to impose the externality and those who did not. All perpetrators participated in two practice rounds prior to participating in any encryption tasks associated with payoffs, and we use the second practice round as a measure of ability. Table D.2 provides the summary statistics for perpetrator performance in all rounds. There was no significant difference in performance by whether the forced externality encryption task was in the first or second round.

Performance in the final round, where perpetrators had to choose whether or not to impose an externality, was 6.8% better (at the 10% significance level) than performance in the first round, where perpetrators were randomly assigned to impose an externality or not. Table D.3 also shows that performance continually improved from practice 1 to round 3. Furthermore, the average performance of perpetrators' rounds where they were forced into imposing a negative externality was similar to when they were forced into not imposing an externality. Figure 4.5 shows that perpetrators' performance was similar under the forced externality and forced no externality conditions.

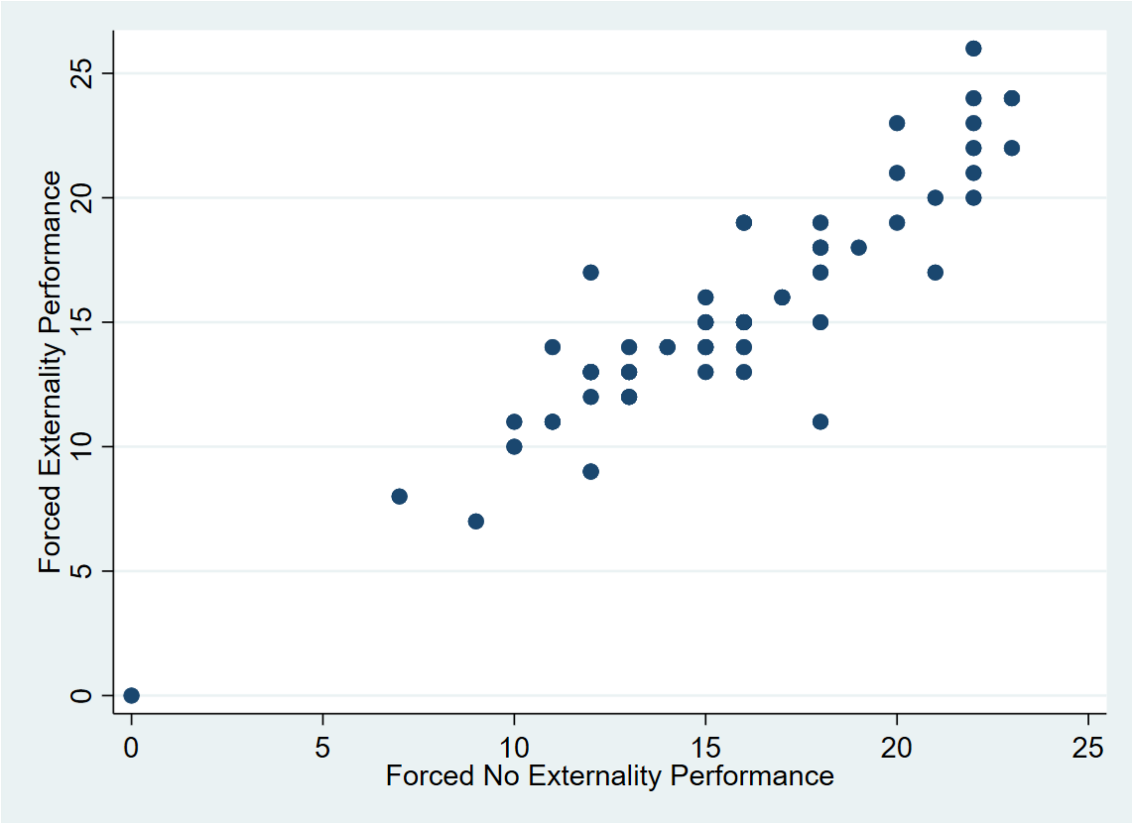


Figure 4.5: Performance of Perpetrator. The Y-axis represents the number of tokens the perpetrator earned in the encryption task when the payoff was associated with a forced externality on the victim, while the x-axis represents the number of tokens the potential perpetrator earned in the encryption task when the payoff was forced to be 25% lower than with no externality imposed on the potential victim. From this graph, you can see that there's no difference in performance between perpetrators who participated in the encryption task with forced externality vs forced no externality.

And, we find no difference in either ability or performance in the last round between those who chose to impose the externality and those who did not. Figure 4.6 shows that perpetrators' performance was also similar under the forced externality and chosen externality conditions. So, the difference in the externality amount is partly due to game improvement in general.

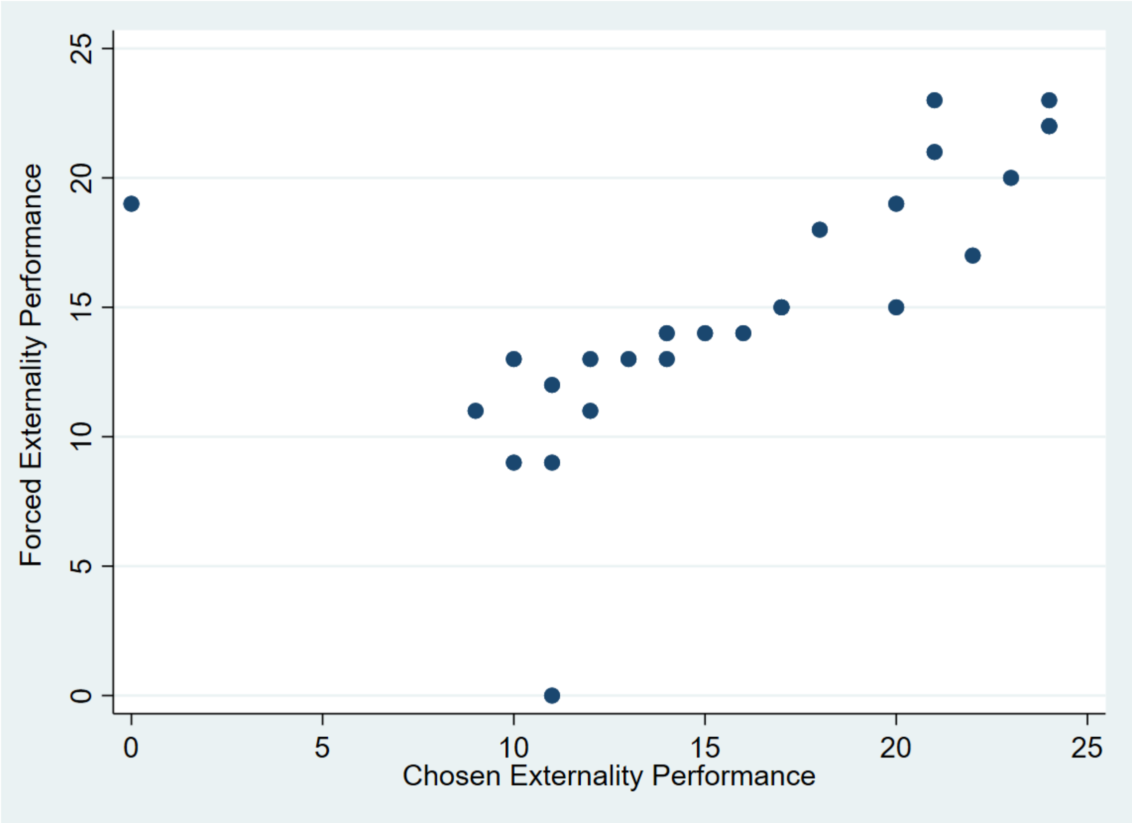


Figure 4.6: Performance of Perpetrator. The Y-axis represents the number of tokens the perpetrator earned in the encryption task when the payoff was associated with a forced externality on the victim, while the x-axis represents the number of tokens the potential perpetrator earned in the encryption task when the perpetrator willfully chose a payoff that would impose a negative externality on the victim. From this graph, you can see that there's no difference in performance between perpetrators who participated in the encryption task with forced externality vs chosen externality.

Second, we look at randomization differences. The perpetrators who were assigned to the control group with forced externality had a 15.1% (at the 1% significance level) lower ability than the average perpetrator. This would artificially lower the externality amount imposed on the untreated group of victims. This carried on through to their actual performance, where they were 8.7% worse than average (at the 5% significance level). The randomization difference simply happened by chance because perpetrators' ability was measured by the practice rounds, and the practice rounds occurred prior to them knowing what group they were in. Although the randomization was applied correctly, perpetrators in the control group (n=30) simply had lower ability by chance.

4.4 Conclusion

Negative environmental externalities are often unintended consequences of economic activities, and people may perceive polluting economic activities to be activities that are not deliberately seeking to harm others. The experience of environmental degradation does not always lead to conflict, though there are several examples of both non-violent and violent conflict occurring in different settings. The behavior of pollution victims towards polluters isn't always consistent, and we propose that this inconsistency in behavior can be due partly to varying perceptions of polluting activities being an intentional choice.

We examine the impact intentions have on victims' behavior towards perpetrators when there can be negative externalities. We investigate whether victims' behavior towards (potential) perpetrators differs if they have knowledge about whether or not the imposition or prevention of the negative externality they experience was a deliberate choice. We look at the effect of perpetrators willfully choosing to impose or prevent a negative externality on victims' behavior in a give-or-take Dictator Game.

We find that victims take away from perpetrators similarly whether they are subjected to a willfully or randomly imposed negative externality. However, (potential) victims give to (potential) perpetrators who choose to prevent a negative externality, but take away from perpetrators who randomly do not impose the externality. Most interestingly, victims' behavior overall changes significantly in the willful choice treatment compared to the random choice one: deliberate good (bad) behavior by perpetrators is rewarded (punished), while we see no difference in victims' behavior towards perpetrators in the random choice scenarios – they always take away from them. This suggests that choices of potential polluters matter for the responses of potential pollution victims.

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Chapter 1 Appendix: Additional Figures, Tables, Survey and Experimental Instructions

A.1 Prison Year Categories

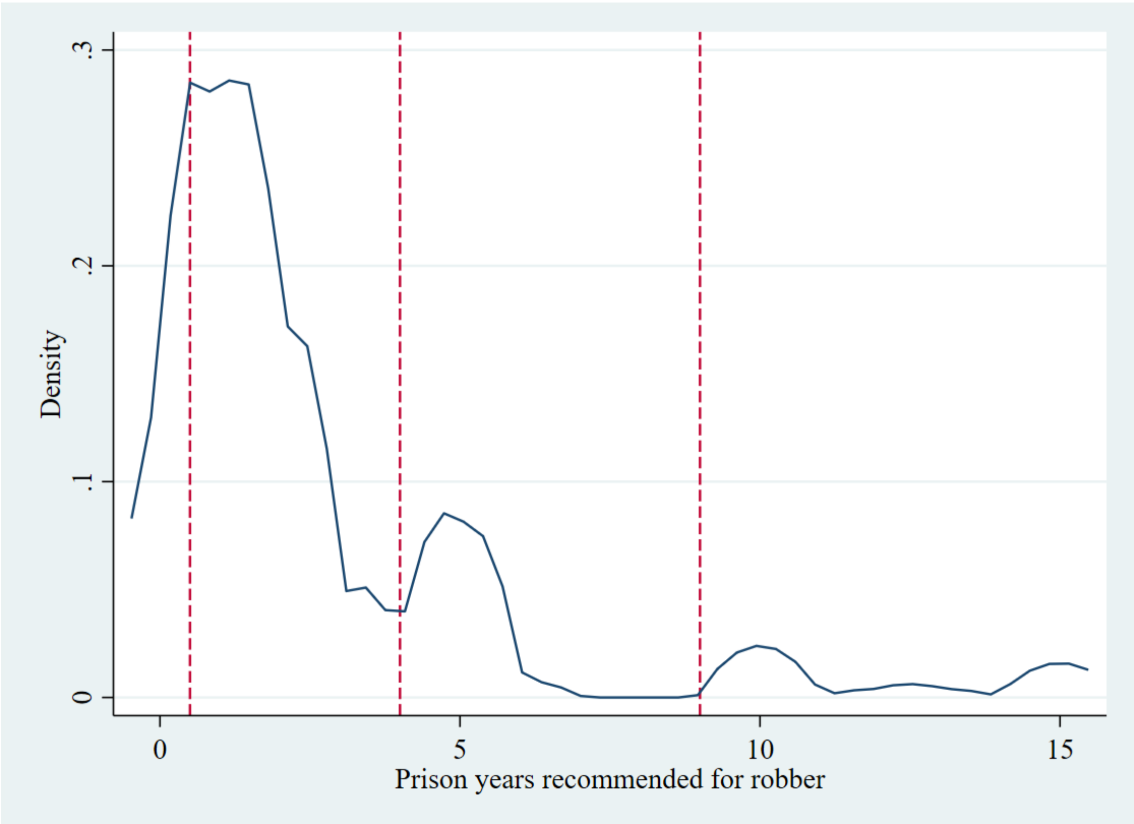


Figure A.1: Density plot of the recommended prison sentence for a robber. Vertical dashed lines indicate the breaks used for categorization.

A.2 Sub-Sample Analysis

Table A.1: Knowledge and Experiences of ASGM Pollution On Money Amount Sent

	(1)	(2)
	Dictator_Treatment	_cons
Awareness of mercury use	0.690	5***
	(1.263)	(1.477)
Knowledge of MC	1.838*	4.412***
	(0.722)	(0.660)
Ban improved water quality	0.141	5.147***
	(0.884)	(0.877)
Worsened water quality	1.029	6.471***
	(1.071)	(1.082)
Crop QQ Decrease	1.167	3.333**
	(1.294)	(1.091)
Awareness of mercury use x Knowledge of MC	0.688	5.238***
	(1.398)	(1.448)
Ban improved water quality x Knowledge of MC	0.440	5.417***
	(1.165)	(1.095)
Worsened water quality x Knowledge of MC	0.214	8***
	(1.538)	(1.071)
Crop QQ Decrease x Knowledge of MC	-0.556	5
	(0.597)	(.)

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.2: Knowledge and Experiences of ASGM Pollution On Prison Year Category

	(1) prison_trt	(2) _cons
Awareness of mercury use	-0.0870	1.087***
	(0.141)	(0.175)
Knowledge of MC	0.0166	1.137***
	(0.125)	(0.120)
Ban improved water quality	0.0747	1.118***
	(0.129)	(0.119)
Worsened water quality	0.124	1.176***
	(0.338)	(0.223)
Crop QQ Decrease	0.267	0.833***
	(0.197)	(0.173)
Awareness of mercury use x Knowledge of MC	-0.106	1.143***
	(0.150)	(0.164)
Ban improved water quality x Knowledge of MC	-0.206	1.292***
	(0.147)	(0.140)
Worsened water quality x Knowledge of MC	0.0143	1.200***
	(0.398)	(0.327)
Crop QQ Decrease x Knowledge of MC	0	1
	(.)	(.)

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

A.3 Tobit Regressions on Prosocial Behavior

Table A.3: Tobit Regression Results - Interaction Effect of *ASGM in HH*Treatment* on Money Amount Sent

Dependent Variable: Money Amount Sent (Y= 0, 5, 10, 15, 20, 25, 30, 35, or 40 GHS)	(1) Interaction effect	(2) + Basic controls	(3) + All controls
ASGM Community Treatment	1.160*	1.002	1.230**
	(0.589)	(0.627)	(0.622)
ASGM in HH	1.926**	1.395*	1.623*
	(0.751)	(0.761)	(0.850)
Treatment × ASGM in HH	-0.567	-0.213	-0.901
	(1.106)	(0.943)	(0.896)
Age		0.0772**	0.0750**
		(0.0333)	(0.0317)
Male		-1.254*	-0.922
		(0.658)	(0.638)
Education		0.212	0.0419
		(0.171)	(0.223)
Living condition		0.341	0.430
		(0.368)	(0.282)
Years in district		-0.0515***	-0.0559**
		(0.0196)	(0.0233)
Urban		-0.973	-0.150
		(0.660)	(0.744)
HL_mercsymp			0.384
			(0.479)
Awareness of mercury use			0.320
			(1.072)
ASGM caused envprobs			-0.424
			(0.556)
Worsened water quality			2.927***
			(0.910)
Constant	3.586***	1.210	0.701
	(0.579)	(1.772)	(1.675)
Pseudo R^2	0.011	0.030	0.052
F	6.277	4.849	8.400
p_value	0.000	0.001	0.000
obs	177	177	177
left_censored	30	30	30
right_censored	0	0	0
uncensored	147	147	147

Standard errors in parentheses

* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Notes: The ASGM Community Treatment dummy equals one if non-miners were randomly chosen to play the treated version of the Dictator Game, with the receiver being from a household living in an ASGM community. The ASGM in HH dummy equals one if the main occupation of any members of a non-miners' household was a small-scale gold miner. Column (1) only includes the interaction effect, column (2) also includes the basic control variables, and column (3) includes both the basic and environmental control variables.

Table A.4: Tobit Regression Results - Interaction Effect of *Awareness of Mercury Use***Knowledge of MC***Treatment* on Money Amount Sent

Dependent Variable: Money Amount Sent (Y= 0, 5, 10, 15, 20, 25, 30, 35, or 40 GHS)	(1) Interaction effect	(2) + Basic controls	(3) + All controls
ASGM Community Treatment	-0.698	-0.207	-0.188
	(0.478)	(0.425)	(0.539)
Awareness of mercury use	-3.207	-4.437**	-4.322
	(3.036)	(2.046)	(2.874)
Treatment × Awareness of mercury use	0.698	0.966	2.067
	(3.261)	(2.444)	(2.780)
Knowledge of MC	-1.171	-0.896	-0.748
	(0.756)	(0.849)	(0.865)
Treatment × Knowledge of MC	3.808***	2.906**	2.747**
	(1.378)	(1.286)	(1.338)
Awareness of mercury use × Knowledge of MC	4.815***	5.096***	5.400***
	(1.619)	(0.982)	(1.969)
Treatment × Awareness of mercury use × Knowledge of MC	-2.864	-2.945	-3.707
	(3.324)	(3.070)	(3.076)
Age		0.0635**	0.0614**
		(0.0320)	(0.0297)
Male		-1.004	-0.793
		(0.618)	(0.606)
Education		0.182	0.0152
		(0.170)	(0.196)
Living condition		0.314	0.396
		(0.393)	(0.301)
Years in district		-0.0405**	-0.0453**
		(0.0192)	(0.0216)
ASGM in HH		1.609**	1.377*
		(0.661)	(0.704)
Urban		-0.907	-0.0553
		(0.599)	(0.662)
High-likelihood of MC			0.320
			(0.561)
ASGM caused envprobs			-0.487
			(0.522)
Worsened water quality			2.809***
			(0.762)
Constant	4.490***	1.932	1.693
	(0.372)	(1.586)	(1.535)
Pseudo R^2	0.020	0.041	0.063
F	9.911	27.86	43.31
p_value	0.000	0.001	0.000
obs	177	177	177
left_censored	30	30	30
right_censored	0	0	0
uncensored	147	147	147

Standard errors in parentheses

* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Notes: The ASGM Community Treatment dummy equals one if non-miners were randomly chosen to play the treated version of the Dictator Game, with the receiver being from a household living in an ASGM community. The Awareness of mercury use dummy equals one if non-miners are aware that mercury is being used for ASGM activities in their local vicinity. The Knowledge of MC dummy equals one if non-miners answered "True" to the statement that mercury contamination can be caused by ASGM. Column (1) only includes the treatment effect, column (2) includes the basic control variables, and column (3) includes both the basic and environmental control variables.

Table A.5: Tobit Regression Results - Interaction Effect of *Worsened water quality*Knowledge of MC*Treatment* on Money Amount Sent

Dependent Variable: Money Amount Sent (Y= 0, 5, 10, 15, 20, 25, 30, 35, or 40 GHS)	(1) Interaction effect	(2) + Basic controls	(3) + All controls
ASGM Community Treatment	-1.112*	-0.507	-0.456
	(0.567)	(0.485)	(0.480)
Worsened water quality	-0.366	0.133	0.251
	(0.989)	(1.366)	(1.190)
Treatment × Worsened water quality	2.891*	2.313	2.118
	(1.576)	(1.508)	(1.416)
Knowledge of MC	-1.417**	-1.210	-0.921
	(0.684)	(0.852)	(0.816)
Treatment × Knowledge of MC	3.524***	2.740**	2.966**
	(1.133)	(1.109)	(1.174)
Worsened water quality × Knowledge of MC	5.363***	4.675**	4.979**
	(1.883)	(2.013)	(2.009)
Treatment × Worsened water quality × Knowledge of MC	-5.167*	-5.078*	-5.021*
	(3.039)	(3.006)	(2.790)
Age		0.0613**	0.0622**
		(0.0291)	(0.0280)
Male		-0.868	-0.775
		(0.661)	(0.624)
Education		0.0909	0.125
		(0.238)	(0.234)
Living condition		0.312	0.217
		(0.343)	(0.316)
Years in district		-0.0434**	-0.0439**
		(0.0184)	(0.0192)
ASGM in HH		1.182*	1.205*
		(0.636)	(0.713)
Urban		-0.319	-0.0770
		(0.571)	(0.790)
Awareness of mercury use			-0.273
			(0.932)
High-likelihood of MC			0.0727
			(0.583)
ASGM caused envprobs			-0.560
			(0.503)
Constant	4.421***	1.895	2.335*
	(0.446)	(1.590)	(1.347)
Pseudo R^2	0.044	0.060	0.066
F	10.51	20.71	54.78
p_value	0.000	0.00111	0.000
obs	177	177	177
left_censored	30	30	30
right_censored	0	0	0
uncensored	147	147	147

Standard errors in parentheses

* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Notes: The ASGM Community Treatment dummy equals one if non-miners were randomly chosen to play the treated version of the Dictator Game, with the receiver being from a household living in an ASGM community. The Worsened water quality dummy equals one when non-miners reported worsened quality of either the water they drink and cook with or the river and/or sea water over the past two years. The Knowledge of MC dummy equals one if non-miners answered "True" to the statement that mercury contamination can be caused by ASGM. Column (1) only includes the treatment effect, column (2) also includes the basic control variables, and column (3) includes both the basic and environmental control variables.

Table A.6: Tobit Regression Results - Interaction Effect of *Ban Improved Water*Knowledge of MC*Treatment* on Money Amount Sent

Dependent Variable: Money Amount Sent (Y= 0, 5, 10, 15, 20, 25, 30, 35, or 40 GHS)	(1) Interaction effect	(2) + Basic controls	(3) + All controls
ASGM Community Treatment	-0.723	-0.216	-0.112
	(0.678)	(0.693)	(0.654)
Ban improved water quality	-0.246	-1.138	-0.671
	(1.217)	(1.084)	(1.264)
Treatment × Ban improved water quality	0.258	0.528	0.264
	(1.554)	(1.461)	(1.413)
Knowledge of MC	-1.469**	-1.595**	-1.049
	(0.692)	(0.792)	(0.819)
Treatment × Knowledge of MC	4.777***	3.847***	3.371**
	(1.334)	(1.396)	(1.413)
Ban improved water quality × Knowledge of MC	2.472	3.074*	2.610*
	(1.665)	(1.557)	(1.542)
Treatment × Ban improved water quality × Knowledge of MC	-3.736	-3.949*	-2.962
	(2.313)	(2.384)	(1.986)
Age		0.0663**	0.0608**
		(0.0313)	(0.0269)
Male		-1.075	-0.823
		(0.762)	(0.690)
Education		0.226	0.0909
		(0.199)	(0.226)
Living condition		0.326	0.339
		(0.362)	(0.293)
Years in district		-0.0466**	-0.0467**
		(0.0191)	(0.0198)
ASGM in HH		1.148*	1.282*
		(0.656)	(0.765)
Urban		-0.954	-0.476
		(0.585)	(0.586)
Awareness of mercury use			-0.576
			(0.975)
High-likelihood of MC			0.203
			(0.591)
ASGM caused envprobs			-0.438
			(0.525)
Worsened water quality			2.562***
			(0.808)
Constant	4.395***	2.084	1.985
	(0.528)	(1.526)	(1.268)
Pseudo R^2	0.022	0.042	0.063
F	4.764	6.440	22.03
p_value	0.000	0.010	0.000
obs	177	177	177
left_censored	30	30	30
right_censored	0	0	0
uncensored	147	147	147

Standard errors in parentheses

* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Notes: The ASGM Community Treatment dummy equals one if non-miners were randomly chosen to play the treated version of the Dictator Game, with the receiver being from a household living in an ASGM community. The Ban improved water quality dummy equals one if non-miners strongly agreed or agreed that the ban on ASGM improved the quality of their drinking/cooking or river/sea water. The Knowledge of MC dummy equals one if non-miners answered "True" to the statement that mercury contamination can be caused by ASGM. Column (1) only includes the treatment effect, column (2) also includes the basic control variables, and column (3) includes both the basic and environmental control variables.

Table A.7: Tobit Regression Results - Interaction Effect of *Crop QQ Decrease*Knowledge of MC*Treatment* on Money Amount Sent

Dependent Variable: Money Amount Sent (Y= 0, 5, 10, 15, 20, 25, 30, 35, or 40 GHS)	(1) Interaction effect	(2) + Basic controls	(3) + All controls
ASGM Community Treatment	-1.047*	-0.635	-0.582
	(0.538)	(0.493)	(0.627)
Crop QQ Decrease	-4.984	-5.651**	-6.266**
	(3.061)	(2.819)	(2.618)
Treatment × Crop QQ Decrease	6.343**	5.020	5.834**
	(3.176)	(3.137)	(2.777)
Knowledge of MC	-0.761	-0.883	-0.665
	(0.819)	(0.800)	(0.852)
Treatment × Knowledge of MC	3.651***	2.723**	2.686**
	(1.190)	(1.163)	(1.252)
Crop QQ Decrease × Knowledge of MC	6.058*	5.922*	7.027**
	(3.279)	(3.138)	(3.092)
Treatment × Crop QQ Decrease × Knowledge of MC	-9.695**	-7.169**	-7.949**
	(3.742)	(3.487)	(3.115)
Age		0.0644*	0.0622*
		(0.0357)	(0.0326)
Male		-0.793	-0.497
		(0.624)	(0.657)
Education		0.286	0.128
		(0.193)	(0.210)
Living condition		0.175	0.239
		(0.388)	(0.303)
Years in district		-0.0437**	-0.0468**
		(0.0193)	(0.0209)
ASGM in HH		1.074	1.091
		(0.708)	(0.772)
Urban		-1.033*	-0.385
		(0.524)	(0.635)
Awareness of mercury use			-0.111
			(1.036)
High-likelihood of MC			0.0984
			(0.670)
ASGM caused envprobs			-0.469
			(0.555)
Worsened water quality			2.930***
			(0.819)
Constant	4.688***	2.318	2.175
	(0.442)	(1.764)	(1.546)
Pseudo R^2	0.023	0.043	0.067
F	3.41	7.841	32.93
p_value	0.003	0.006	0.000
obs	177	177	177
left_censored	30	30	30
right_censored	0	0	0
uncensored	147	147	147

Standard errors in parentheses
* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Notes: The ASGM Community Treatment dummy equals one if non-miners were randomly chosen to play the treated version of the Dictator Game, with the receiver being from a household living in an ASGM community. The Crop QQ Decrease dummy equals one if non-miners reported a decrease in the quality or quantity of their main crop grown over the past two years. The Knowledge of MC dummy equals one if non-miners answered "True" to the statement that mercury contamination can be caused by ASGM. Column (1) only includes the treatment effect, column (2) also includes the basic control variables, and column (3) includes both the basic and environmental control variables.

A.4 Ordered Probit Regressions on Bias in Justice Views

Table A.8: Ordered Probit Regression Results - Interaction Effect of *ASGM in HH*Treatment* on Prison Year Category

Dependent Variable: Prison Year Category (Y= 0, up to 3.9, 4-8.9, and 9-15 years)	(1) Main effect	(2) + Basic controls	(3) + All controls
Miner Treatment	0.145	0.257	0.215
	(0.190)	(0.194)	(0.205)
ASGM in HH	-0.534*	-0.333	-0.355
	(0.322)	(0.367)	(0.332)
Treatment × ASGM in HH	0.392	0.282	0.364
	(0.473)	(0.515)	(0.501)
Age		0.0241**	0.0228**
		(0.0101)	(0.0106)
Male		0.151	0.173
		(0.257)	(0.232)
Education		-0.0734	-0.0843
		(0.0540)	(0.0640)
Living condition		0.0544	0.0760
		(0.141)	(0.129)
Years in district		-0.0161*	-0.0174*
		(0.00848)	(0.00917)
Urban		0.424*	0.491*
		(0.240)	(0.267)
High-likelihood of MC			0.318
			(0.321)
Awareness of mercury use			-0.0652
			(0.252)
ASGM caused envprobs			0.00740
			(0.101)
Worsened water quality			0.275
			(0.227)
Pseudo R^2	0.017	0.050	0.060

Standard errors in parentheses

* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Notes: The Miner Treatment dummy equals one if non-miners were randomly selected into the treated version of the Survey Experiment, with the receiver of a prison sentence recommendation being identified as a small-scale miner. The ASGM in HH dummy equals one if the main occupation of any members of a non-miners' household was a small-scale gold miner. Column (1) only includes the treatment effect, column (2) also includes the basic control variables, and column (3) includes both the basic and environmental control variables.

Table A.9: Ordered Probit Regression Results - Interaction Effect of *Awareness of Mercury Use*Knowledge of MC*Treatment* on Prison Year Category

Dependent Variable: Prison Year Category (Y= 0, up to 3.9, 4-8.9, and 9-15 years)	(1) Main effect	(2) + Basic controls	(3) + All controls
Miner Treatment	0.534**	0.726***	0.679***
	(0.262)	(0.267)	(0.255)
Knowledge of MC	0.137	0.254	0.183
	(0.365)	(0.384)	(0.363)
Treatment	-0.293	-0.490	-0.434
	(0.369)	(0.449)	(0.424)
Awareness of mercury use	-1.021	-0.793	-1.060
	(0.744)	(0.735)	(0.941)
Treatment × Awareness of mercury use	-0.534	-0.509	-0.274
	(0.905)	(0.904)	(0.942)
Knowledge of MC × Awareness of mercury use	1.071	1.055	1.342
	(0.707)	(0.752)	(0.968)
Treatment × Awareness of mercury use × Knowledge of MC	0.179	0.172	-0.108
	(0.951)	(0.991)	(1.073)
Age		0.0270**	0.0256**
		(0.0106)	(0.0113)
Male		0.0849	0.120
		(0.261)	(0.244)
Education		-0.0903	-0.108*
		(0.0551)	(0.0575)
Living condition		0.0448	0.0743
		(0.127)	(0.114)
Years in district		-0.0160**	-0.0170**
		(0.00765)	(0.00816)
ASGM in HH		-0.105	-0.0857
		(0.230)	(0.233)
Urban		0.463	0.555**
		(0.301)	(0.282)
High-likelihood of MC			0.308
			(0.325)
ASGM caused envprobs			0.00732
			(0.111)
Worsened water quality			0.323
			(0.255)
Observations	177	177	177
Pseudo R^2	0.026	0.066	0.077

Standard errors in parentheses
* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Notes: The Miner Treatment dummy equals one if non-miners were randomly selected into the treated version of the Survey Experiment, with the receiver of a prison sentence recommendation being identified as a small-scale miner. The Awareness of mercury use dummy equals one if non-miners are aware that mercury is being used for ASGM activities in their local vicinity. The Knowledge of MC dummy equals one if non-miners answered "True" to the statement that mercury contamination can be caused by ASGM. Column (1) only includes the treatment effect, column (2) includes the basic control variables, and column (3) includes both the basic and environmental control variables.

Table A.10: Ordered Probit Regression Results - Interaction Effect of *Worsened water quality*Knowledge of MC*Treatment* on Prison Year Category

Dependent Variable: Prison Year Category (Y= 0, up to 3.9, 4-8.9, and 9-15 years)	(1) Main effect	(2) + Basic controls	(3) + All controls
Miner Treatment	0.556**	0.746***	0.704***
	(0.264)	(0.240)	(0.223)
Knowledge of MC	0.263	0.522*	0.487
	(0.249)	(0.317)	(0.355)
Treatment	-0.506*	-0.694**	-0.655**
	(0.276)	(0.341)	(0.311)
Worsened water quality	0.333	0.505*	0.544**
	(0.490)	(0.265)	(0.240)
Treatment × Worsened water quality	-0.163	0.0160	0.0114
	(0.806)	(0.759)	(0.806)
Knowledge of MC × Worsened water quality	-0.243	-0.397	-0.405
	(0.661)	(0.463)	(0.452)
Treatment × Worsened water quality × Knowledge of MC	0.198	0.0589	0.0872
	(0.827)	(0.811)	(0.822)
Age		0.0280**	0.0271**
		(0.0109)	(0.0113)
Male		0.0606	0.0723
		(0.281)	(0.259)
Education		-0.108**	-0.107*
		(0.0550)	(0.0647)
Living condition		0.0756	0.0858
		(0.130)	(0.111)
Years in district		-0.0180**	-0.0188**
		(0.00807)	(0.00845)
ASGM in HH		-0.194	-0.186
		(0.238)	(0.184)
Urban		0.476*	0.515*
		(0.247)	(0.280)
Awareness of mercury use			-0.0168
			(0.324)
High-likelihood of MC			0.248
			(0.314)
ASGM caused envprobs			-0.0000765
			(0.110)
Observations	177	177	177
Pseudo R^2	0.013	0.063	0.067

Standard errors in parentheses
* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Notes: The Miner Treatment dummy equals one if non-miners were randomly selected into the treated version of the Survey Experiment, with the receiver of a prison sentence recommendation being identified as a small-scale miner. The Worsened water quality dummy equals one when non-miners reported worsened quality of either the water they drink and cook with or the river and/or sea water over the past two years. The Knowledge of MC dummy equals one if non-miners answered "True" to the statement that mercury contamination can be caused by ASGM. Column (1) only includes the treatment effect, column (2) includes the basic control variables, and column (3) includes both the basic and environmental control variables.

Table A.11: Ordered Probit Regression Results - Interaction Effect of *Ban Improved Water*Knowledge of MC*Treatment* on Prison Year Category

Dependent Variable: Prison Year Category (Y= 0, up to 3.9, 4-8.9, and 9-15 years)	(1) Main effect	(2) + Basic controls	(3) + All controls
Miner Treatment	0.241	0.490*	0.478**
	(0.246)	(0.255)	(0.229)
Knowledge of MC	-0.252	0.00872	-0.0183
	(0.333)	(0.375)	(0.379)
Treatment	0.234	0.0413	0.0775
	(0.407)	(0.462)	(0.401)
Ban improved water quality	-0.757***	-0.775***	-0.735***
	(0.275)	(0.271)	(0.277)
Treatment × Ban improved water quality	0.917**	0.792*	0.706*
	(0.447)	(0.463)	(0.414)
Knowledge of MC × Ban improved water quality	1.302***	1.133**	1.100***
	(0.442)	(0.450)	(0.401)
Treatment × Ban improved water quality × Knowledge of MC	-1.696**	-1.584**	-1.556**
	(0.666)	(0.687)	(0.625)
Age		0.0289**	0.0277**
		(0.0115)	(0.0115)
Male		0.0864	0.120
		(0.281)	(0.259)
Education		-0.0696	-0.0769
		(0.0523)	(0.0574)
Living condition		0.0549	0.0784
		(0.135)	(0.113)
Years in district		-0.0181**	-0.0192**
		(0.00819)	(0.00784)
ASGM in HH		-0.184	-0.144
		(0.240)	(0.204)
Urban		0.398	0.429*
		(0.264)	(0.261)
Awareness of mercury use			-0.115
			(0.242)
High-likelihood of MC			0.288
			(0.297)
ASGM caused envprobs			0.0356
			(0.116)
Worsened water quality			0.233
			(0.224)
Observations	177	177	177
Pseudo R^2	0.029	0.072	0.080

Standard errors in parentheses

* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Notes: The Miner Treatment dummy equals one if non-miners were randomly selected into the treated version of the Survey Experiment, with the receiver of a prison sentence recommendation being identified as a small-scale miner. The Ban improved water quality dummy equals one if non-miners strongly agreed or agreed that the ban on ASGM improved the quality of their drinking/cooking or river/sea water. The Knowledge of MC dummy equals one if non-miners answered "True" to the statement that mercury contamination can be caused by ASGM. Column (1) only includes the treatment effect, column (2) includes the basic control variables, and column (3) includes both the basic and environmental control variables.

Table A.12: Ordered Probit Regression results - Interaction Effect of *Crop QQ Decrease*Knowledge of MC*Treatment* on Prison Year Category

Dependent Variable: Prison Year Category (Y= 0, up to 3.9, 4-8.9, and 9-15 years)	(1) Main effect	(2) + Basic controls	(3) + All controls
Miner Treatment	0.429*	0.612**	0.572**
	(0.259)	(0.271)	(0.262)
Knowledge of MC	0.164	0.342	0.298
	(0.260)	(0.326)	(0.347)
Crop QQ Decrease	-0.658	-0.417	-0.468
	(0.470)	(0.315)	(0.406)
Treatment × Crop QQ Decrease	1.588***	1.326**	1.495**
	(0.554)	(0.637)	(0.697)
Knowledge of MC × Crop QQ Decrease	0.514	0.468	0.423
	(0.525)	(0.443)	(0.535)
Treatment × Crop QQ Decrease × Knowledge of MC	-1.684***	-1.671**	-1.836**
	(0.600)	(0.821)	(0.850)
Age		0.0258**	0.0244**
		(0.0101)	(0.0108)
Male		0.124	0.166
		(0.291)	(0.259)
Education		-0.0696	-0.0833
		(0.0542)	(0.0602)
Living condition		0.0366	0.0598
		(0.138)	(0.119)
Years in district		-0.0169**	-0.0180**
		(0.00779)	(0.00830)
ASGM in HH		-0.234	-0.237
		(0.251)	(0.196)
Urban		0.426*	0.508*
		(0.255)	(0.260)
Awareness of mercury use			-0.00614
			(0.285)
High-likelihood of MC			0.274
			(0.325)
ASGM caused envprobs			0.0109
			(0.118)
Worsened water quality			0.335
			(0.252)
Observations	177	177	177
Pseudo R^2	0.016	0.060	0.070

Standard errors in parentheses
* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Notes: The Miner Treatment dummy equals one if non-miners were randomly chosen to play the treated version of the Survey Experiment, with the receiver of a prison sentence recommendation being a robber who is also a small-scale miner. The Crop QQ Decrease dummy equals one if non-miners reported a decrease in the quality or quantity of their main crop grown over the past two years. The Knowledge of MC dummy equals one if non-miners answered "True" to the statement that mercury contamination can be caused by ASGM. Column (1) only includes the treatment effect, column (2) includes the basic control variables, and column (3) includes both the basic and environmental control variables.

A.5 Predicted Changes in Treatment Effects on Bias in Justice Views

Table A.13: Predicted Change in Treatment Effect for *Knowledge of MC*

	Prison Year Categories			
	1	2	3	4
(1) Untreated, No Knowledge	.2125728	.6842786	.08121	.0219387
(2) Untreated, Knowledge	.1123738	.689223	.1434692	.054934
(3) Treated, No Knowledge	.0665897	.6455538	.1929455	.094911
(4) Treated, Knowledge	.0982696	.6810402	.1565995	.0640907
(5) No Knowledge Effect	-.1459831	-.0387248	.1117355	.0729724
(6) Treatment Effect	-.0141042	-.0081827	.0131302	.0091567
(7) Δ Treatment Effect	.1318789	.0305421	-.0986053	-.0638157

Notes: The predicted change in TE here is given for each Prison Year Category when the difference in predicted probabilities is taken between the individuals who were given the *MinerTreatment* and had *Knowledge of MC*, and the individuals who were given the *MinerTreatment* but did not have any knowledge. This is calculated by taking the difference between the no knowledge effect [(3) - (1)] and treatment effect [(4) - (2)]. The predicted probabilities here have been derived from the Oprobit regression estimates from Table 6, with the inclusion of basic control variables. The predicted change in TE is an increase the probability of selecting 0 years as a prison sentence by 13% as shown in row 7, column 1; while the predicted change in TE is a decrease in the probability of selecting 4-8.9 years as a prison sentence by 10% as shown in row 7, column 3.

Table A.14: Predicted Change in Treatment Effect for *Knowledge of MC* and *Awareness of Mercury Use ("KA")*

	Prison Year Categories			
	1	2	3	4
(1) Untreated, No KA	.1943968	.6964336	.0857808	.0233888
(2) Untreated, KA	.0840904	.6785095	.1668954	.0705047
(3) Treated, No KA	.0561559	.6370212	.2033895	.1034334
(4) Treated, KA	.1007904	.6918745	.149482	.0578531
(5) No KA Effect	-.1382409	-.0594124	.1176087	.0800445
(6) Treatment Effect	.0167	.013365	-.0174134	-.0126516
(7) Δ Treatment Effect	.1549409	.0727774	-.1350221	-.0926962

Notes: The predicted change in TE here is given for each Prison Year Category when the difference in predicted probabilities is taken between the individuals who were given the *MinerTreatment* and had *Knowledge of MC* and *Awareness of Mercury Use*, and the individuals who were given the *MinerTreatment* but did not have any knowledge or awareness. This is calculated by taking the difference between the no knowledge or awareness effect [(3) - (1)] and treatment effect [(4) - (2)]. The predicted probabilities here have been derived from the Oprobit regression estimates from Table A.9, with the inclusion of basic control variables. The predicted change in TE is an increase the probability of selecting 0 years as a prison sentence by 15% as shown in row 7, column 1; while the predicted change in TE is a decrease in the probability of selecting 4-8.9 years as a prison sentence by 14% as shown in row 7, column 3.

Table A.15: Predicted Change in Treatment Effect for *Knowledge of MC* and *Worsened Water Quality* (“KWW")

	Prison Year Categories			
	1	2	3	4
(1) Untreated, No KWW	.2473947	.6702944	.0666513	.0156595
(2) Untreated, KWW	.0946665	.6816616	.1598115	.0638604
(3) Treated, No KWW	.0765251	.6635462	.1801952	.0797335
(4) Treated, KWW	.0750618	.6616727	.1820002	.0812652
(5) No KWW Effect	-.1708696	-.0067482	.1135438	.064074
(6) Treatment Effect	-.0196047	-.0199888	.0221887	.0174049
(7) Δ Treatment Effect	.1512649	-.0132406	-.0913551	-.0466692

Notes: The predicted change in TE here is given for each Prison Year Category when the difference in predicted probabilities is taken between the individuals who were given the *MinerTreatment* and had *Knowledge of MC* and *Worsened Water Quality*, and the individuals who were given the *MinerTreatment* but did not have any knowledge or experience of worsened water. This is calculated by taking the difference between the no knowledge and no experience of worsened water effect [(3) - (1)] and treatment effect [(4) - (2)]. The predicted probabilities here have been derived from the Oprobit regression estimates from Table A.10, with the inclusion of basic control variables. The predicted change in TE is an increase the probability of selecting 0 years as a prison sentence by 15% as shown in row 7, column 1; while the predicted change in TE is a decrease in the probability of selecting 4-8.9 years as a prison sentence by 9% as shown in row 7, column 3.

Table A.16: Predicted Change in Treatment Effect for *Knowledge of MC* and *Ban Improved Water* (“KBIW")

	Prison Year Categories			
	1	2	3	4
(1) Untreated, No KBIW	.1455291	.7086645	.1116191	.0341874
(2) Untreated, KBIW	.0774716	.6768357	.1730027	.07269
(3) Treated, No KBIW	.0610317	.6526669	.1948977	.0914036
(4) Treated, KBIW	.1226925	.7059364	.128354	.043017
(5) No KBIW Effect	-.0844974	-.0559975	.0832787	.0572162
(6) Treatment Effect	.0452209	.0291008	-.0446487	-.029673
(7) Δ Treatment Effect	.1297183	.0850983	-.1279273	-.0868892

Notes: The predicted change in TE here is given for each Prison Year Category when the difference in predicted probabilities is taken between the individuals who were given the *MinerTreatment* and had *Knowledge of MC* and *Ban Improved Water*, and the individuals who were given the *MinerTreatment* but did not have any knowledge or experience of the ban improving water quality. This is calculated by taking the difference between the no knowledge and no experience of ban improved water effect [(3) - (1)] and treatment effect [(4) - (2)]. The predicted probabilities here have been derived from the Oprobit regression estimates from Table A.11, with the inclusion of basic control variables. The predicted change in TE is an increase the probability of selecting 0 years as a prison sentence by 13% as shown in row 7, column 1; while the predicted change in TE is a decrease in the probability of selecting 4-8.9 years as a prison sentence by 13% as shown in row 7, column 3.

Table A.17: Predicted Change in Treatment Effect for *Knowledge of MC* and *Crop QQ Decrease* ("KCrop")

	Prison Year Categories			
	1	2	3	4
(1) Untreated, No KBIW	.1941304	.6923202	.0887841	.0247653
(2) Untreated, KCrop	.1045683	.6878093	.1495111	.0581113
(3) Treated, No KCrop	.0700913	.6541642	.1875025	.0882421
(4) Treated, KCrop	.1457987	.6993909	.1166254	.0381851
(5) No KCrop Effect	-.1240392	-.038156	.0987184	.0634768
(6) Treatment Effect	.0412304	.0115816	-.0328857	-.0199262
(7) Δ Treatment Effect	.1652695	.0497376	-.1316041	-.083403

Notes: The predicted change in TE here is given for each Prison Year Category when the difference in predicted probabilities is taken between the individuals who were given the *MinerTreatment* and had *Knowledge of MC* and *Crop QQ Decrease*, and the individuals who were given the *MinerTreatment* but did not have any knowledge or experience in decrease of quality or quantity of crops grown. This is calculated by taking the difference between the no knowledge and no experience of crop decrease [(3) - (1)] and treatment effect [(4) - (2)]. The predicted probabilities here have been derived from the Oprobit regression estimates from Table A.12, with the inclusion of basic control variables. The predicted change in TE is an increase the probability of selecting 0 years as a prison sentence by 17% as shown in row 7, column 1; while the predicted change in TE is a decrease in the probability of selecting 4-8.9 years as a prison sentence by 13% as shown in row 7, column 3.

A.6 Ghana Survey for Non-Miner Sample

Generated by dkarapetyan, Jan 26, 2022 10:42
Questionnaire created by dkarapetyan, Jan 26, 2022 10:15
Last modified by dkarapetyan, Jan 26, 2022 10:42

Not shared with anyone

Sections: 4, Sub-sections: 12,
Questions: 166.
Questions with enabling conditions: 45
Questions with validation conditions:0
Rosters: 0
Variables: 1

Survey Solutions

Ghana Survey Non Miner Sample

SURVEY IDENTIFICATION INFORMATION
QUESTIONNAIRE DESCRIPTION

CONSENT
No sub-sections, No rosters, Questions: 3, Static texts: 1, Variables: 1.

ANONYMOUS ID NUMBER
No sub-sections, No rosters, Questions: 1, Static texts: 1.

RESPONDENT
Sub-sections: 12, No rosters, Questions: 147, Static texts: 25.

ENUMERATOR
No sub-sections, No rosters, Questions: 15.

LEGEND

SURVEY IDENTIFICATION INFORMATION QUESTIONNAIRE DESCRIPTION

Basic information

Title	Ghana Survey Non Miner Sample

Survey data information

Mode of Data Collection	Face-to-Face

Survey information

Country	Ghana
Year	2018

CONSENT

Start date and time	DATE: CURRENT TIME	enum_start
VARIABLE `Concat(String.Format("{0:mH-d-s}", enum_start),"-",(Quest.IRnd()).ToString("0.00").Substring(2))`	STRING	i1

STATIC TEXT

My name is [state your name].
I am working with Friends of the Nation, a Ghanaian non-governmental organization, on a research project for the University of East Anglia. I would like you to participate in a survey in order to understand environmental issues linked to artisanal and small-scale gold mining in Ghana. Before we begin, I would like to take a minute to explain why I am inviting you and what I will be doing with the information you provide to me. Please stop me at any time if you have any questions. You will have the opportunity of receiving GHS 40 at the end of this survey. After I've told you a bit more about my project, you can decide whether or not you would like to participate.
This research is being conducted by researchers from the University of East Anglia (UEA), United Kingdom, and the University of Oulu, Finland, in collaboration with Friends of the Nation (FoN). We will be interviewing people in different communities in Ghana. The researchers will use the information we collect in articles that might be published, as well as in academic presentations. No publications will include names or other identifiable information on participants. Your name will not be registered during this survey, so you will remain anonymous. We will only register the name and geographical location of your village.
Participation should take about 45 minutes, and is on a purely voluntary basis. You will be asked a series of questions about yourself and your household. There are no risks to you from answering these questions. The information we collect today is anonymous. We will not share any details from the survey about your family with anyone besides the research team. The responses will be securely stored on UEA computers.
The money you earn will be given to you by me in an envelope towards the end of the survey.
If at any time and for any reason, you would prefer not to answer a question, please feel free not to. If at any time you would like to stop participating, please tell me. We can take a break, or stop altogether. You will, however, not be able to receive a payout towards the end of this survey if you decide to stop before the final question. At the end of the survey, you must also sign a receipt form.
There are no correct or incorrect responses, so please express your opinions freely.
If you have any questions regarding this research or your rights as a research study participant, you may contact us at the phone number or email address on this card: Hand participant the business card showing the information.
Are you happy to continue?

Consent statement read?	SINGLE-SELECT 01 ○ Yes 02 ○ No	consent_read
Oral consent provided?	SINGLE-SELECT 01 ○ Yes 02 ○ No	consent_oral

ANONYMOUS ID NUMBER

STATIC TEXT

E `consent_oral==1 && consent_read==1 && IsAnswered(enum_start)`

Write this ID number on the blank envelope provided:
%i1%

Have you written the ID number on the blank envelope?	SINGLE-SELECT check_id 01 O Yes 02 O No

RESPONDENT

E `consent_oral==1 && consent_read==1 && IsAnswered(enum_start)`

Is this interview being held at a mining community where FoN is running their information workshops?	SINGLE-SELECT `mining_community` 01 ○ Yes, this interview is being held at a mining community. 02 ○ No, this interview is being held at a non-mining community.

RESPONDENT

PERSONAL DETAILS

STATIC TEXT

ENUMERATOR INSTRUCTIONS: DO NOT READ OUT "Don't Know" and "Prefer not to say" options.

STATIC TEXT

We first have some questions about you, your personal background, and your household.

What is your age (years)? I To be filled in numeric form only.	NUMERIC: INTEGER `age` _ SPECIAL VALUES -01 Don't Know -02 Prefer not to say
What is your gender?	SINGLE-SELECT `gender` 01 ○ Female 02 ○ Male 03 ○ Other 04 ○ Prefer not to say
Please specify what other gender you are. E `gender==3`	TEXT `gender_other` ....
What is your relation to the household head? I For example, if respondent is the brother of HH, then respondent will b e the sibling of the HH. If respondent is the HH, then respondent will b e the Head.	SINGLE-SELECT `hhrelationship` 01 ○ Head 02 ○ Spouse 03 ○ Parent 04 ○ Child 05 ○ Sibling 06 ○ Grandchild 07 ○ Other 08 ○ Prefer not to say
Please specify what the relation to head of household is. I Please type in the answer. E `hhrelationship==7`	TEXT `hhrelationship_other` ....

What language do you usually speak at home? I You may tick more than one language.	MULTI-SELECT `language` 01 ☐ Twi 02 ☐ Ewe 03 ☐ Dagbani 04 ☐ Dangme 05 ☐ Dagaare 06 ☐ Ga 07 ☐ Nzema 08 ☐ Kasem 09 ☐ Gonja 10 ☐ Fante 11 ☐ English 12 ☐ Other 13 ☐ Prefer not to say
Please specify what other language is usually spoken at home. I Please type in the answer. E `language.Contains(12)`	TEXT `language_other` ....
Can you read and write in English?	SINGLE-SELECT `rw_english` 01 ○ Yes, read and write 02 ○ Yes, read only 03 ○ No 04 ○ Prefer not to say
What is your religion?	SINGLE-SELECT `religion` 00 ○ None 01 ○ Christianity 02 ○ Islam 03 ○ Traditional religion 04 ○ Rastafarian 05 ○ Hinduism 06 ○ Afrikania Mission 07 ○ Buddhism 08 ○ Other 09 ○ Prefer not to say
Please specify what other religion is observed. I Please type in the answer. E `religion==8`	TEXT `religion_other` ....
What is your tribe?	SINGLE-SELECT `tribe` 01 ○ Akan 02 ○ Mole-Dagbon 03 ○ Ewe 04 ○ Ga-Dangme 05 ○ Gurma 06 ○ Guan 07 ○ Grusi 08 ○ Mande 09 ○ None 10 ○ Other 11 ○ Don't Know 12 ○ Prefer not to say

Please specify what the other tribe you belong to is. I Please type in the answer. E `tribe==10`	TEXT — `tribe_other` ....
How many years have you lived in this district? I To be filled in numeric form only.	NUMERIC: DECIMAL — `yrs_in_district` _ . SPECIAL VALUES -01 Don't Know -02 Prefer not to say
What region did you previously live in? E `yrs_in_district<2`	SINGLE-SELECT — `prev_region` 01 ○ Ashanti 02 ○ Brong-Ahafo 03 ○ Central Eastern 04 ○ Greater Accra 05 ○ Northern 06 ○ Upper East 07 ○ Upper West 08 ○ Volta 09 ○ Western 10 ○ Don't Know 11 ○ Prefer not to say
Why did you move? I You may tick more than one reason. E `yrs_in_district<2`	MULTI-SELECT — `reason_move` 01 ☐ Work 02 ☐ School 03 ☐ Family 04 ☐ Other 05 ☐ Don't Know 06 ☐ Prefer not to say
What is the other reason for moving to this district? I Please type in the answer. E `yrs_in_district<2 && reason_move.Contains(4)`	TEXT — `reason_move_other` ....
What is your own highest education level achieved?	SINGLE-SELECT — `education` 00 ○ None 01 ○ Incomplete Primary School 02 ○ Completed Primary School 03 ○ Incomplete Secondary School (Junior or Senior/Technical) 04 ○ Completed Secondary School (Junior or Senior/Technical) 05 ○ Incomplete Tertiary 06 ○ Completed Tertiary 07 ○ Other 08 ○ Prefer not to say
Please specify what other highest education you have achieved. I Please type in the answer. E `education==7`	TEXT — `education_other` ....

What is your main occupation? I You may tick up to 2 main occupations.	MULTI-SELECT `occupation` 00 ☐ None 01 ☐ Farming 02 ☐ Fishing 03 ☐ Industrial mining 04 ☐ Artisanal or small-scale gold mining (galamsey) 05 ☐ Forestry 06 ☐ Wage job 07 ☐ Working for own, or family-owned, business 08 ☐ Student 09 ☐ Religious authority 10 ☐ Other 11 ☐ Prefer not to say
Please specify the other main occupation. I Please type in the answer. E `occupation.Contains(10)`	TEXT `occupation_other` ....

RESPONDENT

HOUSEHOLD DETAILS

How many adults (people over 18 years old) currently live in your household including you? (A household includes all people eating from the same cooking pot) I To be filled in numeric form only.	NUMERIC: INTEGER `hhsize` _ SPECIAL VALUES -01 Don't Know -02 Prefer not to say
What is the highest level of education achieved by anyone in your household (excluding yourself)?	SINGLE-SELECT `education_hh` 00 ○ None 01 ○ Incomplete Primary School 02 ○ Completed Primary School 03 ○ Incomplete Secondary School (Junior or Senior/Technical) 04 ○ Completed Secondary School (Junior or Senior/Technical) 05 ○ Incomplete Tertiary 06 ○ Completed Tertiary 07 ○ Other 08 ○ Prefer not to say
Please specify what the other highest level of education achieved by anyone in your household is. I Please type in the answer. E `education_hh==7`	TEXT `education_hh_other` ....

STATIC TEXT

Have you or anyone in your household been involved in the following occupations in the past TWO YEARS?

Farming	SINGLE-SELECT `farming_hh` 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Fishing	SINGLE-SELECT `fishing_hh` 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Industrial Mining	SINGLE-SELECT `industrial_mining_hh` 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Artisanal and small-scale gold mining (galamsey)	SINGLE-SELECT `ASGM_hh` 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Forestry	SINGLE-SELECT `forestry_hh` 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
In general, how would you describe your household's present living conditions?	SINGLE-SELECT `live_cond` 01 ○ Very bad 02 ○ Fairly bad 03 ○ Neither good nor bad 04 ○ Fairly good 05 ○ Very good 06 ○ Don't Know 07 ○ Prefer not to say
What is your main source of drinking water?	SINGLE-SELECT `dw_source` 01 ○ Household connection 02 ○ Borehole 03 ○ Protected dug well 04 ○ Unprotected well 05 ○ Protected spring 06 ○ Unprotected spring 07 ○ Public standpipe 08 ○ River or pond 09 ○ Tanker truck 10 ○ Bottled water 11 ○ Sachet water 12 ○ Other 13 ○ Don't Know 14 ○ Prefer not to say

Please specify the other source for drinking water. I Please type in the answer. E dw_source==12	TEXT `dw_source_other` ....
What is your main source of cooking water?	SINGLE-SELECT `ck_source` 01 ○ Household connection 02 ○ Borehole 03 ○ Protected dug well 04 ○ Unprotected well 05 ○ Protected spring 06 ○ Unprotected spring 07 ○ Public standpipe 08 ○ River or pond 09 ○ Tanker truck 10 ○ Bottled water 11 ○ Sachet water 12 ○ Other 13 ○ Don't Know 14 ○ Prefer not to say
Please specify the other source for cooking water. I Please type in the answer. E ck_source==12	TEXT `ck_source_other` ....
Do you, or someone else in your household, currently hold any of the following roles? I Tick all that apply.	MULTI-SELECT `comm_role` 01 ☐ Unit committee member 02 ☐ District Assembly member 03 ☐ Traditional Authority (Chief or Queen Mother) 04 ☐ Journalist 05 ☐ Local Community Leader (Examples: Religious authority, youth leader, women's group leader) 06 ☐ Community Activist 07 ☐ None 08 ☐ Prefer not to say
Do you, or someone else in your household, own any of the following? I Tick all that apply.	MULTI-SELECT `assets` 01 ☐ Car 02 ☐ Motorbike 03 ☐ TV 04 ☐ Radio 05 ☐ Mobile phone 06 ☐ Bicycle 07 ☐ None 08 ☐ Prefer not to say

STATIC TEXT

Have you, or anyone in your household, had any of the following health problems in the past TWELVE MONTHS?

Severe mood swings	SINGLE-SELECT mood_swings 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Frequent dizziness	SINGLE-SELECT dizziness 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Hearing Loss	SINGLE-SELECT hearing_loss 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Memory Loss	SINGLE-SELECT memory_loss 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Intense coughing and shortness of breath	SINGLE-SELECT coughing 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Uncoordinated walking or movements	SINGLE-SELECT uncoordinated 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Frequent headaches	SINGLE-SELECT headaches 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Muscle twitching/Tremors (shakiness or trembling)	SINGLE-SELECT tremors 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Muscle weakness	SINGLE-SELECT muscle 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say

Birth defects of children born in household	SINGLE-SELECT `birth_defects` 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Please specify the birth defects seen in children born in the household I Please type in the answer. E `birth_defects==1`	TEXT `birth_defect` ....
Does anyone in your household including yourself own livestock?	SINGLE-SELECT `livestock` 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
What is the main water source for the livestock? I You may tick more than one main water source. E `livestock==1`	MULTI-SELECT `lw_source` 01 ☐ Household connection 02 ☐ Borehole 03 ☐ Protected dug well 04 ☐ Unprotected well 05 ☐ Protected spring 06 ☐ Unprotected spring 07 ☐ Public standpipe 08 ☐ River or pond 09 ☐ Tanker truck 10 ☐ Other 11 ☐ Don't Know 12 ☐ Prefer not to say
Please specify the other source of water for your livestock I Please type in the answer. E `lw_source.Contains(10)`	TEXT `lw_source_other` ....
What is the livestock mainly used for? E `livestock==1`	SINGLE-SELECT `ls_use` 01 ○ Household consumption 02 ○ Selling at the market 03 ○ Household consumption and selling at the market 04 ○ Don't Know 05 ○ Prefer not to say
Has the health of the livestock changed in the last TWO years? E `livestock==1`	SINGLE-SELECT `ls_healthchg` 01 ○ No, no change 02 ○ Yes, it has improved 03 ○ Yes, it has worsened 04 ○ Don't Know

What is the cause of the health change? I Tick all that apply. E `ls_healthchg==2||ls_healthchg==3`	MULTI-SELECT `ls_healthchg_cause` 01 ☐ Pests or disease 02 ☐ Drought 03 ☐ Floods 04 ☐ Heat 05 ☐ Pollution 06 ☐ No/less Pests or disease 07 ☐ No/less Drought 08 ☐ No/less floods 09 ☐ No/less pollution 10 ☐ Other 11 ☐ Don't Know 12 ☐ Prefer not to say
Please specify what the other cause of the health change is. I Please type in the answer. E `ls_healthchg_cause.Contains(10)`	TEXT `ls_healthchg_cause_other` ....

RESPONDENT

FARMER SECTION

E `occupation.Contains(1) || farming_hh==1`

STATIC TEXT

Since you or someone else in your household has been involved in farming, we would now like to ask you some questions related to farming.

What is (or was) the total land farmed by your household (acres)? I To be filled in numeric form only.	NUMERIC: DECIMAL `land_farmed` _ . SPECIAL VALUES -01 Don't Know -02 Prefer not to say
How much of this farmed land is (or was) owned by your household (acres)? I To be filled in numeric form only.	NUMERIC: DECIMAL `land_owned` _ . SPECIAL VALUES -01 Don't Know -02 Prefer not to say
What is (or was) your main water source for irrigation?	SINGLE-SELECT `irrigation_source` 00 ○ No irrigation 01 ○ Public system 02 ○ Reservoir/pond 03 ○ Rivers 04 ○ Well water 05 ○ Rain water 06 ○ Other 07 ○ Don't Know 08 ○ Prefer not to say

Please specify the other source of irrigation water. I Please type in the answer. E irrigation_source==6	TEXT irrigation_source_other ....
What is (or was) the main crop grown by the household?	SINGLE-SELECT crops_grown 01 ○ Maize 02 ○ Cocoa 03 ○ Yams 04 ○ Millet 05 ○ Sorghum 06 ○ Cassava 07 ○ Oil palms 08 ○ Coconuts 09 ○ Sweet potato 10 ○ Other 11 ○ Don't Know 12 ○ Prefer not to say
Please specify what other main crop is grown. I Please type in the answer. E crops_grown==10	TEXT crops_grown_other ....
How many years has (or was) this crop grown (for) by the household? I To be filled in numeric form only.	NUMERIC: INTEGER crops_yrs - SPECIAL VALUES -01 Don't Know -02 Prefer not to say
What is (or was) the crop mainly grown for?	SINGLE-SELECT crops_use 01 ○ Household consumption 02 ○ Selling at the market 03 ○ Household consumption and selling at the market 04 ○ Don't Know 05 ○ Prefer not to say
In the past TWO years, have you or anyone in your household noticed any changes in the quantity or quality of this crop?	SINGLE-SELECT crop_change 00 ○ No 01 ○ Quality or quantity increased 02 ○ Quality or quantity decreased 03 ○ Don't Know 04 ○ Prefer not to say
What was the cause of increased crop quality or quantity? I You may tick more than one cause. E crop_change==1	MULTI-SELECT crop_increase_cause 01 ☐ Better equipment 02 ☐ Fertilizer 03 ☐ Irrigation 04 ☐ Other 05 ☐ Don't Know 06 ☐ Prefer not to say

Please specify the other cause for an increase in crop quality or quantity. I Please type in the answer. E `crop_increase_cause.Contains(4)`	TEXT `crop_increase_cause_other` ....
What was the cause of decreased crop quality or quantity? I You may tick more than one cause. E `crop_change==2`	MULTI-SELECT `crop_decrease_cause` 01 ☐ Pests 02 ☐ Drought 03 ☐ Floods 04 ☐ Heat 05 ☐ Soil Pollution 06 ☐ Water Pollution 07 ☐ Air Pollution 08 ☐ Other 09 ☐ Don't Know 10 ☐ Prefer not to say
Please specify the other cause for a decrease in crop quality or quantity. I Please type in the answer. E `crop_decrease_cause.Contains(8)`	TEXT `crop_decrease_cause_other` ....

RESPONDENT

FISHERMEN SECTION

E `occupation.Contains(2) || fishing_hh==1`

STATIC TEXT

Since you or someone else in your household has been involved in fishing, we would now like to ask you some questions related to fishing.

How many canoes does (or did) your household use for fishing? I To be filled in numeric form only.	NUMERIC: INTEGER `canoes_used` _ SPECIAL VALUES -01 Don't Know -02 Prefer not to say
Where do (or did) you or your household fish from? I Tick all that apply.	MULTI-SELECT `fish_from` 01 ☐ Estuary 02 ☐ River 03 ☐ Sea 04 ☐ Lake 05 ☐ Prefer not to say
What is (or was) the fish that you catch mainly used for?	SINGLE-SELECT `fish_use` 01 ○ Household consumption 02 ○ Selling at the market 03 ○ Household consumption and selling at the market 04 ○ Don't Know 05 ○ Prefer not to say
What is (or was) the main type of fish caught? I Please type in the answer.	TEXT `fish_caught` ....

In the past TWO years, have there been any changes in the quantity or quality of the main type of fish caught? I Tick all that apply.	MULTI-SELECT fish_chg 01 ☐ No, no change 02 ☐ Yes, quality improved 03 ☐ Yes, quantity increased 04 ☐ Yes, quality worsened 05 ☐ Yes, quantity decreased 06 ☐ Other 07 ☐ Don't Know 08 ☐ Prefer not to say
Please specify the other change seen in the fish caught. I Please type in the answer. E `fish_chg.Contains(6)`	TEXT fish_chg_other ....
What is (or was) the cause for the change in the fish caught? I Tick all that apply. E `fish_chg.ContainsAny(2,3,4,5,6)`	MULTI-SELECT fish_chg_cause 01 ☐ Pests or disease 02 ☐ Drought 03 ☐ Floods 04 ☐ Heat 05 ☐ Water pollution 06 ☐ No/less pests or disease 07 ☐ No/less drought 08 ☐ No/less floods 09 ☐ No/less heat 10 ☐ No/less water pollution 11 ☐ Other 12 ☐ Don't Know
Please specify the other reason for the change in fish caught. I Please type in the answer. E `fish_chg_cause.Contains(11)`	TEXT fish_chg_cause_other ....

RESPONDENT

NATURAL AND PHYSICAL ENVIRONMENT

STATIC TEXT

We have some questions for you about the natural and physical environment in which you live and work every day. Use laminated cards and let respondent know they will be answering the next few questions with this.

STATIC TEXT

In general,please answer how satisfied you are with the quality of the following natural resources.

The air that you BREATHE.	SINGLE-SELECT sat_air 01 ○ Very satisfied 02 ○ A bit satisfied 03 ○ Neither satisfied nor dissatisfied 04 ○ A bit dissatisfied 05 ○ Very dissatisfied 06 ○ Don't Know 07 ○ Prefer not to say

The water that you DRINK and COOK with?	SINGLE-SELECT satwater_drinkcook 01 ○ Very satisfied 02 ○ A bit satisfied 03 ○ Neither satisfied nor dissatisfied 04 ○ A bit dissatisfied 05 ○ Very dissatisfied 06 ○ Don't Know 07 ○ Prefer not to say
The river and/or sea water in your local community.	SINGLE-SELECT sat_river_sea 01 ○ Very satisfied 02 ○ A bit satisfied 03 ○ Neither satisfied nor dissatisfied 04 ○ A bit dissatisfied 05 ○ Very dissatisfied 06 ○ Don't Know 07 ○ Prefer not to say
The soil you grow your vegetables and crops in.	SINGLE-SELECT sat_soil 01 ○ Very satisfied 02 ○ A bit satisfied 03 ○ Neither satisfied nor dissatisfied 04 ○ A bit dissatisfied 05 ○ Very dissatisfied 06 ○ Not applicable 07 ○ Don't Know 08 ○ Prefer not to say

STATIC TEXT

Thinking about your experience in the past TWO years, would you say the quality of the following resources changed?

The quality of the air you BREATHE.	SINGLE-SELECT qual_air 01 ○ No, it's about the same 02 ○ Yes, it has improved 03 ○ Yes, it has worsened 04 ○ Don't Know 05 ○ Prefer not to say
The quality of the water you DRINK and COOK with.	SINGLE-SELECT qual_water_drink 01 ○ No, it's about the same 02 ○ Yes, it has improved 03 ○ Yes, it has worsened 04 ○ Don't Know 05 ○ Prefer not to say
The river and/or sea water in your local community.	SINGLE-SELECT qual_river_sea 01 ○ No, it's about the same 02 ○ Yes, it has improved 03 ○ Yes, it has worsened 04 ○ Don't Know 05 ○ Prefer not to say

The soil you grow your vegetables and crops in.	SINGLE-SELECT qual_soil 01 No, it's about the same 02 Yes, it has improved 03 Yes, it has worsened 04 Not Applicable 05 Don't Know 06 Prefer not to say

STATIC TEXT

Thinking of the local community in which you live, have you noticed any of the following problems with the natural surroundings in the past TWO years?

Air Pollution	SINGLE-SELECT air_poll 01 No 02 Yes 03 Don't Know
Deforestation	SINGLE-SELECT deforestation 01 No 02 Yes 03 Don't Know
Polluted drinking and cooking water	SINGLE-SELECT waterpoll_drinkcook 01 No 02 Yes 03 Don't Know
Polluted river and/or sea water	SINGLE-SELECT pollwater_riversea 01 No 02 Yes 03 Don't Know
Landslides	SINGLE-SELECT landslides 01 No 02 Yes 03 Don't Know
Flooding	SINGLE-SELECT flooding 01 No 02 Yes 03 Don't Know
Soil Erosion	SINGLE-SELECT soilerosion 01 No 02 Yes 03 Don't Know
Plant or animal pests	SINGLE-SELECT pests 01 No 02 Yes 03 Don't Know
Soil Pollution	SINGLE-SELECT poll_soil 01 No 02 Yes 03 Don't Know

Drought	SINGLE-SELECT `drought` 01 ○ No 02 ○ Yes 03 ○ Don't Know
Have you noticed any other environmental problems?	SINGLE-SELECT `envproblems_other` 01 ○ Yes 02 ○ No 03 ○ Prefer not to say
Please specify what other environmental problems you have noticed in the past TWO years. I Please type in the answer. E `envproblems_other==1`	TEXT `envproblems_other_specify` ....
What do you think is the main cause of the environmental problems in your community? I You may tick up to 2 answers. E `air_poll==2||deforestation==2||waterpoll_drinkcook==2||pollwater_riversea==2||landslides==2||flooding==2||soilerosion==2||pests==2||poll_soil==2||drought==2||envproblems_other==1`	MULTI-SELECT `envproblems_cause` 01 ☐ Logging 02 ☐ Climate change 03 ☐ Use of pesticides/herbicides 04 ☐ Poor sanitation 05 ☐ Vehicle emmissions 06 ☐ Littering 07 ☐ Small-scale gold mining 08 ☐ Commercial mining 09 ☐ Overcrowding 10 ☐ Illegal building 11 ☐ Normal weather variation 12 ☐ Other 13 ☐ Don't Know
Please specify what other main cause of the environmental problems in your community is. I Please type in the answer. E `envproblems_cause.Contains(12)`	TEXT `envproblems_cause_other` ....

RESPONDENT

MERCURY

STATIC TEXT

We will now ask you some questions about mercury.

Have you heard or read about mercury pollution?	SINGLE-SELECT `aware_mercury` 01 ○ Yes 02 ○ No 03 ○ Prefer not to say

STATIC TEXT

Please state whether you think the following statements about mercury are true or false.

Mercury contamination can be caused by small-scale gold mining (galamsey).	SINGLE-SELECT `mercury_ASGM` 01 ○ True 02 ○ False 03 ○ Don't Know 04 ○ Prefer not to say

Mercury accumulates in fish.	SINGLE-SELECT mercury_accfish 01 True 02 False 03 Don't Know 04 Prefer not to say
Mercury stays in the natural environment for a long time.	SINGLE-SELECT mercury_natenv 01 True 02 False 03 Don't Know 04 Prefer not to say
Mercury enters a mother's breastmilk.	SINGLE-SELECT mercury_breastmilk 01 True 02 False 03 Don't Know 04 Prefer not to say
Mercury contamination can cause muscle twitching and tremors.	SINGLE-SELECT mercury_muscletwitch 01 True 02 False 03 Don't Know 04 Prefer not to say
Mercury contamination can cause birth defects.	SINGLE-SELECT mercury_birthdefect 01 True 02 False 03 Don't Know 04 Prefer not to say

RESPONDENT
GOLD MINING

STATIC TEXT

We will now ask you some questions about gold mining.

In the past TWELVE MONTHS, have you heard or read about artisanal or small-scale gold mining (galamsey) in the MEDIA?	SINGLE-SELECT aware_gold 01 Not at all 02 Some 03 A lot 04 Don't Know 05 Prefer not to say
Artisanal or small-scale gold mining (galamsey) is a way of quickly and cheaply extracting gold. How much do you support this?	SINGLE-SELECT support_gold 01 Strongly support it 02 Somewhat support it 03 Neither support nor oppose it 04 Somewhat oppose it 05 Strongly oppose it 06 Don't Know 07 Prefer not to say

Are you aware of any artisanal or small-scale gold mining (galamsey) in your local community? I If interviewing at a mining site, please tick yes without asking.	SINGLE-SELECT aware_localcommunity 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
What type of artisanal or small-scale gold mining (galamsey) is used in your area? I You may tick more than one answer.	MULTI-SELECT type_gold 01 ☐ Riverbed dredging 02 ☐ Underground mining 03 ☐ Open pits 04 ☐ Not Applicable 05 ☐ None 06 ☐ Other 07 ☐ Don't Know 08 ☐ Prefer not to say
Please specify the other type of artisanal or small-scale gold mining (galamsey) used I Please type in the answer. E type_gold.Contains(6)	TEXT type_gold_other ....
Is mercury used for artisanal or small-scale gold mining (galamsey) in your area?	SINGLE-SELECT mercury_use 01 ○ Yes 02 ○ No 04 ○ Don't Know/Not Applicable 05 ○ Prefer not to say

STATIC TEXT

Please choose how much you agree with the following statements about the effects of artisanal and small-scale gold mining (galamsey) on your LOCAL COMMUNITY. Use laminated cards and let respondent know they will be answering the next few questions with this.

It has provided compensation for land use.	SINGLE-SELECT impact_gold_land_comm 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know/Not Applicable 07 ○ Prefer not to say
It has provided infrustructure.	SINGLE-SELECT impact_gold_infra_comm 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know/Not Applicable 07 ○ Prefer not to say

It has provided health care or education services.	SINGLE-SELECT impact_gold_healthedu_comm 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know/Not Applicable 07 ○ Prefer not to say
It has contributed to increased income from non-mining activities.	SINGLE-SELECT impact_gold_income_comm 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know/Not Applicable 07 ○ Prefer not to say
It has led to illegal land appropriation.	SINGLE-SELECT impact_gold_appr_comm 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know/Not Applicable 07 ○ Prefer not to say
Mining related migration has caused social problems.	SINGLE-SELECT impact_gold_social_comm 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know/Not Applicable 07 ○ Prefer not to say
It has led to pollution of the natural environment.	SINGLE-SELECT impact_gold_poll_comm 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know/Not Applicable 07 ○ Prefer not to say
Overall, artisanal and small-scale gold mining (galamsey) has had a positive effect on the local community.	SINGLE-SELECT impact_gold_overall_comm 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know/Not Applicable 07 ○ Prefer not to say

STATIC TEXT

The government implemented a ban on artisanal and small-scale gold mining (galamsey) in all of Ghana from June 2017 to December 2018. How much do you agree with the following statements on that ban?

The ban improved the quality of the drinking and cooking water in my local community.	SINGLE-SELECT ban_water 01 Strongly disagree 02 Disagree 03 Neither agree nor disagree 04 Agree 05 Strongly agree 06 Don't Know 07 Prefer not to say
The ban improved the quality of the river and/or sea water in my local community.	SINGLE-SELECT ban_riversea 01 Strongly disagree 02 Disagree 03 Neither agree nor disagree 04 Agree 05 Strongly agree 06 Don't Know 07 Prefer not to say
The ban improved the quality of the soil for farming in my local community.	SINGLE-SELECT ban_soil 01 Strongly disagree 02 Disagree 03 Neither agree nor disagree 04 Agree 05 Strongly agree 06 Don't Know 07 Prefer not to say
The ban took away a source of livelihood from my household.	SINGLE-SELECT ban_livelihood 01 Strongly disagree 02 Disagree 03 Neither agree nor disagree 04 Agree 05 Strongly agree 06 Don't Know 07 Prefer not to say
The ban took away a source of livelihood for my local community.	SINGLE-SELECT ban_livelihood_comm 01 Strongly disagree 02 Disagree 03 Neither agree nor disagree 04 Agree 05 Strongly agree 06 Don't Know 07 Prefer not to say
Overall, I supported the ban on artisanal and small-scale gold mining.	SINGLE-SELECT ban_support 01 Strongly disagree 02 Disagree 03 Neither agree nor disagree 04 Agree 05 Strongly agree 06 Don't Know 07 Prefer not to say

RESPONDENT

PRISON SENTENCE DECISION

E `$question_random>0.5`

STATIC TEXT

E `$treatment > 0.5`

We would now like to ask you to state what your decision might be in the following robbery case:
Robbery cases are on the rise in Ghana. In the first quarter of 2018, 968 robbery cases were reported. Recently, a nearby food vendor was robbed. Crimes like this carry a maximum sentence of 15 years. Imagine you are asked to judge how much time this person should spend in prison for this crime.
Here are the case details:
A 28-year-old male, who lives in the community, was seen stealing all of the food vendor's earnings of the day (around 500 Cedis). He was unarmed, and this was his first criminal offense. Police officers arrested him shortly after the incident, but they were unable to recover the stolen cash.

What sentence would you recommend (in years)? You can choose any number between 0 and 15. I To be filled in numeric form only. E `$treatment > 0.5`	NUMERIC: DECIMAL `prison_sentence` _________________________________

STATIC TEXT

E `$treatment < 0.5`

We would now like to ask you to state what your decision might be in the following robbery case:
Robbery cases are on the rise in Ghana. In the first quarter of 2018, 968 robbery cases were reported. Recently, a nearby food vendor was robbed. Crimes like this carry a maximum sentence of 15 years. Imagine you are asked to judge how much time this person should spend in prison for this crime.
Here are the case details:
A 28-year-old male, a small-scale miner who lives in the community, was seen stealing all of the food vendor's earnings of the day (around 500 Cedis). He was unarmed, and this was his first criminal offense. Police officers arrested him shortly after the incident, but they were unable to recover the stolen cash.

What sentence would you recommend? You can choose any number between 0 and 15. I To be filled in numeric form only. E `$treatment < 0.5`	NUMERIC: INTEGER `prison_sentence_miner` _________________________________

RESPONDENT

DICTATOR

E `(mining_community==2)`

STATIC TEXT

E `$dictator_treatment>0.5`

Now we would like to invite you to participate in an activity involving real money. As a thank you for taking the time to answer our questions, we would like to compensate you with 40 Ghanaian Cedis. These are yours to keep. Hand over the funds – eight 5 Cedi bills in an envelope with a UEA sticker - to the respondent. Ask them to please sign the receipt form. If they don't sign, take money back.
As part of the study, the research team will be traveling to a village in the next district similar to yours. This village is approximately two hours away from here by car. I would like to know whether you would be interested in donating any amount of your funds to a randomly selected household from the village I described. Note that households in that village will not be taking part in this survey or exercise. They will only be receivers of the funds.
This is how the donation will work. With me I have a sealed box containing donation envelopes.Show box - make sure this box states "Donation" and does not have a sticker. This box will only be opened when we reach a village in the next district. We will then park the car and walk to the door of the nearest house and give them one, and only one, envelope from this box. We will then proceed two houses down, and repeat the same exercise until we've given out all the envelopes.
We would now like to ask you whether you would like to donate any money to the randomly chosen household in the next village. Here is an envelope with just the number of this survey so you will remain anonymous. This is only for us to keep track of the interviews. Show envelope. Using only the notes we have provided, please put in any amount that you would like in the envelope and seal it. Then, I would like you to put the envelope directly into the donation box. Hand over envelope marked with the ID number to the individual. I will turn around so I cannot see what you do. This way only the receiver will know how much was in the envelope. This box will be unsealed when we get to the village in the next

district.
Do you have any questions?
Turn around. Please go ahead and make your decision, and let me know when you are finished.

Did respondent put an envelope in the donation box? E `$dictator_treatment>0.5`	SINGLE-SELECT `dictator_general` 01 ○ Yes 02 ○ No
You don't have to tell me, but out of interest, how much did you donate (in Cedi)? E `dictator_general==1`	NUMERIC: INTEGER `dictator_general_selfreport` _ SPECIAL VALUES -01 Prefer not to say

STATIC TEXT

E `$dictator_treatment<0.5`

Now we would like to invite you to participate in an activity involving real money. As a thank you for taking the time to answer our questions, we would like to compensate you with 40 Ghanaian Cedis. These are yours to keep. Hand over the funds – eight 5 Cedi bills in an envelope with a UEA sticker - to the respondent. Ask them to please sign the receipt form. If they don't sign, take money back.
As part of the study, the research team will be traveling to a village in the next district similar to yours, except that it also has a large population of small-scale (galamsey) miners. This village is approximately two hours away from here by car. I would like to know whether you would be interested in donating any amount of your funds to a randomly selected household from the village I described. Note that households in that village will not be taking part in this survey or exercise. They will only be receivers of the funds.
This is how the donation will work. With me I have a sealed box containing donation envelopes Show box - make sure it states "Donation" and has a green sticker. This box will only be opened when we reach a village in the next district. We will then park the car and walk to the door of the nearest house and give them one, and only one, envelope from this box. We will then proceed two houses down, and repeat the same exercise until we've given out all the envelopes.
We would now like to ask you whether you would like to donate any money to the randomly chosen household in the next village. Here is an envelope with just the number of this survey so you will remain anonymous. This is only for us to keep track of the interviews. Show envelope. Using only the notes we have provided, please put in any amount that you would like in the envelope and seal it. Then, I would like you to put the envelope directly into the donation box. Hand over envelope marked with the ID number to the individual. I will turn around so I cannot see what you do. This way only the receiver will know how much was in the envelope. This box will be unsealed when we get to the village in the next district.
Do you have any questions?
Turn around. Please go ahead and make your decision, and let me know when you are finished.

Did respondent put an envelope in the donation box? E `$dictator_treatment<0.5`	SINGLE-SELECT `dictator_miner` 01 ○ Yes 02 ○ No
You don't have to tell me, but out of interest, how much did you donate (in Cedi)? E `dictator_miner==1`	NUMERIC: INTEGER `dictator_miner_selfreport` _ SPECIAL VALUES -01 Prefer not to say

RESPONDENT
PRISON SENTENCE DECISION

E `$question_random<0.5`

STATIC TEXT

E `$treatment > 0.5`

We would now like to ask you to state what your decision might be in the following robbery case:
Robbery cases are on the rise in Ghana. In the first quarter of 2018, 968 robbery cases were reported. Recently, a nearby food vendor was robbed. Crimes like this carry a maximum sentence of 15 years. Imagine you are asked to judge how much time this person should spend in prison for this crime.
Here are the case details:
A 28-year-old male, who lives in the community, was seen stealing all of the food vendor's earnings of the day (around 500 Cedis). He was unarmed, and this was his first criminal offense. Police officers arrested him shortly after the

incident, but they were unable to recover the stolen cash.

What sentence would you recommend? You can choose any number between 0 and 15. I To be filled in numeric form only. E `$treatment > 0.5`	NUMERIC: INTEGER prison_sentence_2 _________________________________

STATIC TEXT

E `$treatment < 0.5`

We would now like to ask you to state what your decision might be in the following robbery case:
Robbery cases are on the rise in Ghana. In the first quarter of 2018, 968 robbery cases were reported. Recently, a nearby food vendor was robbed. Crimes like this carry a maximum sentence of 15 years. Imagine you are asked to judge how much time this person should spend in prison for this crime.
Here are the case details:
A 28-year-old male, a small-scale miner who lives in the community, was seen stealing all of the food vendor's earnings of the day (around 500 Cedis). He was unarmed, and this was his first criminal offense. Police officers arrested him shortly after the incident, but they were unable to recover the stolen cash.

What sentence would you recommend(in years)? You can choose any number between 0 and 15. I To be filled in numeric form only. E `$treatment < 0.5`	NUMERIC: DECIMAL prison_sentence_miner_2 _________________________________

RESPONDENT
ATTITUDES

STATIC TEXT

We would like to ask you about your views and attitudes towards different groups of people. How much do you agree with the following statements? Use laminated cards and let respondent know they will be answering the next few questions with this.

I am ready to undergo personal cost (in time and/or money) to help my family or household members.	SINGLE-SELECT cost_hh 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say
I am ready to undergo personal cost (in time and/or money) to help someone from my local community.	SINGLE-SELECT cost_comm 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say
I am ready to undergo personal cost (in time and/or money) to help someone outside of my local community who has helped me before.	SINGLE-SELECT cost_xcomm 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say

I am ready to undergo personal cost (in time and/or money) to help a stranger.	SINGLE-SELECT cost_strang 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say
My family and household members mostly try to be helpful.	SINGLE-SELECT help_hh 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say
People from my local community mostly try to be helpful.	SINGLE-SELECT help_comm 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say
People of another community from mine mostly try to be helpful.	SINGLE-SELECT help_xcomm 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say
People of a different religion from mine mostly try to be helpful.	SINGLE-SELECT help_xrelig 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say
People in general mostly try to be helpful.	SINGLE-SELECT help_gen 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say

Small-scale gold miners mostly try to be helpful.	SINGLE-SELECT help_mine 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say
Farmers mostly try to be helpful.	SINGLE-SELECT help_farm 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say
Fishermen mostly try to be helpful.	SINGLE-SELECT help_fish 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say

RESPONDENT

FINAL QUESTIONS

E mining_community==1

STATIC TEXT

We have now come to the final section of the survey, and have a few last questions for you.

Overall, artisanal and small-scale gold mining (galamsey) has had a positive effect on the local community.	SINGLE-SELECT impact_gold_overall_comm_diff 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know/Not Applicable 07 ○ Prefer not to say

STATIC TEXT

The governments of some countries have introduced penalties for the use of mercury in small scale gold mining.

Would you support the introduction of a fine in Ghana for small scale miners who use mercury? If yes, how high should it be?	SINGLE-SELECT mercury_fine 01 ○ No, no fine. 02 ○ Yes, the fine should be 0 - 100 GHS 03 ○ Yes, the fine should be 100 - 500 GHS 04 ○ Yes, the fine should be 500 - 1000 GHS 05 ○ Yes, the fine should be 1,000 - 5,000 GHS 06 ○ Yes, the fine should be over 5,000 GHS 07 ○ Don't Know 08 ○ Prefer not to say
Would you support the introduction of a prison sentence in Ghana for small scale miners who use mercury? If yes, how severe should it be?	SINGLE-SELECT mercury_prisonsentence 01 ○ No, no prison sentence. 02 ○ Yes, 0 - 3 months 03 ○ Yes, 3 - 6 months 04 ○ Yes, 6 - 12 months 05 ○ Yes, over 12 months 06 ○ Don't Know 07 ○ Prefer not to say

STATIC TEXT

Thank you very much for your time. We are now finished with the survey.

ENUMERATOR

E `consent_oral==1 && consent_read==1 && IsAnswered(enum_start)`

Enumerator name	TEXT	enum_name
Name of village or city	TEXT	enum_vill
Name of district	TEXT	enum_distr
Is the area mostly rural or mostly urban? I Note: Rural is in sparsely populated countryside area; urban is in well p opulated town/city.	SINGLE-SELECT 01 ○ Mostly rural 02 ○ Mostly urban	enum_rururb
GPS coordinates	GPS _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ N _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ W _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ A	enum_gps
Language in which the interview was conducted	SINGLE-SELECT 01 ○ English 02 ○ Twi 03 ○ Ewe 04 ○ Dagbani 05 ○ Dangme 06 ○ Dagaare 07 ○ Ga 08 ○ Nzema 09 ○ Kasem 10 ○ Gonja 11 ○ Fante 12 ○ Other	enum_lang
Please specify the other language the interview was conducted in. E `enum_lang==12`	TEXT	enum_lang_other
Did you narrate the video?	SINGLE-SELECT 01 ○ Yes 02 ○ No	enum_narration
Do you personally know the respondent or anyone in their household?	SINGLE-SELECT 01 ○ Yes 02 ○ No 03 ○ Prefer not to say	enum_relation

Material of house wall	MULTI-SELECT resp_house 01 ☐ Brick 02 ☐ Mud 03 ☐ Concrete 04 ☐ Corrugated iron 05 ☐ Tents 06 ☐ Thatched 07 ☐ Not applicable - mining site 08 ☐ Other 09 ☐ Don't know
Please specify the other material of house wall. E resp_house.Contains(8)	TEXT resp_house_other ....
Is the road surface of durable material?	SINGLE-SELECT resp_road 01 ○ Yes 02 ○ No 03 ○ Don't know
Road surface type E resp_road==1||resp_road==2	MULTI-SELECT resp_road_type 01 ☐ Gravel 02 ☐ Cobblestone 03 ☐ Asphalt 04 ☐ Concrete 05 ☐ Dirt 06 ☐ Other 07 ☐ Don't Know
Specify the other road surface type E resp_road_type.Contains(6)	TEXT resp_road_type_other ....
End time	DATE: CURRENT TIME enum_end ....

LEGEND

Legend and structure of information in this file

Name of section

Enabling condition for this section

Question title

Type of question, scope

Variable name

Answer options

SECTION 5: OTHER INCOME SOURCES

E s4_other_sources_which.Contains(98)

Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur?

I This refers to family relations
E s3_time_other > 0
V1 s4_rel_leaders_which.Contains(98)
M1 Can not be itself
V2 (s3_time_other_breeding_advice <= (50 - s3_time_art_insem_advice)) ||s3_time_other_breeding_advice == 0
M2 This person is not in the list
F optioncode != s5_ignored_option_code

MULTI-SELECT
SCOPE: PREFILLED

s4_rel_leaders_other

01 ☐ Community animal health workers
02 ☐ Private
03 ☐ Government
04 ☐ Livestock keepers association
05 ☐ NGO

And 5 other [13]

Additional information:
"I" — Question instruction
"E" — Enabling condition
"V1" — Validation condition №1
"M1" — Message for validation №1
"F" — Filter in Categorical questions

Link to full set in appendix

Breadcrumbs

Type or roster

Roster Title

CHAPTER 3 IDENTIFICATION /
Roster: LEADER RELATION DETAILS
generated by fixed list:

01 Ward Livestock Officer
02 Village Livestock Officer
99 Other (specify)

List items

Chapter 2 Appendix: Additional Figures, Tables, Survey and Experimental Instructions

B.1 Research Design

Figure B.1: Original Research Design

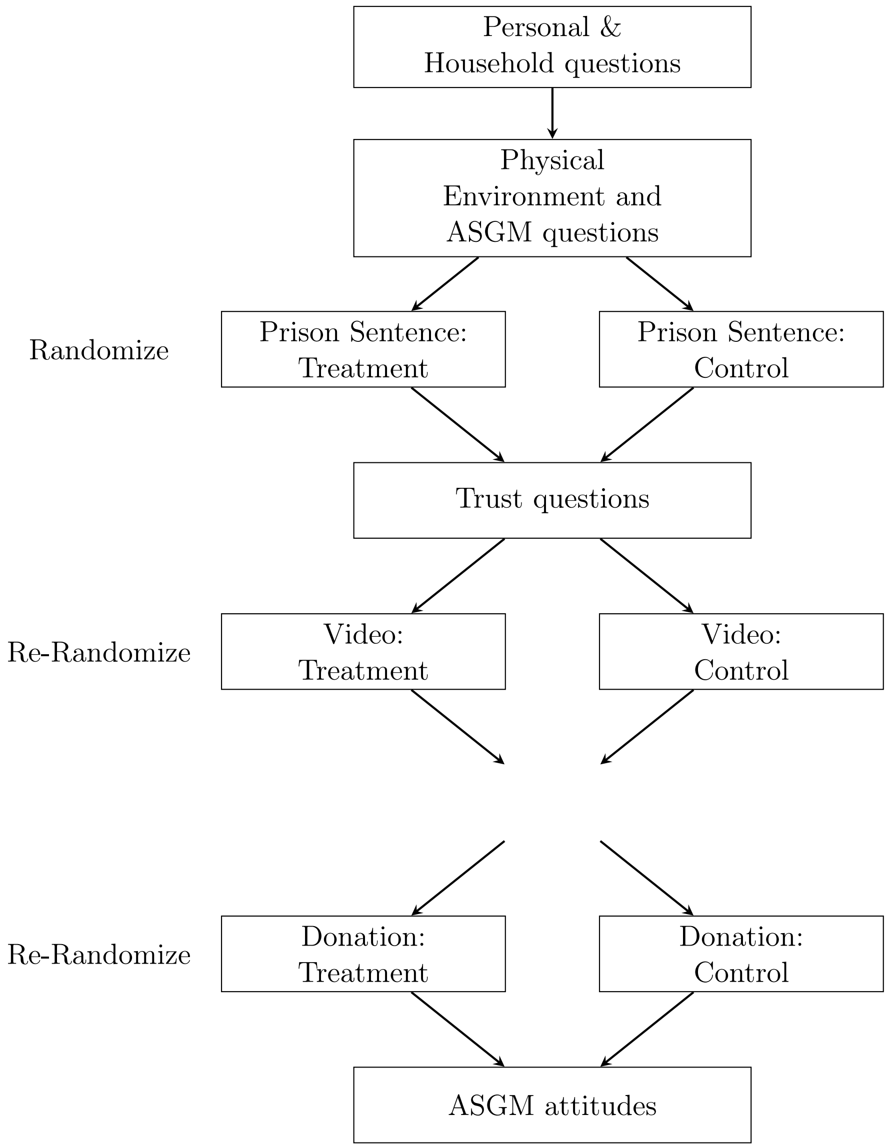
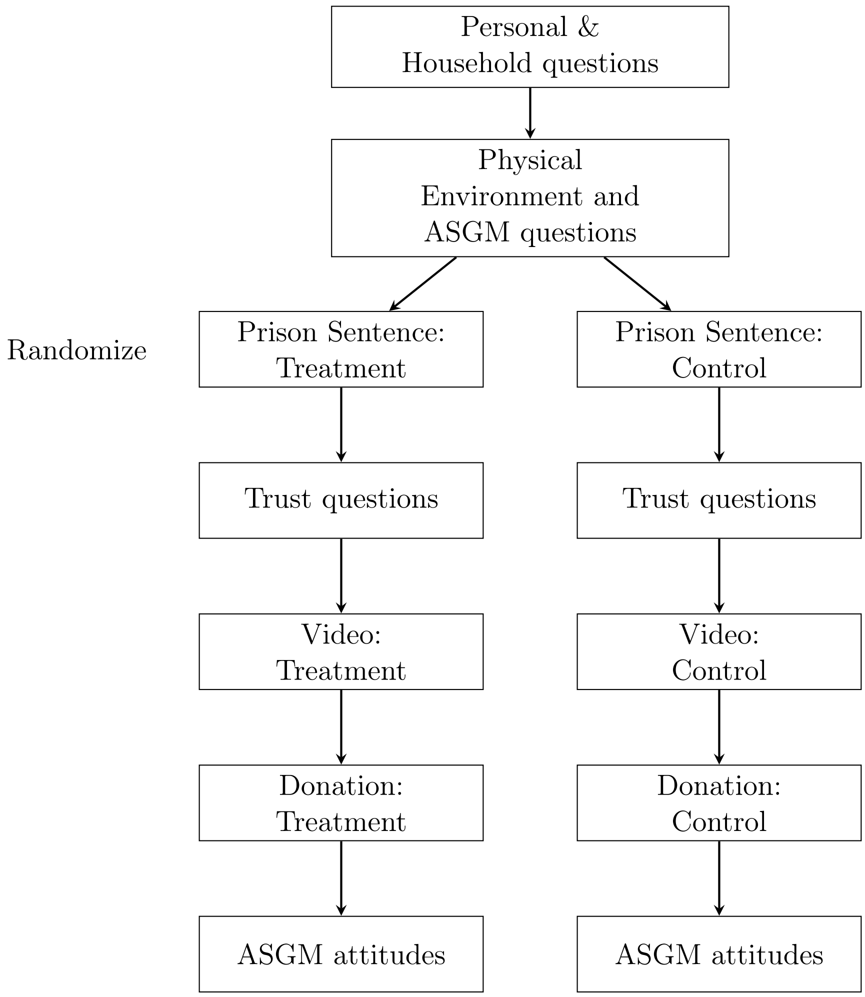


Figure B.2: Executed Research Design



Prison Sentence Experiment Vignette

The following vignette was presented to subjects in the treated version, with the wording in bold being the only difference in the treatment:

"We would now like to ask you to state what your decision might be in the following robbery case: Robbery cases are on the rise in Ghana. In the first quarter of 2018, 968 robbery cases were reported. Recently, a nearby food vendor was robbed. Crimes like this carry a maximum sentence of 15 years. Imagine you are asked to judge how much time this person should spend in prison for this crime. Here are the case details: A 28-year-old male, ***a small-scale miner*** *who lives in the community, was seen stealing all of the food vendor's earnings of the day (around 500 Cedis). He was unarmed, and this was his first criminal offense. Police officers arrested him shortly after the incident, but they were unable to recover the stolen cash. What sentence would you recommend? You can choose any number between 0 and 15."*

Script for Video Experiment

Note: sections in italics are not for translation

The following video will tell you about the dangers of using mercury in artisanal and small-scale goldmining.

First section of Minamata Disease video (applies only to treatment version of video):

In the early stages, people suffered from jerking muscle movements, unnatural bending of limbs, and a loss of speaking ability. Some victims suffered an agonizing death within a few weeks of getting the disease.

The video will show you some of the serious health effects of using mercury in the goldmining process, and it will tell you about the alternative technologies for concentrating the gold ore.

Animation sequence begins

In processing gold using mercury, when the amalgam is heated and burnt off, it releases harmful mercury vapor that pollutes the surroundings.

The mercury vapor is inhaled by miners and other people working on mining sites. Mercury vapor also affects people – including women and children – working and living close to mining sites long after the amalgam is burnt.

The harmful fumes return to the soil and waterbodies as methylmercury, which stores in ground and in fishes and pollutes the environment.

People eat the contaminated fish, and children and adults experience health symptoms of mercury poisoning such as Minamata Disease. Mercury poisoning also affects breastfed babies and the development of unborn babies in a woman's womb. Mercury poisoning can cause irreversible damage to the nervous system: some of the symptoms never go away again.

Second section of Minamata Disease video (applies only to treatment version of video):

Minamata disease was named after the place where it was first discovered. The disease is categorized in two different types: Minamata disease in children and adults, and foetal-type Minamata disease. Minamata disease in children and adults was caused by eating fish or shellfish contaminated with methylmercury.

Health symptoms of Minamata Disease:

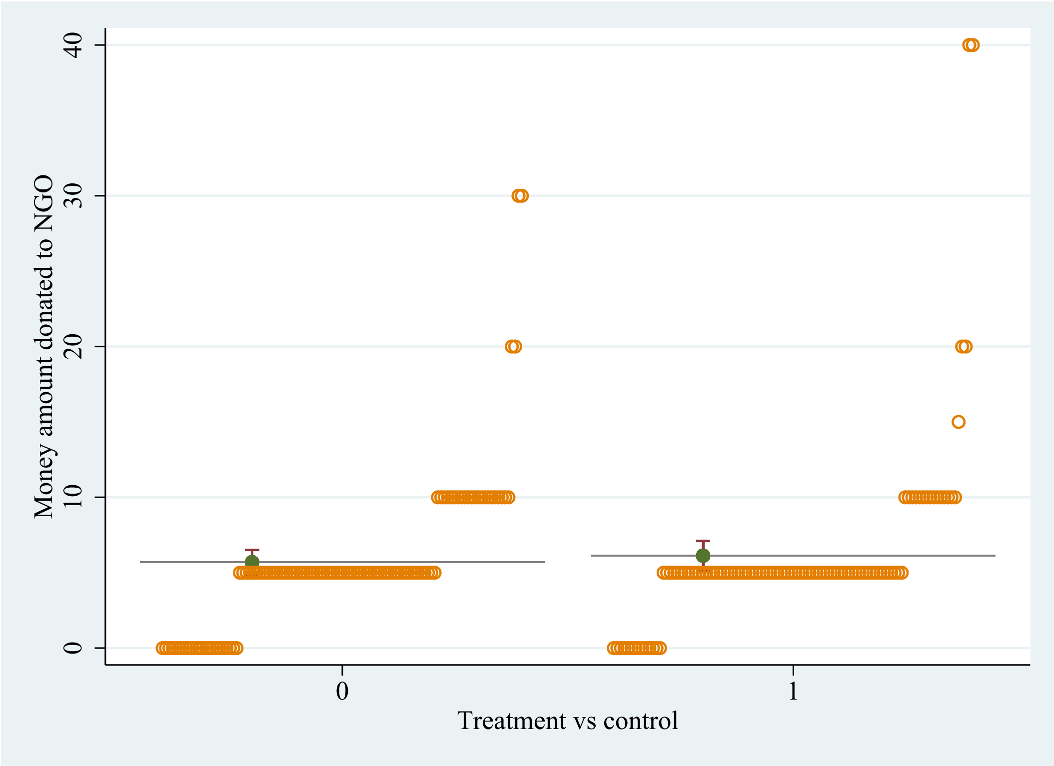
- Uncoordinated walking
- Numbness in limbs
- Brain damage in children
- Excessive salivation
- Hypertension
- Heart attack
- Renal failure
- Epilepsy

By switching to cleaner technology you can recover more gold, improve your own health and that of your community, and secure the future of our natural environment. You can switch to cleaner technology by adopting a suitable mineral processing workflow based on the characteristics of your ore. There is a cleaner alternative available to you: go for mercury-free now!

For further information, please contact Friends of the Nation.

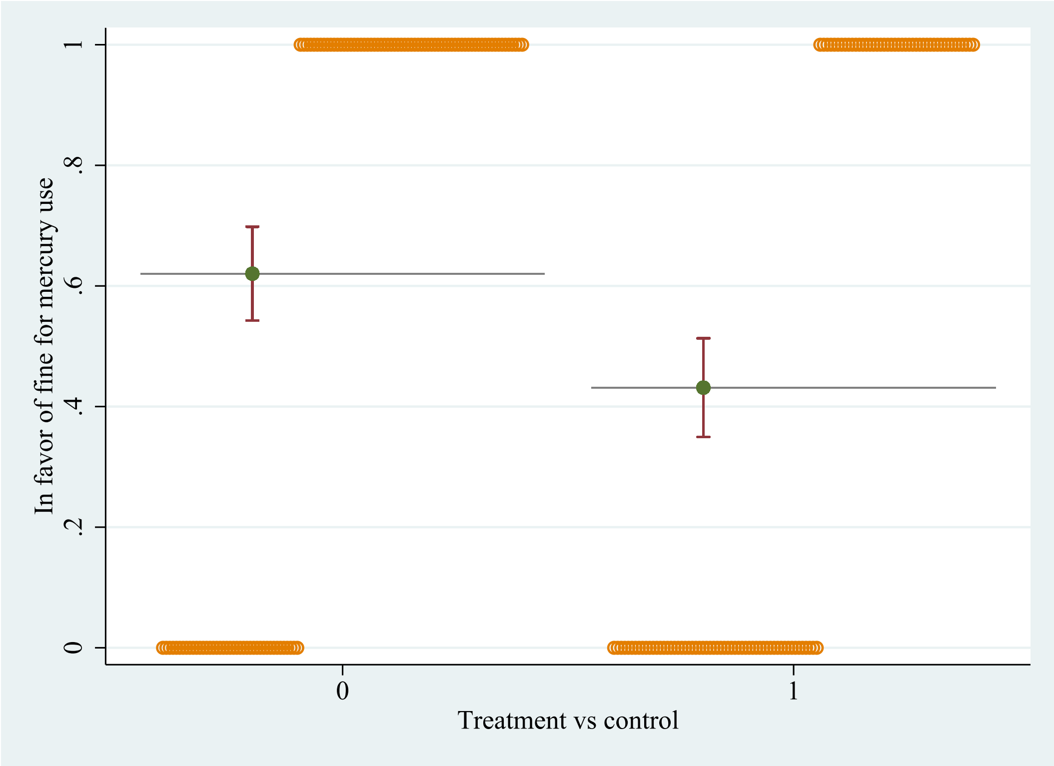
B.2 Graphical Analysis

Figure B.3: Treatment effect on donation amounts



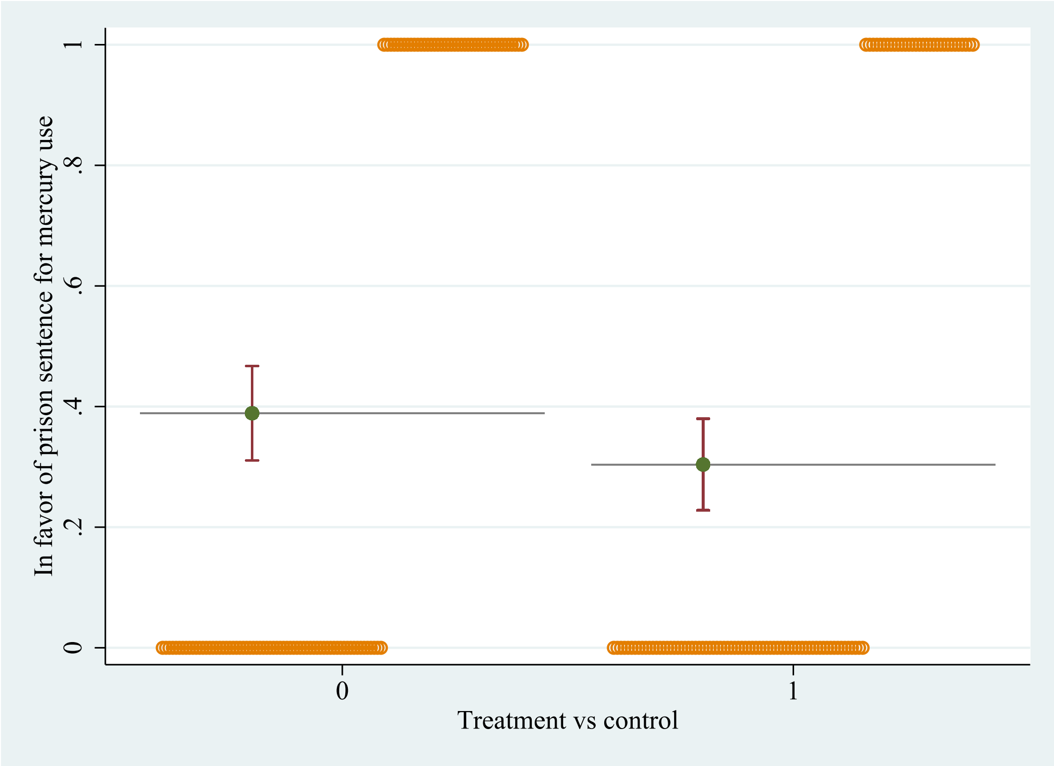
Note: Treatment and control groups are given on x-axis, and donation amounts in GHC on the y-axis. Yellow dots show frequency of responses, the solid lines show average response value, and the green dots show average effects on control (left) and treated (right) with 90% confidence intervals.

Figure B.4: Treatment effect on agreement to a fine for mercury use



Note: Treatment and control groups are given on x-axis, and agreement to fine on the y-axis. Yellow dots show frequency of responses, the solid lines show average response value, and the green dots show average effects on control (left) and treated (right) with 90% confidence intervals.

Figure B.5: Treatment effect on agreement to a prison sentence for mercury use



Note: Treatment and control groups are given on x-axis, and agreement to sentence on the y-axis. Yellow dots show frequency of responses, the solid lines show average response value, and the green dots show average effects on control (left) and treated (right) with 90% confidence intervals.

Table B.5: OLS Results of Treatment on Prison Years

	(1)	(2)
	Main effect	+ District Controls
treated_miner	0.222	0.181
	(0.417)	(0.419)
Adansi North		0
		(.)
Amenfi East		-1.776***
		(0.492)
Amenfi West		-0.593
		(0.598)
Aowin		-0.530
		(0.786)
Atiwa East		-1.115*
		(0.596)
Tongo		-0.999*
		(0.491)
Constant	1.450***	2.252***
	(0.282)	(0.549)
Observations	210	210
Pseudo R^2		

Standard errors in parentheses

* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Table B.1: Demographic Controls

VARIABLES	(1) change in attitude	(2) money donated	(3) in favor of fine	(4) fine dummy	(5) in favor of prison sentence	(6) prison dummy
treated_miner	-0.221**	0.707	-0.251	-0.0971**	0.104	0.0190
	(-2.410)	(1.166)	(-1.633)	(-2.215)	(0.647)	(0.295)
age	-0.00254	0.00231	0.0251**	0.0101**	0.0313**	0.00961**
	(-0.490)	(0.0441)	(2.494)	(2.706)	(2.809)	(2.553)
female	0.279**	1.765	0.409	0.102	-0.157	0.0162
	(2.729)	(1.628)	(1.286)	(1.169)	(-0.769)	(0.128)
education	0.104**	0.156	0.116*	0.0239	0.0993	0.0139
	(2.784)	(0.755)	(2.056)	(1.041)	(1.637)	(0.556)
UC or DA member	-0.0823	2.093*	0.0846	0.355***	0.346	0.307***
	(-0.629)	(1.906)	(0.267)	(3.411)	(1.387)	(3.295)
traditional authority	0.0458	4.709	0.433	0.243	-0.222	0.153
	(0.195)	(1.240)	(0.859)	(1.479)	(-0.467)	(0.645)
other leader	-0.212*	1.567	-0.387	0.0643	0.0935	0.0501
	(-1.778)	(0.885)	(-1.433)	(0.541)	(0.331)	(0.471)
yrs_in_district	-0.00577	-0.0535	-0.0178	-0.00754	-0.0139**	-0.00557
	(-0.951)	(-0.779)	(-1.346)	(-1.454)	(-2.624)	(-1.555)
Amenfi East	-0.127	-3.618*	-0.588	-0.240*	-0.639*	-0.316***
	(-0.784)	(-1.927)	(-1.408)	(-1.961)	(-2.048)	(-3.422)
Amenfi West	-0.242*	-2.470	0.227	-0.0257	-0.0763	-0.128
	(-1.753)	(-1.308)	(0.564)	(-0.260)	(-0.249)	(-1.536)
Aowin	-0.172	-0.281	0.00474	-0.000186	0.586	0.199
	(-1.434)	(-0.109)	(0.00615)	(-0.000610)	(0.782)	(0.658)
Atiwa East	-0.184	-4.197*	0.242	0.0139	0.218	0.121
	(-1.081)	(-2.032)	(0.510)	(0.108)	(0.592)	(1.013)
Tongo	-0.0111	-4.675**	-0.246	-0.127	-0.189	-0.108
	(-0.0665)	(-2.567)	(-0.638)	(-0.899)	(-0.631)	(-1.189)
Constant	0.115	7.521***	1.388***	0.216	0.460	0.00299
	(0.476)	(3.194)	(3.420)	(1.451)	(1.036)	(0.0198)
Observations	208	210	210	210	210	210
R-squared	0.117	0.174	0.124	0.197	0.200	0.222

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table B.2: Household Controls

VARIABLES	(1) change in attitude	(2) money donated	(3) in favor of fine	(4) fine dummy	(5) in favor of prison sentence	(6) prison dummy
treated_miner	-0.187**	0.459	-0.177	-0.104	0.0849	0.0157
	(-2.112)	(0.740)	(-0.979)	(-1.632)	(0.529)	(0.229)
living conditions	-0.0331	0.545	0.380***	0.0892**	0.205**	0.0621*
	(-0.716)	(1.003)	(2.852)	(2.284)	(2.634)	(1.842)
car or motorbike	-0.0679	1.687**	0.0143	0.0521	-0.0643	0.0251
	(-0.701)	(2.663)	(0.0686)	(0.648)	(-0.317)	(0.313)
farming or fishing in HH	-0.0695	0.996	-0.0258	0.0603	0.363***	0.177***
	(-0.889)	(1.523)	(-0.145)	(1.103)	(3.015)	(2.834)
livestock	0.275***	-0.732	0.341	0.112	-0.0346	0.0703
	(2.825)	(-0.785)	(1.268)	(1.137)	(-0.238)	(0.735)
Amenfi East	-0.145	-3.834*	-0.774**	-0.291**	-0.820**	-0.332***
	(-1.173)	(-2.045)	(-2.090)	(-2.408)	(-2.771)	(-3.747)
Amenfi West	-0.272	-2.690	0.249	-0.0122	-0.124	-0.102
	(-1.667)	(-1.521)	(0.597)	(-0.119)	(-0.500)	(-1.430)
Aowin	-0.131	-0.425	-0.0300	-0.00800	0.611	0.202
	(-1.068)	(-0.182)	(-0.0455)	(-0.0311)	(0.978)	(0.885)
Atiwa East	-0.0984	-3.925*	0.403	0.101	0.435	0.234**
	(-0.647)	(-1.924)	(0.926)	(0.783)	(1.289)	(2.190)
Tongo	-0.122	-4.364**	-0.340	-0.150	-0.508*	-0.164**
	(-0.885)	(-2.390)	(-0.958)	(-1.330)	(-1.900)	(-2.185)
Constant	0.319*	5.790***	1.287***	0.298*	1.077***	0.0773
	(1.739)	(4.503)	(2.905)	(2.006)	(3.414)	(0.643)
Observations	208	210	210	210	210	210
R-squared	0.072	0.161	0.162	0.151	0.177	0.202

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table B.3: Mercury Knowledge and Experience Controls

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	change in attitude	money donated	in favor of fine	fine dummy	in favor of prison sentence	prison dummy
treated_miner	-0.207**	0.455	-0.349**	-0.150**	-0.0225	-0.0295
	(-2.340)	(0.639)	(-2.213)	(-2.586)	(-0.136)	(-0.423)
time_ASGM	-0.00589	0.0540	0.0199	0.0111*	0.00815	0.00565
	(-0.527)	(1.025)	(1.074)	(1.829)	(0.466)	(0.994)
exposure to mercury	-0.0872	1.354	0.0532	-0.00315	0.184	0.102
	(-0.669)	(1.583)	(0.201)	(-0.0333)	(1.154)	(1.520)
aware of mercury pollution	0.455**	-3.308	0.141	-0.259	-0.123	-0.260
	(2.122)	(-1.036)	(0.190)	(-1.436)	(-0.180)	(-1.130)
knows ASGM mercury contamination	-0.462**	-2.793**	-0.530	0.0141	-0.0468	-0.0550
	(-2.215)	(-2.474)	(-1.079)	(0.141)	(-0.106)	(-0.391)
knows mercury cause muscle twitch	-0.00285	0.734	-0.598*	-0.0669	-0.0777	0.0363
	(-0.0270)	(1.201)	(-1.984)	(-0.692)	(-0.481)	(0.467)
Amenfi East	-0.319**	-3.307*	-0.730*	-0.296**	-0.638**	-0.300***
	(-2.145)	(-1.787)	(-1.896)	(-2.193)	(-2.708)	(-3.851)
Amenfi West	-0.381**	-2.365	0.173	-0.0388	-0.106	-0.120
	(-2.289)	(-1.273)	(0.411)	(-0.418)	(-0.411)	(-1.616)
Aowin	-0.208	0.00740	-0.134	-0.00101	0.615	0.205
	(-1.420)	(0.00300)	(-0.175)	(-0.00323)	(0.826)	(0.693)
Atiwa East	-0.222	-4.024*	0.367	0.0559	0.533	0.213*
	(-1.339)	(-1.907)	(0.825)	(0.441)	(1.564)	(1.983)
Tongo	-0.152	-3.957**	-0.482	-0.174	-0.386	-0.107
	(-0.964)	(-2.380)	(-1.402)	(-1.660)	(-1.550)	(-1.276)
Constant	0.415	12.12**	3.000***	0.849***	1.738***	0.532***
	(1.672)	(2.437)	(4.701)	(5.386)	(3.964)	(4.269)
Observations	206	207	207	207	207	207
R-squared	0.081	0.171	0.132	0.112	0.139	0.163

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table B.4: Health Controls

VARIABLES	(1) change in attitude	(2) money donated	(3) in favor of fine	(4) fine dummy	(5) in favor of prison sentence	(6) prison dummy
treated_miner	-0.228**	0.311	-0.267*	-0.128**	0.0485	-0.00792
	(-2.448)	(0.510)	(-2.033)	(-2.581)	(0.312)	(-0.117)
dizziness	0.184*	1.026	-0.170	-0.0299	-0.146	-0.0221
	(1.916)	(0.768)	(-0.633)	(-0.355)	(-0.571)	(-0.306)
hearing loss	-0.183	-0.879	0.109	0.0806	0.0488	0.0946
	(-0.820)	(-0.890)	(0.293)	(0.515)	(0.122)	(0.476)
memory loss	0.0142	0.136	0.225	0.199**	0.314*	0.228***
	(0.100)	(0.130)	(1.388)	(2.751)	(1.916)	(3.726)
frequent headaches	-0.0341	0.0209	-0.305	-0.0211	0.0870	0.111
	(-0.487)	(0.0194)	(-1.320)	(-0.278)	(0.539)	(1.567)
coughing	-0.0105	-2.162*	-0.391	-0.236*	-0.348*	-0.206**
	(-0.0751)	(-1.920)	(-1.491)	(-1.744)	(-1.742)	(-2.470)
muscle weakness	0.0685	0.0664	-0.908***	-0.229**	-0.319*	-0.182**
	(0.738)	(0.0866)	(-2.952)	(-2.799)	(-1.762)	(-2.644)
tremors	0.0522	-1.203*	0.0228	0.129*	-0.155	-0.00449
	(0.244)	(-1.986)	(0.108)	(1.756)	(-0.733)	(-0.0537)
Amenfi East	-0.154	-4.792**	-1.195***	-0.427***	-1.022***	-0.471***
	(-1.019)	(-2.238)	(-3.008)	(-4.332)	(-3.501)	(-6.212)
Amenfi West	-0.266	-2.398	-0.112	-0.105	-0.275	-0.178***
	(-1.582)	(-1.178)	(-0.323)	(-1.513)	(-1.034)	(-2.925)
Aowin	-0.0784	-0.168	-0.413	-0.0747	0.403	0.136
	(-0.545)	(-0.0622)	(-0.942)	(-0.403)	(0.658)	(0.635)
Atiwa East	-0.0739	-4.555*	0.0353	-0.0201	0.192	0.103
	(-0.438)	(-2.014)	(0.0728)	(-0.183)	(0.530)	(0.973)
Tongo	-0.0575	-4.459**	-0.689**	-0.232**	-0.617**	-0.216**
	(-0.396)	(-2.248)	(-2.193)	(-2.543)	(-2.132)	(-2.655)
Constant	0.166	8.920***	3.478***	0.859***	2.122***	0.501***
	(0.923)	(3.502)	(8.777)	(9.008)	(6.308)	(5.326)
Observations	208	210	210	210	210	210
R-squared	0.062	0.144	0.229	0.214	0.172	0.235

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

B.3 Survey, Instructions, and Experimental scripts

Generated by dkarapetyan, Jan 26, 2022 10:43
Questionnaire created by dkarapetyan, Jan 26, 2022 10:17
Last modified by dkarapetyan, Jan 26, 2022 10:42

Not shared with anyone

Sections: 4, Sub-sections: 13,
Questions: 178.
Questions with enabling conditions: 50
Questions with validation conditions:0
Rosters: 0
Variables: 1

Ghana Survey Miner Sample

SURVEY IDENTIFICATION INFORMATION
QUESTIONNAIRE DESCRIPTION

SURVEY IDENTIFICATION INFORMATION QUESTIONNAIRE DESCRIPTION

Basic information

Title Ghana Survey Miner Sample

Survey data information

Mode of Data Collection Face-to-Face

Survey information

Country Ghana

Year 2018

CONSENT

Start date and time	DATE: CURRENT TIME `enum_start`
VARIABLE `Concat(String.Format("{0:mH-d-s}", enum_start),"-",(Quest.IRnd()).ToString("0.00").Substring(2))`	STRING `i1`

STATIC TEXT

My name is [state your name].
I am working with Friends of the Nation, a Ghanaian non-governmental organization, on a research project for the University of East Anglia. I would like you to participate in a survey in order to understand environmental issues linked to artisanal and small-scale gold mining in Ghana. Before we begin, I would like to take a minute to explain why I am inviting you and what I will be doing with the information you provide to me. Please stop me at any time if you have any questions. You will have the opportunity of receiving GHS 40 at the end of this survey. After I've told you a bit more about my project, you can decide whether or not you would like to participate.
This research is being conducted by researchers from the University of East Anglia (UEA), United Kingdom, and the University of Oulu, Finland, in collaboration with Friends of the Nation (FoN). We will be interviewing people in different communities in Ghana. The researchers will use the information we collect in articles that might be published, as well as in academic presentations. No publications will include names or other identifiable information on participants. Your name will not be registered during this survey, so you will remain anonymous. We will only register the name and geographical location of your village.
Participation should take about 45 minutes, and is on a purely voluntary basis. You will be asked a series of questions about yourself and your household. There are no risks to you from answering these questions. The information we collect today is anonymous. We will not share any details from the survey about your family with anyone besides the research team. The responses will be securely stored on UEA computers.
The money you earn will be given to you by me in an envelope towards the end of the survey.
If at any time and for any reason, you would prefer not to answer a question, please feel free not to. If at any time you would like to stop participating, please tell me. We can take a break, or stop altogether. You will, however, not be able to receive a payout towards the end of this survey if you decide to stop before the final question. At the end of the survey, you must also sign a receipt form.
There are no correct or incorrect responses, so please express your opinions freely.
If you have any questions regarding this research or your rights as a research study participant, you may contact us at the phone number or email address on this card: Hand participant the business card showing the information.
Are you happy to continue?

Consent statement read?	SINGLE-SELECT `consent_read` 01 ○ Yes 02 ○ No
Oral consent provided?	SINGLE-SELECT `consent_oral` 01 ○ Yes 02 ○ No

ANONYMOUS ID NUMBER

STATIC TEXT

E `consent_oral==1 && consent_read==1 && IsAnswered(enum_start)`

Write this ID number on the blank envelope provided:
%i1%

Have you written the ID number on the blank envelope?	SINGLE-SELECT check_id 01 O Yes 02 O No

RESPONDENT

E `consent_oral==1 && consent_read==1 && IsAnswered(enum_start)`

Is this interview being held at a mining community where FoN is running their information workshops?	SINGLE-SELECT `mining_community` 01 ○ Yes, this interview is being held at a mining community. 02 ○ No, this interview is being held at a non-mining community.

RESPONDENT

PERSONAL DETAILS

STATIC TEXT

ENUMERATOR INSTRUCTIONS: DO NOT READ OUT "Don't Know" and "Prefer not to say" options.

STATIC TEXT

We first have some questions about you, your personal background, and your household.

What is your age (years)? I To be filled in numeric form only.	NUMERIC: INTEGER `age` _ SPECIAL VALUES -01 Don't Know -02 Prefer not to say
What is your gender?	SINGLE-SELECT `gender` 01 ○ Female 02 ○ Male 03 ○ Other 04 ○ Prefer not to say
Please specify what other gender you are. E `gender==3`	TEXT `gender_other` ....
What is your relation to the household head? I For example, if respondent is the brother of HH, then respondent will be the sibling of the HH. If respondent is the HH, then respondent will be the Head.	SINGLE-SELECT `hhrelationship` 01 ○ Head 02 ○ Spouse 03 ○ Parent 04 ○ Child 05 ○ Sibling 06 ○ Grandchild 07 ○ Other 08 ○ Prefer not to say
Please specify what the relation to head of household is. I Please type in the answer. E `hhrelationship==7`	TEXT `hhrelationship_other` ....

What language do you usually speak at home? I You may tick more than one language.	MULTI-SELECT `language` 01 ☐ Twi 02 ☐ Ewe 03 ☐ Dagbani 04 ☐ Dangme 05 ☐ Dagaare 06 ☐ Ga 07 ☐ Nzema 08 ☐ Kasem 09 ☐ Gonja 10 ☐ Fante 11 ☐ English 12 ☐ Other 13 ☐ Prefer not to say
Please specify what other language is usually spoken at home. I Please type in the answer. E `language.Contains(12)`	TEXT `language_other` ....
Can you read and write in English?	SINGLE-SELECT `rw_english` 01 ○ Yes, read and write 02 ○ Yes, read only 03 ○ No 04 ○ Prefer not to say
What is your religion?	SINGLE-SELECT `religion` 00 ○ None 01 ○ Christianity 02 ○ Islam 03 ○ Traditional religion 04 ○ Rastafarian 05 ○ Hinduism 06 ○ Afrikania Mission 07 ○ Buddhism 08 ○ Other 09 ○ Prefer not to say
Please specify what other religion is observed. I Please type in the answer. E `religion==8`	TEXT `religion_other` ....
What is your tribe?	SINGLE-SELECT `tribe` 01 ○ Akan 02 ○ Mole-Dagbon 03 ○ Ewe 04 ○ Ga-Dangme 05 ○ Gurma 06 ○ Guan 07 ○ Grusi 08 ○ Mande 09 ○ None 10 ○ Other 11 ○ Don't Know 12 ○ Prefer not to say

Please specify what the other tribe you belong to is. I Please type in the answer. E tribe==10	TEXT tribe_other ....
How many years have you lived in this district? I To be filled in numeric form only.	NUMERIC: DECIMAL yrs_in_district _. SPECIAL VALUES -01 Don't Know -02 Prefer not to say
What region did you previously live in? E yrs_in_district<2	SINGLE-SELECT prev_region 01 ○ Ashanti 02 ○ Brong-Ahafo 03 ○ Central Eastern 04 ○ Greater Accra 05 ○ Northern 06 ○ Upper East 07 ○ Upper West 08 ○ Volta 09 ○ Western 10 ○ Don't Know 11 ○ Prefer not to say
Why did you move? I You may tick more than one reason. E yrs_in_district<2	MULTI-SELECT reason_move 01 ☐ Work 02 ☐ School 03 ☐ Family 04 ☐ Other 05 ☐ Don't Know 06 ☐ Prefer not to say
What is the other reason for moving to this district? I Please type in the answer. E yrs_in_district<2 && reason_move.Contains(4)	TEXT reason_move_other ....
What is your own highest education level achieved?	SINGLE-SELECT education 00 ○ None 01 ○ Incomplete Primary School 02 ○ Completed Primary School 03 ○ Incomplete Secondary School (Junior or Senior/Technical) 04 ○ Completed Secondary School (Junior or Senior/Technical) 05 ○ Incomplete Tertiary 06 ○ Completed Tertiary 07 ○ Other 08 ○ Prefer not to say
Please specify what other highest education you have achieved. I Please type in the answer. E education==7	TEXT education_other ....

What is your main occupation?	MULTI-SELECT `occupation`
I You may tick up to 2 main occupations.	00 ☐ None 01 ☐ Farming 02 ☐ Fishing 03 ☐ Industrial mining 04 ☐ Artisanal or small-scale gold mining (galamsey) 05 ☐ Forestry 06 ☐ Wage job 07 ☐ Working for own, or family-owned, business 08 ☐ Student 09 ☐ Religious authority 10 ☐ Other 11 ☐ Prefer not to say
Please specify the other main occupation. I Please type in the answer. E `occupation.Contains(10)`	TEXT `occupation_other` ....

RESPONDENT

HOUSEHOLD DETAILS

How many adults (people over 18 years old) currently live in your household including you? (A household includes all people eating from the same cooking pot) I To be filled in numeric form only.	NUMERIC: INTEGER `hhsize` _ SPECIAL VALUES -01 Don't Know -02 Prefer not to say
What is the highest level of education achieved by anyone in your household (excluding yourself)?	SINGLE-SELECT `education_hh` 00 ○ None 01 ○ Incomplete Primary School 02 ○ Completed Primary School 03 ○ Incomplete Secondary School (Junior or Senior/Technical) 04 ○ Completed Secondary School (Junior or Senior/Technical) 05 ○ Incomplete Tertiary 06 ○ Completed Tertiary 07 ○ Other 08 ○ Prefer not to say
Please specify what the other highest level of education achieved by anyone in your household is. I Please type in the answer. E `education_hh==7`	TEXT `education_hh_other` ....

STATIC TEXT

Have you or anyone in your household been involved in the following occupations in the past TWO YEARS?

Farming	SINGLE-SELECT `farming_hh` 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Fishing	SINGLE-SELECT `fishing_hh` 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Industrial Mining	SINGLE-SELECT `industrial_mining_hh` 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Artisanal and small-scale gold mining (galamsey)	SINGLE-SELECT `ASGM_hh` 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Forestry	SINGLE-SELECT `forestry_hh` 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
In general, how would you describe your household's present living conditions?	SINGLE-SELECT `live_cond` 01 ○ Very bad 02 ○ Fairly bad 03 ○ Neither good nor bad 04 ○ Fairly good 05 ○ Very good 06 ○ Don't Know 07 ○ Prefer not to say
What is your main source of drinking water?	SINGLE-SELECT `dw_source` 01 ○ Household connection 02 ○ Borehole 03 ○ Protected dug well 04 ○ Unprotected well 05 ○ Protected spring 06 ○ Unprotected spring 07 ○ Public standpipe 08 ○ River or pond 09 ○ Tanker truck 10 ○ Bottled water 11 ○ Sachet water 12 ○ Other 13 ○ Don't Know 14 ○ Prefer not to say

Please specify the other source for drinking water. I Please type in the answer. E dw_source==12	TEXT dw_source_other ....
What is your main source of cooking water?	SINGLE-SELECT ck_source 01 ○ Household connection 02 ○ Borehole 03 ○ Protected dug well 04 ○ Unprotected well 05 ○ Protected spring 06 ○ Unprotected spring 07 ○ Public standpipe 08 ○ River or pond 09 ○ Tanker truck 10 ○ Bottled water 11 ○ Sachet water 12 ○ Other 13 ○ Don't Know 14 ○ Prefer not to say
Please specify the other source for cooking water. I Please type in the answer. E ck_source==12	TEXT ck_source_other ....
Do you, or someone else in your household, currently hold any of the following roles? I Tick all that apply.	MULTI-SELECT comm_role 01 ☐ Unit committee member 02 ☐ District Assembly member 03 ☐ Traditional Authority (Chief or Queen Mother) 04 ☐ Journalist 05 ☐ Local Community Leader (Examples: Religious authority, youth leader, women's group leader) 06 ☐ Community Activist 07 ☐ None 08 ☐ Prefer not to say
Do you, or someone else in your household, own any of the following? I Tick all that apply.	MULTI-SELECT assets 01 ☐ Car 02 ☐ Motorbike 03 ☐ TV 04 ☐ Radio 05 ☐ Mobile phone 06 ☐ Bicycle 07 ☐ None 08 ☐ Prefer not to say

STATIC TEXT

Have you, or anyone in your household, had any of the following health problems in the past TWELVE MONTHS?

Severe mood swings	SINGLE-SELECT 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say	mood_swings
Frequent dizziness	SINGLE-SELECT 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say	dizziness
Hearing Loss	SINGLE-SELECT 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say	hearing_loss
Memory Loss	SINGLE-SELECT 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say	memory_loss
Intense coughing and shortness of breath	SINGLE-SELECT 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say	coughing
Uncoordinated walking or movements	SINGLE-SELECT 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say	uncoordinated
Frequent headaches	SINGLE-SELECT 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say	headaches
Muscle twitching/Tremors (shakiness or trembling)	SINGLE-SELECT 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say	tremors
Muscle weakness	SINGLE-SELECT 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say	muscle

Birth defects of children born in household	SINGLE-SELECT `birth_defects` 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Please specify the birth defects seen in children born in the household I Please type in the answer. E `birth_defects==1`	TEXT `birth_defect` ....
Does anyone in your household including yourself own livestock?	SINGLE-SELECT `livestock` 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
What is the main water source for the livestock? I You may tick more than one main water source. E `livestock==1`	MULTI-SELECT `lw_source` 01 ☐ Household connection 02 ☐ Borehole 03 ☐ Protected dug well 04 ☐ Unprotected well 05 ☐ Protected spring 06 ☐ Unprotected spring 07 ☐ Public standpipe 08 ☐ River or pond 09 ☐ Tanker truck 10 ☐ Other 11 ☐ Don't Know 12 ☐ Prefer not to say
Please specify the other source of water for your livestock I Please type in the answer. E `lw_source.Contains(10)`	TEXT `lw_source_other` ....
What is the livestock mainly used for? E `livestock==1`	SINGLE-SELECT `ls_use` 01 ○ Household consumption 02 ○ Selling at the market 03 ○ Household consumption and selling at the market 04 ○ Don't Know 05 ○ Prefer not to say
Has the health of the livestock changed in the last TWO years? E `livestock==1`	SINGLE-SELECT `ls_healthchg` 01 ○ No, no change 02 ○ Yes, it has improved 03 ○ Yes, it has worsened 04 ○ Don't Know

What is the cause of the health change? I Tick all that apply. E ls_healthchg==2||ls_healthchg==3	MULTI-SELECT ls_healthchg_cause 01 ☐ Pests or disease 02 ☐ Drought 03 ☐ Floods 04 ☐ Heat 05 ☐ Pollution 06 ☐ No/less Pests or disease 07 ☐ No/less Drought 08 ☐ No/less floods 09 ☐ No/less pollution 10 ☐ Other 11 ☐ Don't Know 12 ☐ Prefer not to say
Please specify what the other cause of the health change is. I Please type in the answer. E ls_healthchg_cause.Contains(10)	TEXT ls_healthchg_cause_other ....

RESPONDENT

FARMER SECTION

E occupation.Contains(1) \|\| farming_hh==1

STATIC TEXT

Since you or someone else in your household has been involved in farming, we would now like to ask you some questions related to farming.

What is (or was) the total land farmed by your household (acres)? I To be filled in numeric form only.	NUMERIC: DECIMAL land_farmed _ . SPECIAL VALUES -01 Don't Know -02 Prefer not to say
How much of this farmed land is (or was) owned by your household (acres)? I To be filled in numeric form only.	NUMERIC: DECIMAL land_owned _ . SPECIAL VALUES -01 Don't Know -02 Prefer not to say
What is (or was) your main water source for irrigation?	SINGLE-SELECT irrigation_source 00 ○ No irrigation 01 ○ Public system 02 ○ Reservoir/pond 03 ○ Rivers 04 ○ Well water 05 ○ Rain water 06 ○ Other 07 ○ Don't Know 08 ○ Prefer not to say

Please specify the other source of irrigation water. I Please type in the answer. E irrigation_source==6	TEXT irrigation_source_other ....
What is (or was) the main crop grown by the household?	SINGLE-SELECT crops_grown 01 ○ Maize 02 ○ Cocoa 03 ○ Yams 04 ○ Millet 05 ○ Sorghum 06 ○ Cassava 07 ○ Oil palms 08 ○ Coconuts 09 ○ Sweet potato 10 ○ Other 11 ○ Don't Know 12 ○ Prefer not to say
Please specify what other main crop is grown. I Please type in the answer. E crops_grown==10	TEXT crops_grown_other ....
How many years has (or was) this crop grown (for) by the household? I To be filled in numeric form only.	NUMERIC: INTEGER crops_yrs _ SPECIAL VALUES -01 Don't Know -02 Prefer not to say
What is (or was) the crop mainly grown for?	SINGLE-SELECT crops_use 01 ○ Household consumption 02 ○ Selling at the market 03 ○ Household consumption and selling at the market 04 ○ Don't Know 05 ○ Prefer not to say
In the past TWO years, have you or anyone in your household noticed any changes in the quantity or quality of this crop?	SINGLE-SELECT crop_change 00 ○ No 01 ○ Quality or quantity increased 02 ○ Quality or quantity decreased 03 ○ Don't Know 04 ○ Prefer not to say
What was the cause of increased crop quality or quantity? I You may tick more than one cause. E crop_change==1	MULTI-SELECT crop_increase_cause 01 ☐ Better equipment 02 ☐ Fertilizer 03 ☐ Irrigation 04 ☐ Other 05 ☐ Don't Know 06 ☐ Prefer not to say

Please specify the other cause for an increase in crop quality or quantity. I Please type in the answer. E crop_increase_cause.Contains(4)	TEXT crop_increase_cause_other ....
What was the cause of decreased crop quality or quantity? I You may tick more than one cause. E crop_change==2	MULTI-SELECT crop_decrease_cause 01 ☐ Pests 02 ☐ Drought 03 ☐ Floods 04 ☐ Heat 05 ☐ Soil Pollution 06 ☐ Water Pollution 07 ☐ Air Pollution 08 ☐ Other 09 ☐ Don't Know 10 ☐ Prefer not to say
Please specify the other cause for a decrease in crop quality or quantity. I Please type in the answer. E crop_decrease_cause.Contains(8)	TEXT crop_decrease_cause_other ....

RESPONDENT

FISHERMEN SECTION

E occupation.Contains(2) || fishing_hh==1

STATIC TEXT

Since you or someone else in your household has been involved in fishing, we would now like to ask you some questions related to fishing.

How many canoes does (or did) your household use for fishing? I To be filled in numeric form only.	NUMERIC: INTEGER canoes_used _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ SPECIAL VALUES -01 Don't Know -02 Prefer not to say
Where do (or did) you or your household fish from? I Tick all that apply.	MULTI-SELECT fish_from 01 ☐ Estuary 02 ☐ River 03 ☐ Sea 04 ☐ Lake 05 ☐ Prefer not to say
What is (or was) the fish that you catch mainly used for?	SINGLE-SELECT fish_use 01 ○ Household consumption 02 ○ Selling at the market 03 ○ Household consumption and selling at the market 04 ○ Don't Know 05 ○ Prefer not to say
What is (or was) the main type of fish caught? I Please type in the answer.	TEXT fish_caught ....

In the past TWO years, have there been any changes in the quantity or quality of the main type of fish caught? I Tick all that apply.	MULTI-SELECT fish_chg 01 ☐ No, no change 02 ☐ Yes, quality improved 03 ☐ Yes, quantity increased 04 ☐ Yes, quality worsened 05 ☐ Yes, quantity decreased 06 ☐ Other 07 ☐ Don't Know 08 ☐ Prefer not to say
Please specify the other change seen in the fish caught. I Please type in the answer. E `fish_chg.Contains(6)`	TEXT fish_chg_other ....
What is (or was) the cause for the change in the fish caught? I Tick all that apply. E `fish_chg.ContainsAny(2,3,4,5,6)`	MULTI-SELECT fish_chg_cause 01 ☐ Pests or disease 02 ☐ Drought 03 ☐ Floods 04 ☐ Heat 05 ☐ Water pollution 06 ☐ No/less pests or disease 07 ☐ No/less drought 08 ☐ No/less floods 09 ☐ No/less heat 10 ☐ No/less water pollution 11 ☐ Other 12 ☐ Don't Know
Please specify the other reason for the change in fish caught. I Please type in the answer. E `fish_chg_cause.Contains(11)`	TEXT fish_chg_cause_other ....

RESPONDENT

MINER SECTION

E `occupation.Contains(4) || ASGM_hh==1 || industrial_mining_hh==1`

STATIC TEXT

Since you or someone else in your household has been involved in mining, we would now like to ask you some questions related to mining.

How long (in years) have (or did) you or your household member(s) work(ed) on a small-scale mining site?	NUMERIC: DECIMAL time_ASGM _ SPECIAL VALUES -01 Don't Know -02 Prefer not to say

STATIC TEXT

Are (or were) you or your household member(s) regularly exposed to the following?

Dust from mining activities	SINGLE-SELECT mining_dust 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Exhaust fumes from mining machinery	SINGLE-SELECT mining_exhaustfumes 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Mercury fumes	SINGLE-SELECT mining_mercuryfumes 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Direct contact with mercury	SINGLE-SELECT mining_mercurycontact 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
Have you or your household member(s) had exposure to any other dangers during mining activities?	SINGLE-SELECT mining_otherexposure 01 ○ Yes 02 ○ No
Please specify what other exposures you or your household member(s) have had during mining activities. E mining_otherexposure==1	TEXT mining_otherexposure_specify ....
Do (or did) you or your household member(s) wear protective gear during mining activities?	SINGLE-SELECT mining_gear 01 ○ No 02 ○ Yes 03 ○ Don't Know 04 ○ Prefer not to say
What type of protective gear do (or did) you or your household member(s) wear? I Tick all that apply. E mining_gear==2	MULTI-SELECT mining_gear_type 01 ☐ Gloves 02 ☐ Masks 03 ☐ Hard Hats 04 ☐ Goggles 05 ☐ Other 06 ☐ Don't Know 07 ☐ Prefer not to say
Please specify what other gear you or your household member(s) wear(or wore). I Please type in the answer. E mining_gear_type.Contains(5)	TEXT mining_geartype_other ....

STATIC TEXT

We have some questions for you about the natural and physical environment in which you live and work every day. Use laminated cards and let respondent know they will be answering the next few questions with this.

STATIC TEXT

In general,please answer how satisfied you are with the quality of the following natural resources.

The air that you BREATHE.	SINGLE-SELECT sat_air 01 ○ Very satisfied 02 ○ A bit satisfied 03 ○ Neither satisfied nor dissatisfied 04 ○ A bit dissatisfied 05 ○ Very dissatisfied 06 ○ Don't Know 07 ○ Prefer not to say
The water that you DRINK and COOK with?	SINGLE-SELECT satwater_drinkcook 01 ○ Very satisfied 02 ○ A bit satisfied 03 ○ Neither satisfied nor dissatisfied 04 ○ A bit dissatisfied 05 ○ Very dissatisfied 06 ○ Don't Know 07 ○ Prefer not to say
The river and/or sea water in your local community.	SINGLE-SELECT sat_river_sea 01 ○ Very satisfied 02 ○ A bit satisfied 03 ○ Neither satisfied nor dissatisfied 04 ○ A bit dissatisfied 05 ○ Very dissatisfied 06 ○ Don't Know 07 ○ Prefer not to say
The soil you grow your vegetables and crops in.	SINGLE-SELECT sat_soil 01 ○ Very satisfied 02 ○ A bit satisfied 03 ○ Neither satisfied nor dissatisfied 04 ○ A bit dissatisfied 05 ○ Very dissatisfied 06 ○ Not applicable 07 ○ Don't Know 08 ○ Prefer not to say

STATIC TEXT

Thinking about your experience in the past TWO years, would you say the quality of the following resources changed?

The quality of the air you BREATHE.	SINGLE-SELECT qual_air 01 ○ No, it's about the same 02 ○ Yes, it has improved 03 ○ Yes, it has worsened 04 ○ Don't Know 05 ○ Prefer not to say

The quality of the water you DRINK and COOK with.	SINGLE-SELECT qual_water_drink 01 ○ No, it's about the same 02 ○ Yes, it has improved 03 ○ Yes, it has worsened 04 ○ Don't Know 05 ○ Prefer not to say
The river and/or sea water in your local community.	SINGLE-SELECT qual_river_sea 01 ○ No, it's about the same 02 ○ Yes, it has improved 03 ○ Yes, it has worsened 04 ○ Don't Know 05 ○ Prefer not to say
The soil you grow your vegetables and crops in.	SINGLE-SELECT qual_soil 01 ○ No, it's about the same 02 ○ Yes, it has improved 03 ○ Yes, it has worsened 04 ○ Not Applicable 05 ○ Don't Know 06 ○ Prefer not to say

STATIC TEXT

Thinking of the local community in which you live, have you noticed any of the following problems with the natural surroundings in the past TWO years?

Air Pollution	SINGLE-SELECT air_poll 01 ○ No 02 ○ Yes 03 ○ Don't Know
Deforestation	SINGLE-SELECT deforestation 01 ○ No 02 ○ Yes 03 ○ Don't Know
Polluted drinking and cooking water	SINGLE-SELECT waterpoll_drinkcook 01 ○ No 02 ○ Yes 03 ○ Don't Know
Polluted river and/or sea water	SINGLE-SELECT pollwater_riversea 01 ○ No 02 ○ Yes 03 ○ Don't Know
Landslides	SINGLE-SELECT landslides 01 ○ No 02 ○ Yes 03 ○ Don't Know
Flooding	SINGLE-SELECT flooding 01 ○ No 02 ○ Yes 03 ○ Don't Know

Soil Erosion	SINGLE-SELECT soilerosion 01 ○ No 02 ○ Yes 03 ○ Don't Know
Plant or animal pests	SINGLE-SELECT pests 01 ○ No 02 ○ Yes 03 ○ Don't Know
Soil Pollution	SINGLE-SELECT poll_soil 01 ○ No 02 ○ Yes 03 ○ Don't Know
Drought	SINGLE-SELECT drought 01 ○ No 02 ○ Yes 03 ○ Don't Know
Have you noticed any other environmental problems?	SINGLE-SELECT envproblems_other 01 ○ Yes 02 ○ No 03 ○ Prefer not to say
Please specify what other environmental problems you have noticed in the past TWO years. I Please type in the answer. E envproblems_other==1	TEXT envproblems_other_specify ....
What do you think is the main cause of the environmental problems in your community? I You may tick up to 2 answers. E air_poll==2||deforestation==2||waterpoll_drinkcook==2||pollwater_riversea==2||landslides==2||flooding==2||soilerosion==2||pests==2||poll_soil==2||drought==2||envproblems_other==1	MULTI-SELECT envproblems_cause 01 ☐ Logging 02 ☐ Climate change 03 ☐ Use of pesticides/herbicides 04 ☐ Poor sanitation 05 ☐ Vehicle emmissions 06 ☐ Littering 07 ☐ Small-scale gold mining 08 ☐ Commercial mining 09 ☐ Overcrowding 10 ☐ Illegal building 11 ☐ Normal weather variation 12 ☐ Other 13 ☐ Don't Know
Please specify what other main cause of the environmental problems in your community is. I Please type in the answer. E envproblems_cause.Contains(12)	TEXT envproblems_cause_other ....

RESPONDENT

MERCURY

STATIC TEXT

We will now ask you some questions about mercury.

Have you heard or read about mercury pollution?	SINGLE-SELECT aware_mercury 01 ○ Yes 02 ○ No 03 ○ Prefer not to say

STATIC TEXT

Please state whether you think the following statements about mercury are true or false.

Mercury contamination can be caused by small-scale gold mining (galamsey).	SINGLE-SELECT mercury_ASGM 01 ○ True 02 ○ False 03 ○ Don't Know 04 ○ Prefer not to say
Mercury accumulates in fish.	SINGLE-SELECT mercury_accfish 01 ○ True 02 ○ False 03 ○ Don't Know 04 ○ Prefer not to say
Mercury stays in the natural environment for a long time.	SINGLE-SELECT mercury_natenv 01 ○ True 02 ○ False 03 ○ Don't Know 04 ○ Prefer not to say
Mercury enters a mother's breastmilk.	SINGLE-SELECT mercury_breastmilk 01 ○ True 02 ○ False 03 ○ Don't Know 04 ○ Prefer not to say
Mercury contamination can cause muscle twitching and tremors.	SINGLE-SELECT mercury_muscletwitch 01 ○ True 02 ○ False 03 ○ Don't Know 04 ○ Prefer not to say
Mercury contamination can cause birth defects.	SINGLE-SELECT mercury_birthdefect 01 ○ True 02 ○ False 03 ○ Don't Know 04 ○ Prefer not to say

RESPONDENT

GOLD MINING

STATIC TEXT

We will now ask you some questions about gold mining.

In the past TWELVE MONTHS, have you heard or read about artisanal or small-scale gold mining (galamsey) in the MEDIA?	SINGLE-SELECT `aware_gold` 01 ○ Not at all 02 ○ Some 03 ○ A lot 04 ○ Don't Know 05 ○ Prefer not to say
Artisanal or small-scale gold mining (galamsey) is a way of quickly and cheaply extracting gold. How much do you support this?	SINGLE-SELECT `support_gold` 01 ○ Strongly support it 02 ○ Somewhat support it 03 ○ Neither support nor oppose it 04 ○ Somewhat oppose it 05 ○ Strongly oppose it 06 ○ Don't Know 07 ○ Prefer not to say
Are you aware of any artisanal or small-scale gold mining (galamsey) in your local community? I If interviewing at a mining site, please tick yes without asking.	SINGLE-SELECT `aware_localcommunity` 01 ○ Yes 02 ○ No 03 ○ Don't Know 04 ○ Prefer not to say
What type of artisanal or small-scale gold mining (galamsey) is used in your area? I You may tick more than one answer.	MULTI-SELECT `type_gold` 01 □ Riverbed dredging 02 □ Underground mining 03 □ Open pits 04 □ Not Applicable 05 □ None 06 □ Other 07 □ Don't Know 08 □ Prefer not to say
Please specify the other type of artisanal or small-scale gold mining (galamsey) used I Please type in the answer. E `type_gold.Contains(6)`	TEXT `type_gold_other` ....
Is mercury used for artisanal or small-scale gold mining (galamsey) in your area?	SINGLE-SELECT `mercury_use` 01 ○ Yes 02 ○ No 04 ○ Don't Know/Not Applicable 05 ○ Prefer not to say

STATIC TEXT

Please choose how much you agree with the following statements about the effects of artisanal and small-scale gold mining (galamsey) on your LOCAL COMMUNITY. Use laminated cards and let respondent know they will be answering the next few questions with this.

It has provided compensation for land use.	SINGLE-SELECT `impact_gold_land_comm` 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know/Not Applicable 07 ○ Prefer not to say

It has provided infrustructure.	SINGLE-SELECT impact_gold_infra_comm 01 Strongly disagree 02 Disagree 03 Neither agree nor disagree 04 Agree 05 Strongly agree 06 Don't Know/Not Applicable 07 Prefer not to say
It has provided health care or education services.	SINGLE-SELECT impact_gold_healthedu_comm 01 Strongly disagree 02 Disagree 03 Neither agree nor disagree 04 Agree 05 Strongly agree 06 Don't Know/Not Applicable 07 Prefer not to say
It has contributed to increased income from non-mining activities.	SINGLE-SELECT impact_gold_income_comm 01 Strongly disagree 02 Disagree 03 Neither agree nor disagree 04 Agree 05 Strongly agree 06 Don't Know/Not Applicable 07 Prefer not to say
It has led to illegal land appropriation.	SINGLE-SELECT impact_gold_appr_comm 01 Strongly disagree 02 Disagree 03 Neither agree nor disagree 04 Agree 05 Strongly agree 06 Don't Know/Not Applicable 07 Prefer not to say
Mining related migration has caused social problems.	SINGLE-SELECT impact_gold_social_comm 01 Strongly disagree 02 Disagree 03 Neither agree nor disagree 04 Agree 05 Strongly agree 06 Don't Know/Not Applicable 07 Prefer not to say
It has led to pollution of the natural environment.	SINGLE-SELECT impact_gold_poll_comm 01 Strongly disagree 02 Disagree 03 Neither agree nor disagree 04 Agree 05 Strongly agree 06 Don't Know/Not Applicable 07 Prefer not to say

Overall, artisanal and small-scale gold mining (galamsey) has had a positive effect on the local community.	SINGLE-SELECT `impact_gold_overall_comm` 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know/Not Applicable 07 ○ Prefer not to say

STATIC TEXT

The government implemented a ban on artisanal and small-scale gold mining (galamsey) in all of Ghana from June 2017 to December 2018. How much do you agree with the following statements on that ban?

The ban improved the quality of the drinking and cooking water in my local community.	SINGLE-SELECT `ban_water` 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say
The ban improved the quality of the river and/or sea water in my local community.	SINGLE-SELECT `ban_riversea` 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say
The ban improved the quality of the soil for farming in my local community.	SINGLE-SELECT `ban_soil` 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say
The ban took away a source of livelihood from my household.	SINGLE-SELECT `ban_livelihood` 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say

The ban took away a source of livelihood for my local community.	SINGLE-SELECT ban_livelihood_comm 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say
Overall, I supported the ban on artisanal and small-scale gold mining.	SINGLE-SELECT ban_support 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say

RESPONDENT

PRISON SENTENCE DECISION

STATIC TEXT

E `$treatment > 0.5`

We would now like to ask you to state what your decision might be in the following robbery case:
Robbery cases are on the rise in Ghana. In the first quarter of 2018, 968 robbery cases were reported. Recently, a nearby food vendor was robbed. Crimes like this carry a maximum sentence of 15 years. Imagine you are asked to judge how much time this person should spend in prison for this crime.
Here are the case details:
A 28-year-old male, who lives in the community, was seen stealing all of the food vendor's earnings of the day (around 500 Cedis). He was unarmed, and this was his first criminal offense. Police officers arrested him shortly after the incident, but they were unable to recover the stolen cash.

What sentence would you recommend (in years)? You can choose any number between 0 and 15. I To be filled in numeric form only. E `$treatment > 0.5`	NUMERIC: DECIMAL prison_sentence _ .

STATIC TEXT

E `$treatment < 0.5`

We would now like to ask you to state what your decision might be in the following robbery case:
Robbery cases are on the rise in Ghana. In the first quarter of 2018, 968 robbery cases were reported. Recently, a nearby food vendor was robbed. Crimes like this carry a maximum sentence of 15 years. Imagine you are asked to judge how much time this person should spend in prison for this crime.
Here are the case details:
A 28-year-old male, a small-scale miner who lives in the community, was seen stealing all of the food vendor's earnings of the day (around 500 Cedis). He was unarmed, and this was his first criminal offense. Police officers arrested him shortly after the incident, but they were unable to recover the stolen cash.

What sentence would you recommend? You can choose any number between 0 and 15. I To be filled in numeric form only. E `$treatment < 0.5`	NUMERIC: INTEGER prison_sentence_miner _ .

RESPONDENT

ATTITUDES

STATIC TEXT

We would like to ask you about your views and attitudes towards different groups of people. How much do you agree with the following statements? Use laminated cards and let respondent know they will be answering the next few questions with this.

I am ready to undergo personal cost (in time and/or money) to help my family or household members.	SINGLE-SELECT `cost_hh` 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say
I am ready to undergo personal cost (in time and/or money) to help someone from my local community.	SINGLE-SELECT `cost_comm` 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say
I am ready to undergo personal cost (in time and/or money) to help someone outside of my local community who has helped me before.	SINGLE-SELECT `cost_xcomm` 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say
I am ready to undergo personal cost (in time and/or money) to help a stranger.	SINGLE-SELECT `cost_strang` 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say
My family and household members mostly try to be helpful.	SINGLE-SELECT `help_hh` 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know 07 ○ Prefer not to say

People from my local community mostly try to be helpful.	SINGLE-SELECT help_comm 01 Strongly disagree 02 Disagree 03 Neither agree nor disagree 04 Agree 05 Strongly agree 06 Don't Know 07 Prefer not to say
People of another community from mine mostly try to be helpful.	SINGLE-SELECT help_xcomm 01 Strongly disagree 02 Disagree 03 Neither agree nor disagree 04 Agree 05 Strongly agree 06 Don't Know 07 Prefer not to say
People of a different religion from mine mostly try to be helpful.	SINGLE-SELECT help_xrelig 01 Strongly disagree 02 Disagree 03 Neither agree nor disagree 04 Agree 05 Strongly agree 06 Don't Know 07 Prefer not to say
People in general mostly try to be helpful.	SINGLE-SELECT help_gen 01 Strongly disagree 02 Disagree 03 Neither agree nor disagree 04 Agree 05 Strongly agree 06 Don't Know 07 Prefer not to say
Small-scale gold miners mostly try to be helpful.	SINGLE-SELECT help_mine 01 Strongly disagree 02 Disagree 03 Neither agree nor disagree 04 Agree 05 Strongly agree 06 Don't Know 07 Prefer not to say
Farmers mostly try to be helpful.	SINGLE-SELECT help_farm 01 Strongly disagree 02 Disagree 03 Neither agree nor disagree 04 Agree 05 Strongly agree 06 Don't Know 07 Prefer not to say

Fishermen mostly try to be helpful.

SINGLE-SELECT help_fish

01 ○ Strongly disagree
02 ○ Disagree
03 ○ Neither agree nor disagree
04 ○ Agree
05 ○ Strongly agree
06 ○ Don't Know
07 ○ Prefer not to say

RESPONDENT

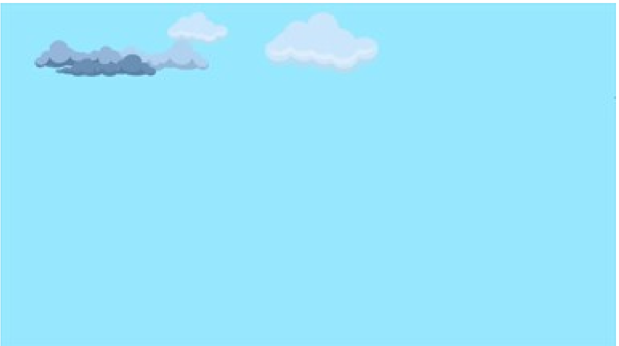
VIDEO

E mining_community==1

STATIC TEXT

E $video_treatment > 0.5

GOLD MINING VIDEO. We would now like you to watch a short video about gold mining. Please confirm whether you can hear or see the video by nodding your head after I play the video. After you are done watching the video, go ahead and return the tablet and headphones back to me.



Did respondent watch the video?

E $video_treatment > 0.5

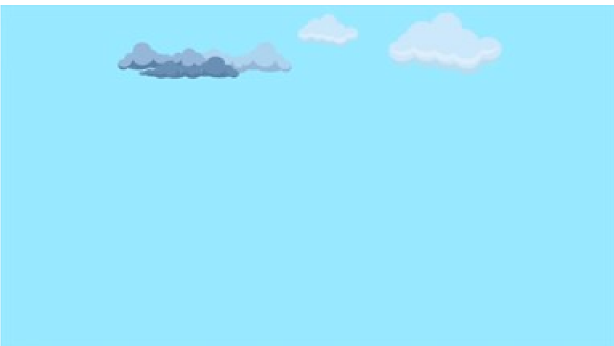
SINGLE-SELECT goldmining_video

01 ○ Yes
02 ○ No

STATIC TEXT

E $video_treatment < 0.5

A GOLD MINING VIDEO. We would now like you to watch a short video about gold mining. Please confirm whether you can hear or see the video by nodding your head after I play the video. After you are done watching the video, go ahead and return the tablet and headphones back to me.



Did respondent watch the video?

E $video_treatment < 0.5

SINGLE-SELECT minamata_video

01 ○ Yes
02 ○ No

RESPONDENT

DONATION

E mining_community==1

STATIC TEXT

E $donation_treatment > 0.5

Now we would like to invite you to participate in an activity involving real money. As a thank you for taking the time to answer our questions, we would like to compensate you with 40 Ghanaian Cedis. These are yours to keep. Hand over the funds – eight 5 Cedi bills in an envelope with a UEA sticker - to the respondent. Ask them to please sign the receipt form. If they don't sign, take money back.
As part of the study protocol, we have selected a Ghanaian non-profit organization as a designated charity called Wacam. Wacam is a community based human rights advocacy organization.
I would like to know whether you would be interested in donating any amount of your funds to Wacam.
This is how the donation will work. With me I have a sealed box containing donation envelopes.Show box and make sure this box states "Wacam" and does not have a sticker. This box will only be opened by a representative of Wacam. In this manner we will make sure that the donations all reach the organization.
We would now like to ask you whether you would like to donate any Cedi to Wacam. Here is an envelope with just the number of this survey so you will remain anonymous. This is only for us to keep track of the interviews. Show envelope.
Using only the notes we have provided, please put in any amount that you would like in the envelope and seal it. Then, please put the envelope directly into the donation box. Hand over envelope marked with the ID number to the individual.
I will turn around so I cannot see what you do. This way only the receiver will know how much was in the envelope. This box will be unsealed when we meet a representative from Wacam.
Do you have any questions?
Turn around. Please go ahead and make your decision, and let me know when you are finished.

Did respondent put an envelope in the donation box? E $donation_treatment > 0.5	SINGLE-SELECT donation_general 01 ○ Yes 02 ○ No

STATIC TEXT

E $donation_treatment > 0.5

I would like to ask you two addtional questions related to this exercise.

How well did you know Wacam before I came? E $donation_treatment > 0.5	SINGLE-SELECT know_wacam 01 ○ Very well 02 ○ A little bit 03 ○ Not at all 04 ○ Prefer not to say
You don't have to tell me, but out of interest, how much did you donate (in Cedi)? E $donation_treatment > 0.5	NUMERIC: INTEGER reported_donation _ SPECIAL VALUES -01 Prefer not to say

STATIC TEXT

E $donation_treatment < 0.5

Now we would like to invite you to participate in an activity involving real money. As a thank you for taking the time to answer our questions, we would like to compensate you with 40 Ghanaian Cedi. These are yours to keep. Hand over the funds – eight 5 Cedi bills in an envelope with a UEA sticker - to the respondent. Ask them to please sign the receipt form. If they don't sign, take money back.
As part of the study protocol, we have selected a Ghanaian non-profit organization as a designated charity called Wacam. Wacam is a community based human rights advocacy organization, with a focus on environmental problems, including the health impacts of mining activities.
I would like to know whether you would be interested in donating any amount of your funds to Wacam.
This is how the donation will work. With me I have a sealed box containing donation envelopes. Show box - make sure box states "Wacam" and has a green sticker. This box will only be opened by a representative of Wacam. In this manner we will make sure that the donations all reach the organization.
We would now like to ask you whether you would like to donate any Cedi to Wacam. Here is an envelope with just the number of this survey so you will remain anonymous. This is only for us to keep track of the interviews. Show envelope .
Using only the notes we have provided, please put in any amount that you would like in the envelope and seal it. Then, please put the envelope directly into the donation box. Hand over envelope marked with the ID number to the individual.
I will turn around so I cannot see what you do. This way only the receiver will know how much was in the envelope. This box will be unsealed when we meet a representative from Wacam.
Do you have any questions?
Turn around.Please go ahead and make your decision, and let me know when you are finished.

Did respondent put an envelope in the donation box? E `$donation_treatment < 0.5`	SINGLE-SELECT `donation_miner` 01 ○ Yes 02 ○ No

STATIC TEXT

E `$donation_treatment < 0.5`

I would like to ask you two addtional questions related to this exercise.

How well did you know Wacam before I came? E `$donation_treatment < 0.5`	SINGLE-SELECT `know_Wacam_miner` 01 ○ Very well 02 ○ A little bit 03 ○ Not at all 04 ○ Prefer not to say
You don't have to tell me, but out of interest, how much did you donate (in Cedi)? E `$donation_treatment < 0.5`	NUMERIC: INTEGER `reported_donation_miner` _ SPECIAL VALUES -01 Prefer not to say

RESPONDENT

FINAL QUESTIONS

E `mining_community==1`

STATIC TEXT

We have now come to the final section of the survey, and have a few last questions for you.

Overall, artisanal and small-scale gold mining (galamsey) has had a positive effect on the local community.	SINGLE-SELECT `impact_gold_overall_comm_diff` 01 ○ Strongly disagree 02 ○ Disagree 03 ○ Neither agree nor disagree 04 ○ Agree 05 ○ Strongly agree 06 ○ Don't Know/Not Applicable 07 ○ Prefer not to say

STATIC TEXT

The governments of some countries have introduced penalties for the use of mercury in small scale gold mining.

Would you support the introduction of a fine in Ghana for small scale miners who use mercury? If yes, how high should it be?	SINGLE-SELECT `mercury_fine` 01 ○ No, no fine. 02 ○ Yes, the fine should be 0 - 100 GHS 03 ○ Yes, the fine should be 100 - 500 GHS 04 ○ Yes, the fine should be 500 - 1000 GHS 05 ○ Yes, the fine should be 1,000 - 5,000 GHS 06 ○ Yes, the fine should be over 5,000 GHS 07 ○ Don't Know 08 ○ Prefer not to say

Would you support the introduction of a prison sentence in Ghana for small scale miners who use mercury? If yes, how severe should it be?	SINGLE-SELECT mercury_prisonsentence 01 ○ No, no prison sentence. 02 ○ Yes, 0 - 3 months 03 ○ Yes, 3 - 6 months 04 ○ Yes, 6 - 12 months 05 ○ Yes, over 12 months 06 ○ Don't Know 07 ○ Prefer not to say

STATIC TEXT

Thank you very much for your time. We are now finished with the survey.

ENUMERATOR

E consent_oral==1 && consent_read==1 && IsAnswered(enum_start)

Enumerator name	TEXT enum_name ....
Name of village or city	TEXT enum_vill ....
Name of district	TEXT enum_distr ....
Is the area mostly rural or mostly urban? I Note: Rural is in sparsely populated countryside area; urban is in well populated town/city.	SINGLE-SELECT enum_rururb 01 ○ Mostly rural 02 ○ Mostly urban
GPS coordinates	GPS enum_gps _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ N _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ W _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ A
Language in which the interview was conducted	SINGLE-SELECT enum_lang 01 ○ English 02 ○ Twi 03 ○ Ewe 04 ○ Dagbani 05 ○ Dangme 06 ○ Dagaare 07 ○ Ga 08 ○ Nzema 09 ○ Kasem 10 ○ Gonja 11 ○ Fante 12 ○ Other
Please specify the other language the interview was conducted in. E enum_lang==12	TEXT enum_lang_other ....
Did you narrate the video?	SINGLE-SELECT enum_narration 01 ○ Yes 02 ○ No
Do you personally know the respondent or anyone in their household?	SINGLE-SELECT enum_relation 01 ○ Yes 02 ○ No 03 ○ Prefer not to say

Material of house wall	MULTI-SELECT resp_house 01 ☐ Brick 02 ☐ Mud 03 ☐ Concrete 04 ☐ Corrugated iron 05 ☐ Tents 06 ☐ Thatched 07 ☐ Not applicable - mining site 08 ☐ Other 09 ☐ Don't know
Please specify the other material of house wall. E resp_house.Contains(8)	TEXT resp_house_other ....
Is the road surface of durable material?	SINGLE-SELECT resp_road 01 ○ Yes 02 ○ No 03 ○ Don't know
Road surface type E resp_road==1||resp_road==2	MULTI-SELECT resp_road_type 01 ☐ Gravel 02 ☐ Cobblestone 03 ☐ Asphalt 04 ☐ Concrete 05 ☐ Dirt 06 ☐ Other 07 ☐ Don't Know
Specify the other road surface type E resp_road_type.Contains(6)	TEXT resp_road_type_other ....
End time	DATE: CURRENT TIME enum_end ....

LEGEND

Legend and structure of information in this file

Name of section

Enabling condition for this section

Question title

Type of question, scope

Variable name

Answer options

SECTION 5: OTHER INCOME SOURCES

E `s4_other_sources_which.Contains(98)`

Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur?

I This refers to family relations
E `s3_time_other > 0`
V1 `s4_rel_leaders_which.Contains(98)`
M1 Can not be itself
V2 `(s3_time_other_breeding_advice <= (50 - s3_time_art_in-sem_advice)) ||s3_time_other_breeding_advice == 0`
M2 This person is not in the list
F `optioncode != s5_ignored_option_code`

MULTI-SELECT
SCOPE: PREFILLED

`s4_rel_leaders_other`

01 ☐ Community animal health workers
02 ☐ Private
03 ☐ Government
04 ☐ Livestock keepers association
05 ☐ NGO

And 5 other [13]

Additional information:
"I" — Question instruction
"E" — Enabling condition
"V1" — Validation condition №1
"M1" — Message for validation №1
"F" — Filter in Categorical questions

Link to full set in appendix

Breadcrumbs

Type or roster

Roster Title

CHAPTER 3 IDENTIFICATION /
Roster: LEADER RELATION DETAILS
generated by fixed list:

01 Ward Livestock Officer
02 Village Livestock Officer
99 Other (specify)

List items

Chapter 3 Appendix: Additional Figures, Tables, and Experimental Instructions

C.1 Screenshots of Experiment

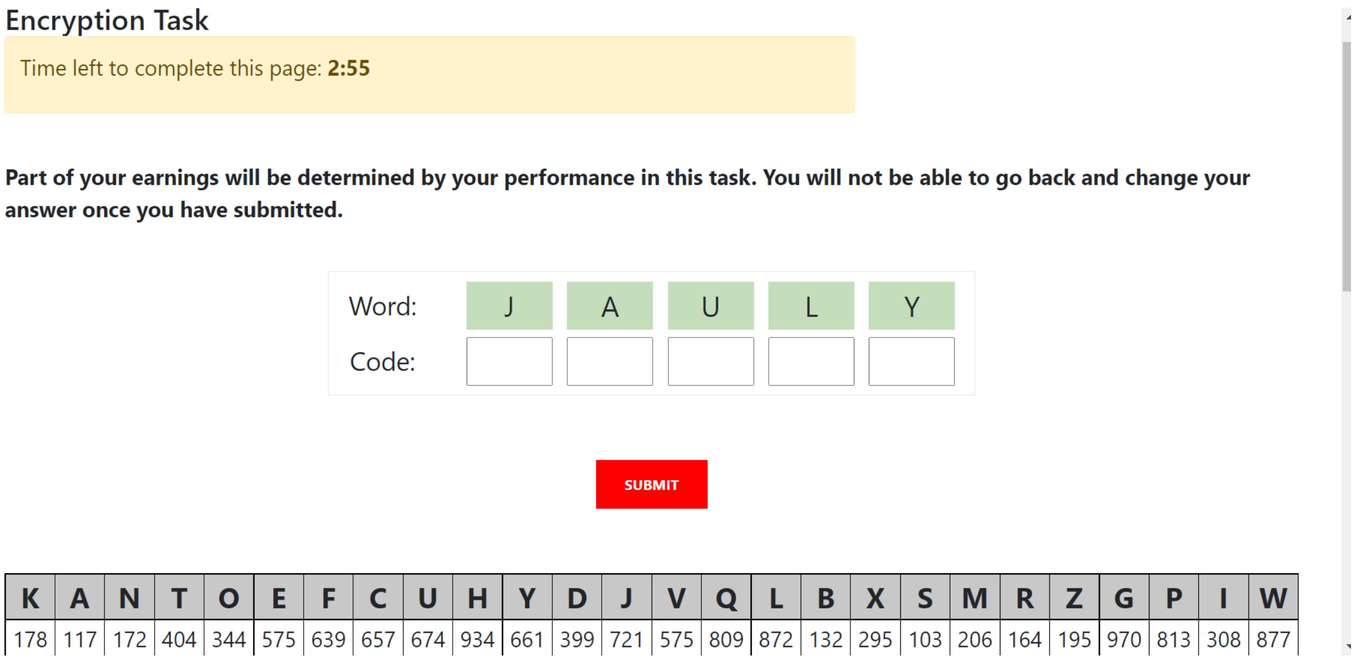


Figure C.1: Screenshot of Encryption Task

Decision Task Instructions

Thank you for completing the Encryption task. Recall that in that task, you were matched with a Blue player whose payoff scheme decreased your earnings. We now turn to the Decision task.

In this task, **you (as the Yellow player)** are matched with the **same Blue player** you were matched with for the Encryption task. You will now be given **20 tokens**, while your matched Blue player will be given **10 tokens**. However, you now have an opportunity to change their earnings.

You can transfer tokens to, or take away tokens from, your matched Blue player. You can transfer a **positive amount** in 1 token increments **up to a total of 20 tokens**, or you can take away/transfer a **negative amount** in 1 token increments **up to a total of 10 tokens**. Positive and negative transfer examples are provided on the next screen.

Next

Figure C.2: Screenshot of Decision Task Instructions

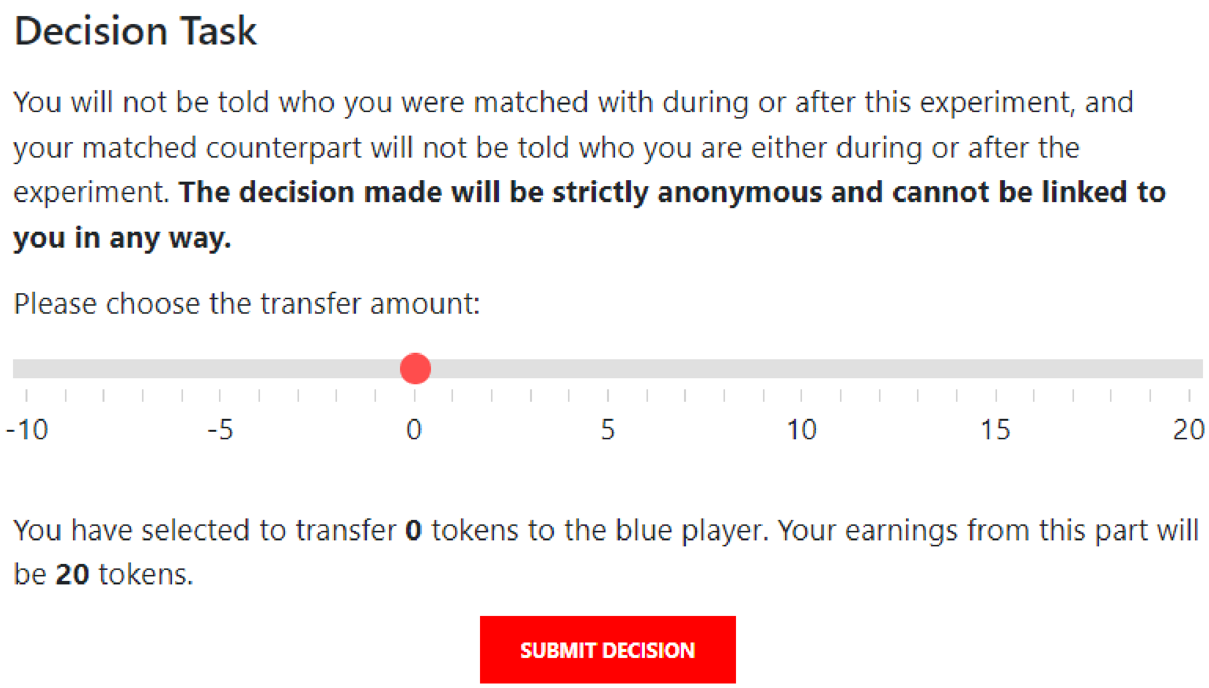
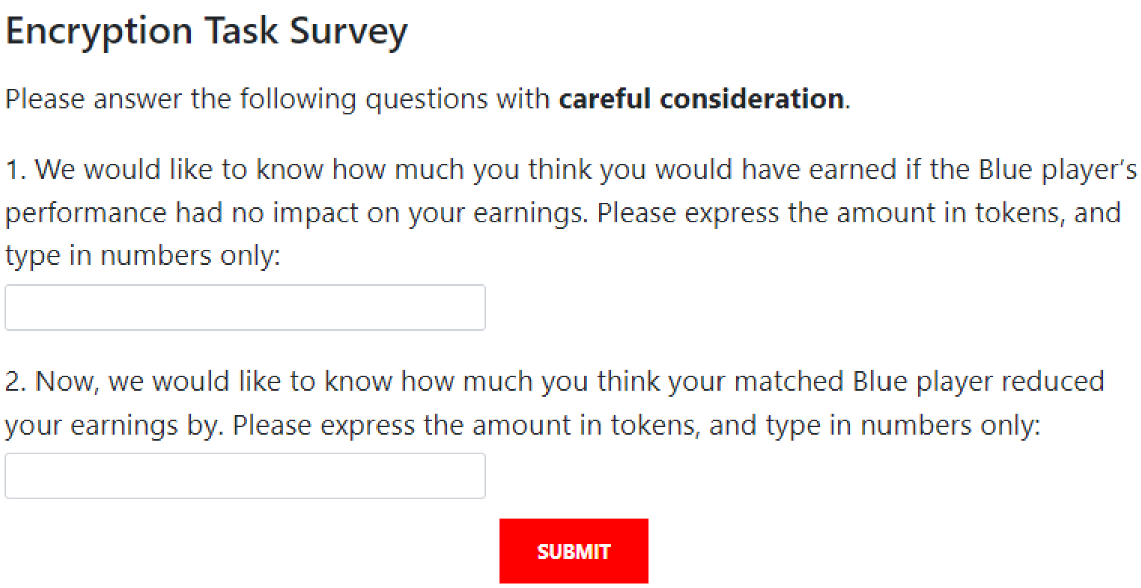


Figure C.3: Screenshot of Decision Task



Encryption Task Survey

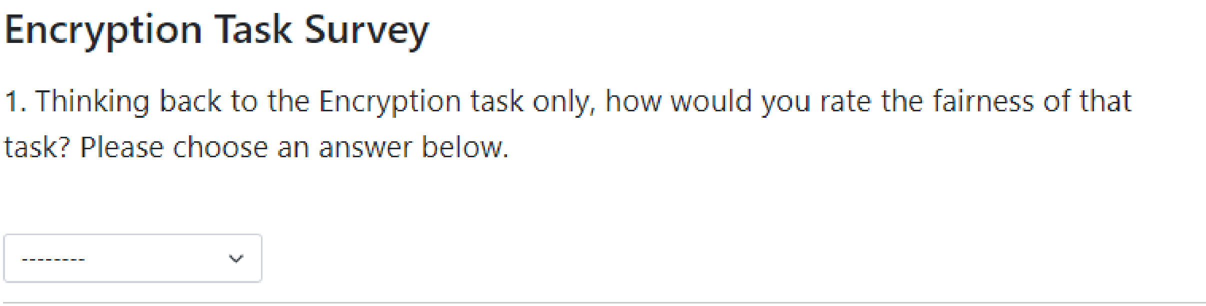
Please answer the following questions with **careful consideration**.

1. We would like to know how much you think you would have earned if the Blue player's performance had no impact on your earnings. Please express the amount in tokens, and type in numbers only:

2. Now, we would like to know how much you think your matched Blue player reduced your earnings by. Please express the amount in tokens, and type in numbers only:

SUBMIT

Figure C.4: Screenshot of Beliefs in Externality Amount



Encryption Task Survey

1. Thinking back to the Encryption task only, how would you rate the fairness of that task? Please choose an answer below.

Figure C.5: Screenshot of Fairness Survey

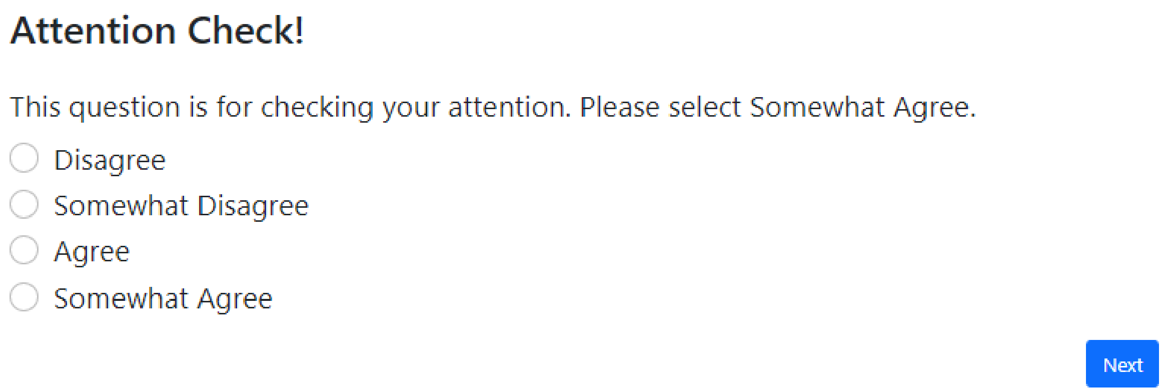


Figure C.6: Screenshot of Attention Check

Encryption Task Understanding Check

To check you have understood the instructions, please answer the following questions. You may go back and read the instructions as many times as you want. **If you answer any question incorrectly, the computer program will automatically take you back to the instructions screen.**

Your earnings will be higher the better your performance is.

- ◯ True
- ◯ False

You are randomly and anonymously paired with a Blue player.

- ◯ True
- ◯ False

How many tokens will you earn for each word you encrypt correctly?

- ◯ 1
- ◯ 2
- ◯ 4

How many tokens will you lose for each word the Blue player encrypted correctly?

- ◯ 1
- ◯ 2
- ◯ 4

Back   Next

Figure C.7: Screenshot of Understanding Check

C.2 Victim Role Statistics and Graphs

Table C.1: Summary Statistics by Treatment vs Control

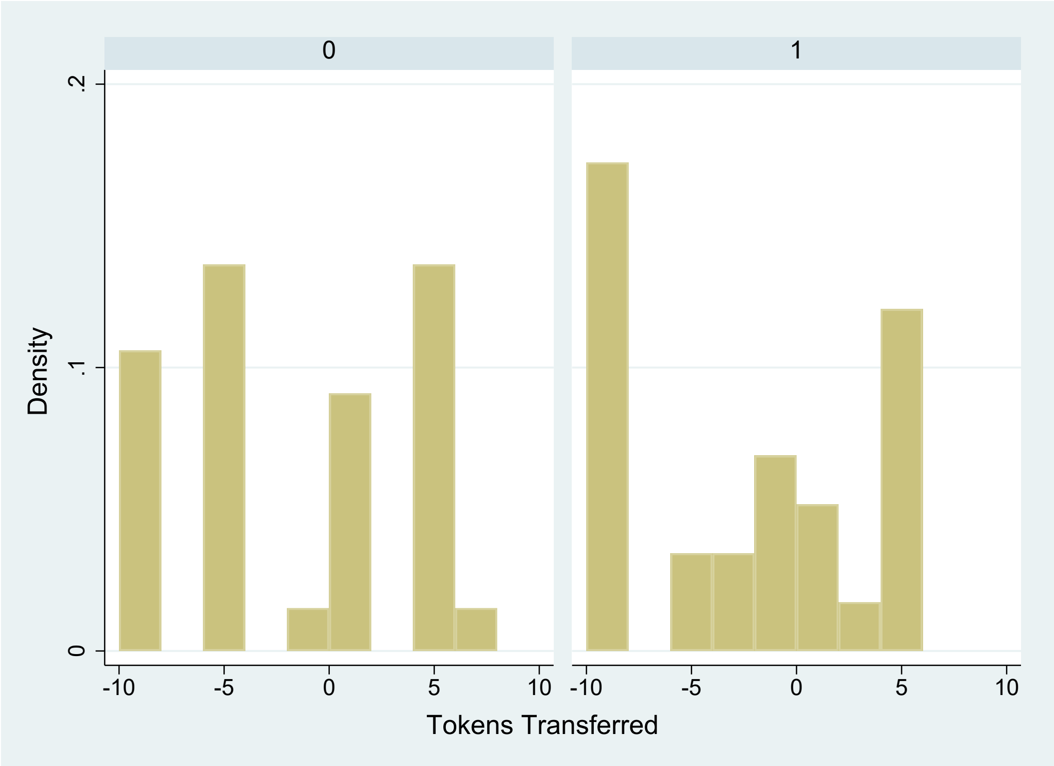
	Treated	Untreated	Difference	Std. Error
Tokens Transferred	-2.9310	-1.9394	0.9916	1.5072
age	28.5517	31.7188	3.1670	2.3354
female	0.4828	0.5152	0.0324	0.1293
employed	0.3103	0.4545	0.1442	0.1246
student	0.3103	0.1818	-0.1285	0.1096
externality amount	15.8276	15.7879	-0.0397	1.0966
net encryption earnings	17.3448	16.2121	-1.1327	2.4462
beliefs	12.5172	11.3030	-1.2142	1.8343
fairness	-0.4483	-0.0909	0.3574	0.3284
Observations	62			

* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Table C.2: Proportions Tests of Takers vs Givers

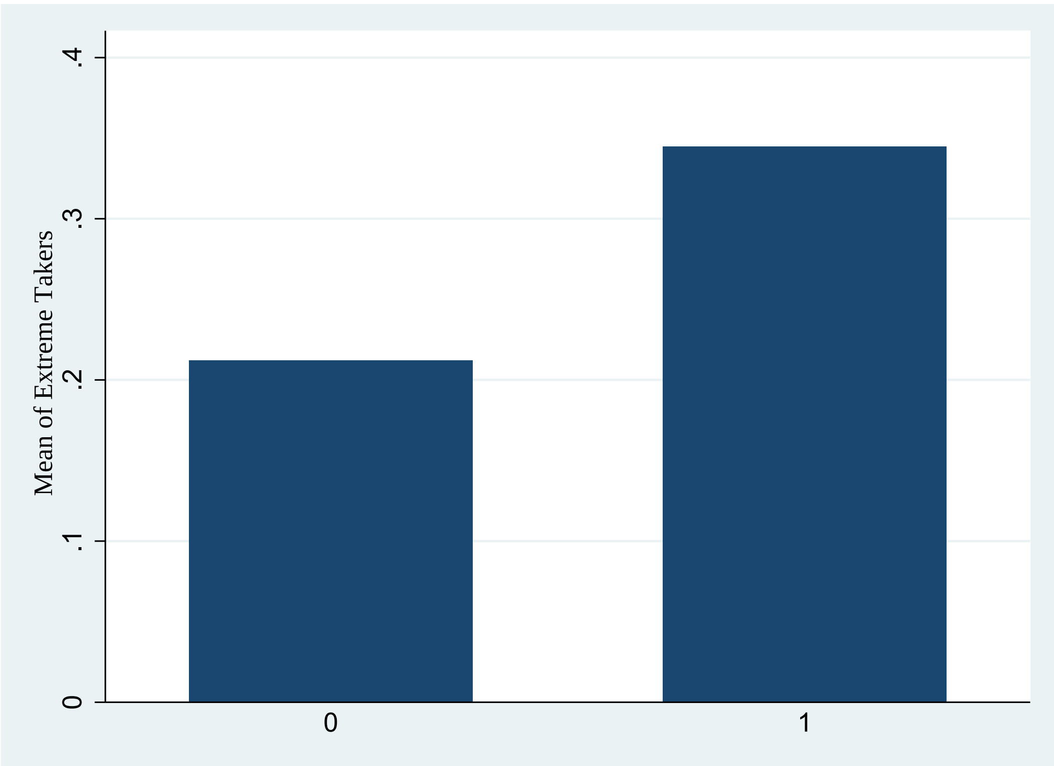
	Treated	Untreated	p-value
Takers	0.621	0.515	0.403
Givers	0.276	0.333	0.624
Extreme Takers	0.345	0.212	0.243
Extreme Givers	0.241	0.303	0.587
Observations	29	33	

Figure C.8: Token Transfer Amount by Treatment vs Control



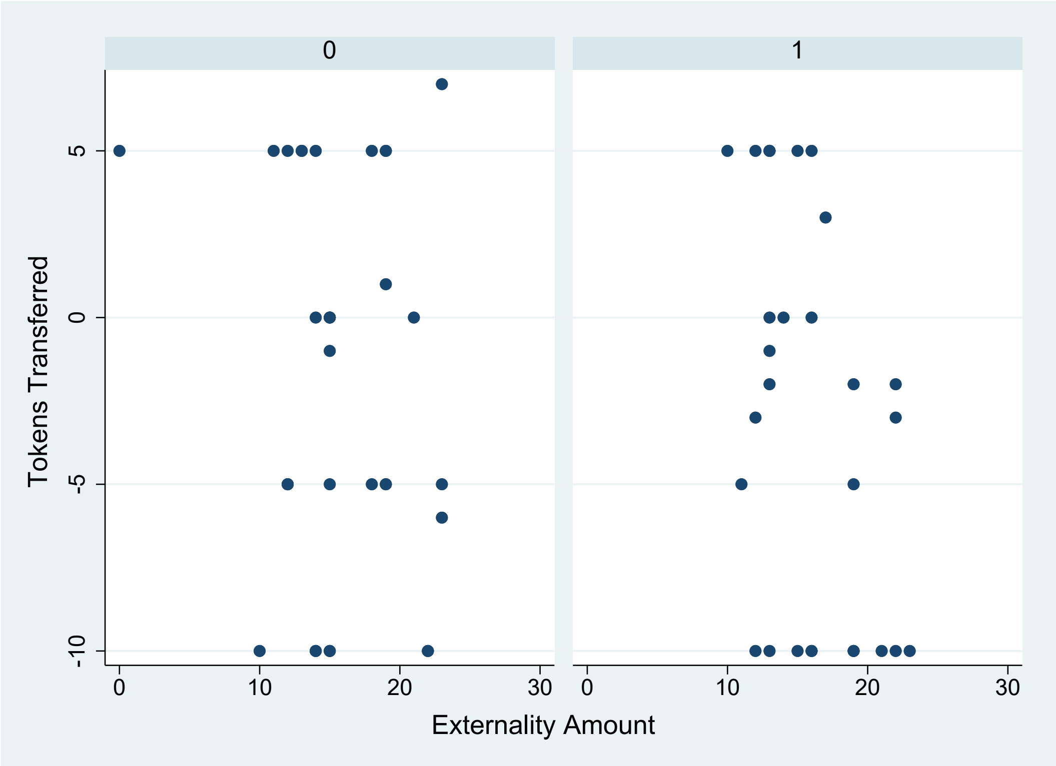
Note: Treatment and control groups are given on x-axis, and the percentage of victims transferring each amount are given on y-axis.

Figure C.9: Extreme Takers by Treatment vs Control



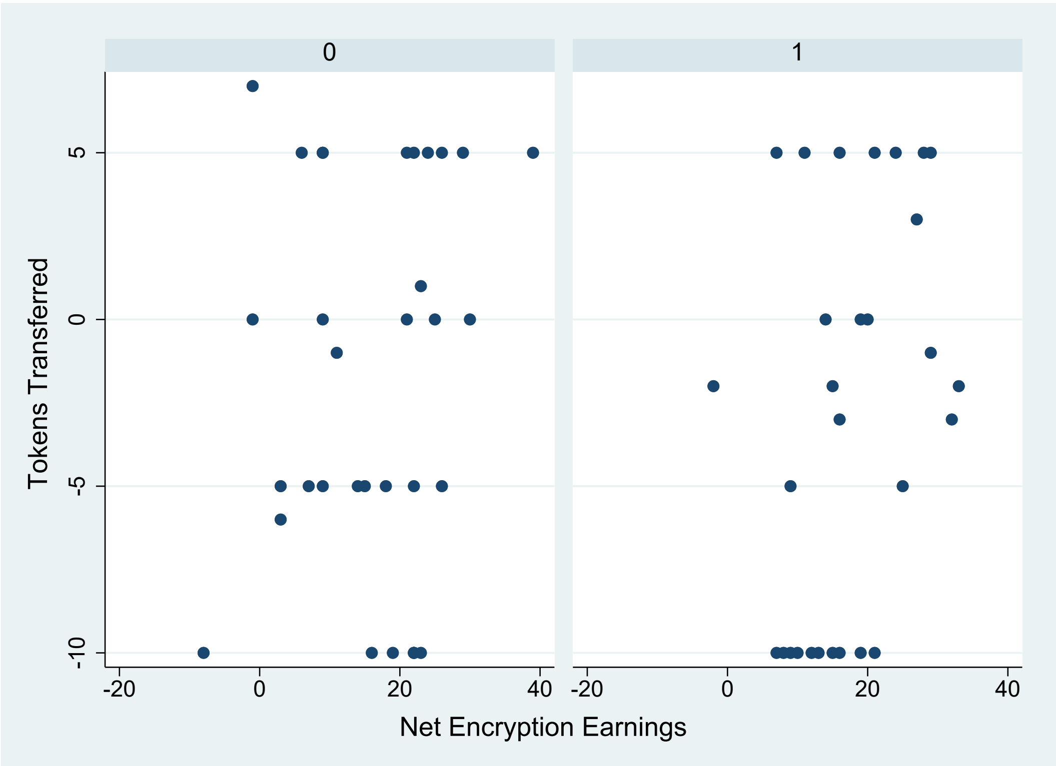
Note: Treatment and control groups are given on x-axis, and the proportion of extreme takers are given on y-axis.

Figure C.10: Externality Amount on Tokens Transferred by Treatment vs Control



Note: The externality amount imposed by treatment and control groups are given on x-axis, and the number of tokens transferred on y-axis.

Figure C.11: Net Encryption Earnings on Tokens Transferred by Treatment vs Control



Note: Victims' net earnings by treatment and control groups are given on x-axis, and the number of tokens transferred on y-axis.

Table C.3: OLS Regression Results of Negative Externality Beliefs on Money Amount Sent

	(1) Treated	(2) Untreated	(3) Treated	(4) Untreated
underestimate	-2.489	1.182		
	(2.348)	(2.177)		
overestimate			3.530	-0.740
			(2.456)	(2.403)
Constant	-1.300	-2.727	-3.905***	-1.760
	(1.901)	(1.778)	(1.290)	(1.183)
Observations	29	33	29	33
R^2	0.040	0.009	0.071	0.003

Standard errors in parentheses

* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Chapter 4 Appendix: Additional Tables and Full Experimental Instructions

D.1 Additional Analysis

Table D.1: Oprobit Regression results of Choice Treatment*Externality Imposed on Token Tranfer Categories

Dependent Variable: Token Transfer Categories	(1) Main effect	(2) + Basic controls	(3) + All controls
Willful Choice Treatment	0.424*	0.453*	0.438
	(0.255)	(0.274)	(0.281)
Externality Imposed	-0.434***	-0.231	-0.212
	(0.140)	(0.239)	(0.255)
Willful Choice Treatment × Externality Imposed	-0.341*	-0.371	-0.380
	(0.203)	(0.241)	(0.252)
Age		0.0106	0.0109
		(0.00755)	(0.00749)
Female		0.111	0.156
		(0.193)	(0.199)
Student		-0.154	-0.146
		(0.141)	(0.144)
Externality Amount		-0.0145	-0.00385
		(0.0154)	(0.0158)
Fairness of Experiment			0.0715**
			(0.0362)
Belief Discrepancy			-0.00753***
			(0.00266)
/			
cut1	-0.263*	0.0961	0.208
	(0.138)	(0.346)	(0.350)
cut2	0.349**	0.713**	0.828**
	(0.142)	(0.338)	(0.338)
Observations	300	291	291
R^2			

Standard errors in parentheses

* $p < 0.1$, ** $p < .05$, *** $p < 0.01$

Notes: Willful Choice is a dummy variable equal to one if a victim was randomly assigned into the treated version of the experiment, where the perpetrator was able to willfully choose whether a negative externality would be prevented or imposed. Externality Imposed is a dummy variable equal to one if a negative externality was imposed on a victim, whether or not it was randomly assigned or willfully imposed. The interaction effect between Willful Choice and Externality Imposed is therefore needed in order to determine the treatment effects both with and without the negative externality imposed. Column (1) only includes the interaction effect, column (2) also includes the basic control variables, and column (3) includes additional control variables.

D.2 Perpetrator Statistics

Table D.2: Perpetrator Summary Statistics

	Mean	SD	Min	Max
age	25.09	7.71	18.00	54.00
female	0.46	0.50	0.00	1.00
externality_choice	0.56	0.50	0.00	1.00
forced externality performance (round 1 or 2)	15.49	4.86	0.00	26.00
forced no externality performance(round 1 or 2)	15.66	4.57	0.00	23.00
choice performance (round 3)	16.32	5.60	0.00	27.00

Table D.3: Perpetrator Performance By Round

	mean	min	max	count
Practice Round 1	1.590164	0	3	61
Practice Round 2	1.819672	0	4	61
Encryption Task Round 1	15.2623	0	23	61
Encryption Task Round 2	15.59016	0	26	61
Encryption Rask Round 3	16.29508	0	27	61

D.3 Full Experimental Instructions

BLUE

Welcome!

Thank you for agreeing to take part in this Prolific study. The study is being run by researchers at the University of East Anglia. Any data which is collected about your participation in this study will be anonymous, and will not be linked to you in any way. If you have any concerns at any time during the study, or would like to withdraw from the study, you may contact the lead researcher Deanna Karapetyan, by sending an email to d.karapetyan@uea.ac.uk.

Please note that if you withdraw from the study you will not receive payment for your participation. The study you are about to take part in has received approval from the School of Economics Research Ethics Committee at the University of East Anglia. If you would like to make a formal complaint please contact the chair of the Research Ethics Committee, Dr. David Hugh-Jones (d.hugh-jones@uea.ac.uk).

Before we begin, please enter your Prolific ID.

Your Prolific ID:

Next

Consent

Please review the following information, and state whether you would like to provide your consent to continue below. If you do not provide consent, please return to Prolific and mark this study as 'Returned'.

- I am at least 18 years old.

- My participation in this study is voluntary, and I will have the opportunity to earn additional money based on my decisions during this study.

- I understand that data generated by my participation in this study will be analysed by researchers at the University of East Anglia, and will be stored in accordance with the University of East Anglia data protection guidelines.

- Anonymized data generated by my participation in this study may be used for research purposes, which includes being shared with other researchers and appearing in future publications.

- The researcher will collect my anonymized demographic information which I have previously provided to Prolific, and which will be linked to data generated by my participation in this study.

If you consent to participation, please choose "I consent" below.

Consent

Next

Overview of Study

Here is a brief overview of the study.

<u>What will I have to do?</u>
This study will be divided into **three parts**. Each part will consist of one task.

You will first participate in Part 1. After you have completed Part 1, the computer program will prompt you to start Part 2. And, once you have completed Part 2, the computer program will then prompt you to move on to Part 3.

Each part should take an average of 10 minutes to complete, and the whole study should take an average of 30 minutes to complete in total.

Next

Overview of Study

<u>How much payment will I receive for my participation?</u>
You will receive £2.50 as the participation fee for completing the study.

You will also have the opportunity to earn additional money.

In this study, we will be using a currency called "tokens". These tokens will determine your **additional earnings**, which will depend on your performance and the decisions you make. For each token you earn, you will be paid £0.05.

At the end of the study, the computer program will **randomly pick Part 1, Part 2, or Part 3** to determine your additional earnings. Since nobody knows which part will be selected for payment, you should pay close attention to all three parts of the study as your decisions may determine your earnings.

Your total payment from this study will be equal to the participation fee plus your additional earnings.

Let's say, for example, that the computer program chose the additional earnings from Part 2. If you earned 100 tokens in total for the task in Part 2, you would be paid £5 (100*£0.05) in additional earnings. Your total payment would therefore be £8.75 (£3.75 + £5).

Next

Overview of Study

<u>How will payment be made?</u>

You will receive the participation fee of £2.50 plus your additional earnings **only if you complete all parts** of the study.

Once you complete the study, you will receive the participation fee payment first.

Once all participants complete the study, your additional earnings payment will be made via the Prolific platform within a maximum of 21 days from the conclusion of the study.

<u>Please note!</u>

There will be several **Attention Check** questions throughout this study meant to test whether you are paying attention.

If you fail to correctly complete two or more of these Attention Check questions, you may not be paid.

Finally, please note that this study **does not employ deception**. This is regulated by the researchers' institutional ethics committees.

Next

Attention Check!

This question is for checking your attention. Please select Agree.

- Disagree
- Agree
- Somewhat Agree
- Somewhat Disagree

Next

Part 1: General Instructions

You will now begin Part 1 of the study.

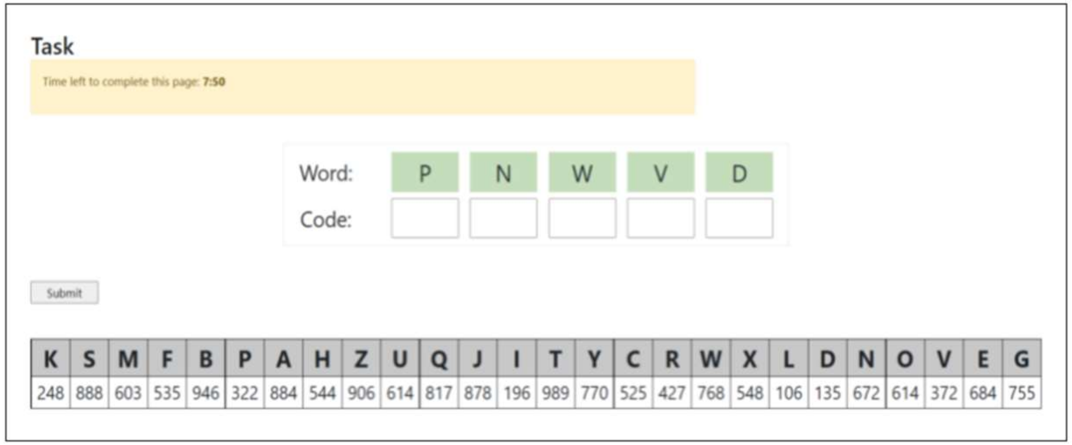
Your task in Part 1 is an Encryption task, where you will encrypt a sequence of 5-letters ("words") into numbers. The Encryption task lasts **6 minutes**.

Instructions will be provided on the next screen. You will have a chance to practice the task for 2 rounds, with each round lasting 1 minute. **During the practice, you will not earn any additional money.**

Next

Encryption Task Instructions

In this task, you will be shown a **sequence of 5-letters (a "word")** that you will encode into 5 numbers. As you can see in the screenshot below, the first letter in the word is "P". The letter "P" corresponds to the number "322" in the encoding table at the bottom of the screen. To complete this letter correctly, you should put the number "322" into the box below the letter "P", either by **typing the number or using copy-paste**. You need to complete encoding all 5 letters correctly to have a correct answer.



After you finish encoding a word, the computer program will prompt you with another word to encode. You are free to encode as many words as you can.

You will now have a chance to practice the task in 2 different rounds, with each round lasting 1 minute.

The practice rounds will notify you whenever errors are made, while the earnings round will not.

Next

Encryption Task Practice

Time left to complete this page: **0:58**

Once you are done encrypting a word, please either click the **SUBMIT** button or **tab from the last letter and press enter** on your keyboard. Please get accustomed with the task during **1 minute**.

Word:	X	D	G	N	K
Code:					

SUBMIT

I	H	Y	W	M	J	X	C	T	S	F	B	G	U	E	Z	D	K	O	L	P	Q	V	R	A	N
925	735	878	607	434	582	674	294	562	832	612	623	859	625	681	699	725	864	659	938	207	156	182	259	940	330

Encryption Task Practice Results

Thank you for completing the Encryption task practice. You correctly encrypted 0 word(s) in this round.

You will now practice the task again for 1 minute.

Next

Encryption Task Practice

Time left to complete this page: **0:58**

Once you are done encrypting a word, please either click the **SUBMIT** button or **tab from the last letter and press enter** on your keyboard. Please get accustomed with the task during **1 minute**.

Word:	N	H	R	M	U
Code:					

SUBMIT

L	C	M	Q	Z	R	H	Y	W	J	G	P	V	O	F	A	I	X	E	S	D	N	K	B	U	T
561	611	369	986	872	993	305	326	224	171	978	434	469	636	937	397	931	500	782	315	967	429	282	752	402	221

Encryption Task Practice Results

Thank you for completing the Encryption task practice. You correctly encrypted 0 word(s) in this round.

Next

Attention Check!

This question is for checking your attention. Please select Disagree.

- ◯ Disagree
- ◯ Somewhat Disagree
- ◯ Agree
- ◯ Somewhat Agree

Next

Encryption Task Player Roles

In this study, individuals participate in pairs. This means that you will be paired with another individual participating in the study, and that your decisions may impact their earnings, while their decisions may impact your earnings.

Participants have different roles, and to differentiate between them, we have labeled them as the "Blue player" and the "Yellow player".

- You have been assigned to be the **Blue player**.

- Your counterpart Yellow player will be randomly matched with you for each part of the study. Once you complete Part 1, you will be re-matched with **another** Yellow player for Part 2. And, once you complete Part 2, you will again be re-matched with another Yellow player for Part 3.

Next

Part 1: Encryption Task Earnings Instructions

Both Blue and Yellow players engage in the Encryption task for their additional earnings. You are free to earn as many tokens as you can during the 6-minute Encryption task. You will earn nothing for any word encrypted incorrectly. Note that both Yellow and Blue players face the same conditions in this task, except for the payoff amount.

For each word encrypted correctly by **you (the Blue player)**, you will earn **1.5 tokens**. But, for each word encrypted correctly by your matched **Yellow player**, the Yellow player will earn 2 tokens.

Your performance will not have any effect on your matched Yellow player's earnings. And, the reverse is also true: your matched Yellow player's performance will not have any impact your earnings.

Here are three different scenarios of what impact your performance and your matched Yellow player's performance will have on additional earnings:

Suppose both you and your matched Yellow player were able to encrypt 20 words correctly. Your earnings would be (20 x 1.5=) 30 tokens, while the Yellow player would earn (20 x 2=) 40 tokens.

Now, suppose you were able to encrypt 25 words correctly, while your matched Yellow player was able to encrypt 20 words correctly. Your earnings would be (25 x 1.5=) 37.5 tokens, while the Yellow player would earn (20 x 2=) 40 tokens.

As a last example, suppose you were only able to encrypt 5 words correctly, while your matched Yellow player was able to encrypt 20 words correctly. Your earnings would be (5 x 1.5=) 7.5 tokens, while the Yellow player would earn (20 x 2=) 40 tokens.

Next

Part 1: Encryption Task Understanding Check

To check you have understood the instructions, please answer the following questions. You may go back and read the instructions as many times as you want. **If you answer any question incorrectly, the computer program will automatically take you back to the instructions screen.**

Your earnings will be higher the better your performance is.

- True
- False

How many tokens will you earn for each word you encrypt correctly?

- 1.5
- 2
- 4

How many tokens will the Yellow player lose for every word you encrypt correctly?

- 1
- 0
- 4

How many tokens will you lose for for every word the Yellow player encrypts correctly?

- 1
- 0
- 4

Back

Next

Begin Encryption Task

Please proceed to the Encryption Task.

You will not be able to pause the task, so please make sure that you are available for the next 6 minutes without any interruption.

Begin Encryption Task

Encryption Task

Time left to complete this page: **5:59**

Part of your earnings will be determined by your performance in this task. You will not be able to go back and change your answer once you have submitted.

Word:	O	Q	A	W	F
Code:					

SUBMIT

H	M	Y	J	L	N	Z	W	T	K	B	F	E	D	C	V	X	S	P	U	R	O	G	Q	A	I
901	578	786	581	150	908	250	402	376	310	171	905	618	724	839	523	253	835	133	879	960	645	191	585	839	472

Part 1: Encryption Task Complete

You have completed Part 1, and your earnings will be displayed on the next page.

Next

Part 1: Encryption Task Earnings

Your earnings are 0.0 tokens in this Encryption task.

Next

Part 2: General Instructions

You have completed Part 1.

You will now begin Part 2 of the study.

Once again, you will participate in the same Encryption task for additional earnings. The Encryption task will last for **6 minutes** again. The difference, however, will be that you will **not have the same payoff scheme**. Instructions for this task and the new payoff scheme are provided on the next screen.

Next

Part 2: Encryption Task Earnings Instructions

Both Blue and Yellow players engage in the Encryption task for their additional earnings. For each word encrypted correctly, you will earn 2 tokens. You are free to earn as many tokens as you can during the 6-minute Encryption task. You will earn nothing for any word encrypted incorrectly. Note that both Yellow and Blue players face the same conditions. So, **each player earns 2 tokens for each word encrypted correctly**.

However, there is one additional condition that depends on the roles. For **each word you (as the Blue player) encrypt correctly**, your matched Yellow player **loses 1 token** from their earnings. But, the reverse is not true: the number of words encrypted correctly by the Yellow player has no effect on the earnings of the Blue player.

Here are three different scenarios of what impact your performance and your matched Yellow player's performance will have on additional earnings:

Suppose both you and your matched Yellow player encrypt 20 words correctly. Your earnings would be (20 x 2=) 40 tokens, while the Yellow player would earn (20 x 2=) 40 minus (20 x 1=) 20 = 20 tokens.

Now, suppose you were able to encrypt 25 words correctly, while your matched Yellow player was able to encrypt 20 words correctly. Your earnings would be (25 x 2=) 50 tokens, while the Yellow player would earn (20 x 2=) 40 minus (25 x 1=) 25 = 15 tokens.

As a last example, suppose you were only able to encrypt 5 words correctly, while your matched Yellow player was able to encrypt 20 words correctly. Your earnings would be (5 x 2=) 10 tokens, while the Yellow player would earn (20 x 2=) 40 minus (5 x 1=) 5 = 35 tokens.

Next

Begin Encryption Task

Please proceed to the Encryption Task.

You will not be able to pause the task, so please make sure that you are available for the next 6 minutes without any interruption.

Begin Encryption Task

Encryption Task

Time left to complete this page: **5:59**

Part of your earnings will be determined by your performance in this task. You will not be able to go back and change your answer once you have submitted.

Word:	R	Z	N	G	J
Code:					

SUBMIT

I	D	F	A	J	Z	X	B	G	L	E	Y	P	C	S	H	Q	R	O	M	U	N	T	W	V	K
811	281	405	791	698	259	510	217	192	520	662	758	582	309	146	794	835	974	215	315	437	965	876	749	425	520

Part 2: Encryption Task Complete

You have completed Part 2, and your earnings will be displayed on the next page.

Next

Part 2: Encryption Task Earnings

Your earnings are 0.0 tokens in this Encryption task.

Next

Part 3: General Instructions

You have completed Part 2 of the study.

You will now begin Part 3 of the study.

Once again, you will engage in same Encryption task for additional earnings. The Encryption task will last for 6 minutes again. The difference, however, will be that you will now have a **choice between two different payoff schemes** before you begin the task. Instructions for this are provided on the next screen.

Next

Part 3: Encryption Task Earnings Instructions

As the **Blue player**, you will now have a decision to make about your earnings and the earnings of your matched Yellow player. You will choose to either earn **2 tokens** for each word encrypted correctly **while the Yellow player loses 1 token** OR earn **1.5 tokens** for each word encrypted correctly **without the Yellow player losing tokens**.

For each word the Yellow player encrypts correctly, 2 tokens will be added to their earnings. And, once again, the Yellow player's performance will not have any impact on your earnings.

On the next screen, you will be provided with three different scenarios of what impact your performance and your matched Yellow player's performance could have on additional earnings.

Next

Part 3: Encryption Task Payoff Choice

You will now choose between two different payoff schemes. The **first payoff** scheme **decreases** your matched Yellow player's earnings the better you perform in the task. The **second payoff** scheme has **no effect** on your matched Yellow player's earnings the better you perform.

Please choose between the two following types of payoffs:

- ○ I would like to earn 2 tokens for every word I encrypt correctly, with a 1 token decrease from the earnings of the Yellow player I am paired with.
- ○ I would like to earn 1.5 tokens for every word I encrypt correctly, without decreasing the earnings of the Yellow player I am paired with.

Next

Part 3: Begin Encryption Task

Please proceed to the Encryption Task.

You will not be able to pause the task, so please make sure that you are available for the next 6 minutes without any interruption.

Begin Encryption Task

Encryption Task

Time left to complete this page: **6:00**

Part of your earnings will be determined by your performance in this task. You will not be able to go back and change your answer once you have submitted.

Word:	E	X	Q	Z	O
Code:					

SUBMIT

M	W	X	Q	K	C	L	P	G	B	H	Y	V	D	J	R	U	T	N	E	A	Z	S	I	O	F
672	551	235	334	996	447	827	362	647	176	817	219	812	588	131	874	699	245	663	897	647	570	783	220	830	691

Part 3: Encryption Task Complete

You have completed the Encryption task, and your earnings will be displayed on the next page.

Next

Part 3: Encryption Task Earnings

Your earnings are 0.0 tokens for this Encryption task.

Next

Encryption Task Survey

1. How would you rate the fairness of the Encryption task with the payoff scheme that didn't take away any earnings from your matched Yellow player while giving you a payoff of 1.5 tokens per word encrypted correctly? Please choose an answer below.

----

2. How would you rate the fairness of the Encryption task with the payoff scheme that took away earnings from your matched Yellow player while giving you a payoff of 2 tokens per word encrypted correctly? Please choose an answer below.

----

3. How would you rate your enjoyment of participating in all the Encryption tasks? Please choose an answer below.

SUBMIT

Thank You!

Thank you for your participation!

The computer program has randomly chosen **Part 3** to compute your additional earnings.

You correctly encrypted 0 words in Part 3 and earned 0.0 tokens.

Your additional earnings will thus be £0.00.

You may also receive an additional amount depending on a decision made by the Yellow player you were paired with in Part 3.

You have now completed the study, and your additional earnings will be processed within 21 days.

Next

YELLOW TREATED

Welcome!

Thank you for agreeing to take part in this Prolific study. The study is being run by researchers at the University of East Anglia. Any data which is collected about your participation in this study will be anonymous, and will not be linked to you in any way. If you have any concerns at any time during the study, or would like to withdraw from the study, you may contact the lead researcher Deanna Karapetyan, by sending an email to d.karapetyan@uea.ac.uk.

Please note that if you withdraw from the study you will not receive payment for your participation. The study you are about to take part in has received approval from the School of Economics Research Ethics Committee at the University of East Anglia. If you would like to make a formal complaint please contact the chair of the Research Ethics Committee, Dr. David Hugh-Jones (d.hugh-jones@uea.ac.uk).

Before we begin, please enter your Prolific ID.

Your Prolific ID:

Next

Consent

Please review the following information, and state whether you would like to provide your consent to continue below. If you do not provide consent, please return to Prolific and mark this study as 'Returned'.

- I am at least 18 years old.

- My participation in this study is voluntary, and I will have the opportunity to earn additional money based on my decisions during this study.

- I understand that data generated by my participation in this study will be analysed by researchers at the University of East Anglia, and will be stored in accordance with the University of East Anglia data protection guidelines.

- Anonymized data generated by my participation in this study may be used for research purposes, which includes being shared with other researchers and appearing in future publications.

- The researcher will collect my anonymized demographic information which I have previously provided to Prolific, and which will be linked to data generated by my participation in this study.

If you consent to participation, please choose "I consent" below.

Consent

Next

Overview of Study

Here is a brief overview of the study.

What will I have to do?

This study will consist of two tasks along with brief survey questions, and should take an average of 30 minutes to complete in total.

How much payment will I receive for my participation?

You will receive £2.50 as the participation fee for completing the study.

You will also have the opportunity to earn additional money.

In this study, we will be using a currency called "tokens". These tokens will determine your **additional earnings**, which will depend on your performance and the decisions you make. For each token you earn, you will be paid £0.05. As an example, if you earned 100 tokens in total, you would be paid £5 (100*£0.05).

Your total payment from this study will be equal to the participation fee plus your additional earnings. So, if you earned 100 tokens in total for the two tasks, you would be paid a total of £8.75 (£3.75 + £5).

Next

Overview of Study

How will payment be made?
You will receive the participation fee of £2.50 plus your additional earnings **only if you complete** the study.

Once you complete the study, you will receive the participation fee payment first.

Once all participants complete the study, your additional earnings payment will be made via the Prolific platform within a maximum of 21 days from the conclusion of the study.

Please note!
There will be several **Attention Check** questions throughout this study meant to test whether you are paying attention.

If you fail to correctly complete two or more of these Attention Check questions, you may not be paid.

Finally, please note that this study **does not employ deception**. This is regulated by the researchers' institutional ethics committees.

Next

Attention Check!

This question is for checking your attention. Please select Agree.

- ○ Disagree
- ● Agree
- ○ Somewhat Agree
- ○ Somewhat Disagree

Next

General Instructions

You will now participate in two tasks:

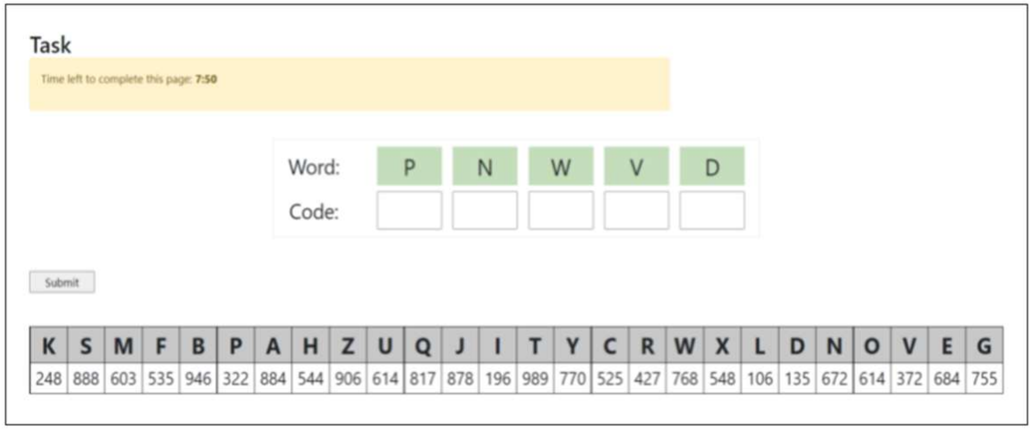
1. An **Encryption task**, where you will encrypt a sequence of 5-letters ("words") into numbers. You will encrypt as many words as you can within **6 minutes**. Instructions will be provided on the next screen. You will have a chance to practice the task for 2 rounds, with each round lasting 1 minute. **During the practice, you will not earn any additional money**.

2. A **Decision task**, with instructions for the task provided to you after the Encryption task has already been completed.

Next

Encryption Task Instructions

In this task, you will be shown a **sequence of 5-letters (a "word")** that you will encode into 5 numbers. As you can see in the screenshot below, the first letter in the word is "P". The letter "P" corresponds to the number "322" in the encoding table at the bottom of the screen. To complete this letter correctly, you should put the number "322" into the box below the letter "P", either by **typing the number or using copy-paste**. You need to complete encoding all 5 letters correctly to have a correct answer.



After you finish encoding a word, the computer program will prompt you with another word to encode. You are free to encode as many words as you can.

You will now have a chance to practice the task in 2 different rounds, with each round lasting 1 minute.

The practice rounds will notify you whenever errors are made, while the earnings round will not.

Next

Encryption Task Practice

Time left to complete this page: **0:58**

Once you are done encrypting a word, please either click the **SUBMIT** button or **tab from the last letter and press enter** on your keyboard. Please get accustomed with the task during **1 minute**.

Word:	M	L	I	Q	F
Code:					

SUBMIT

V	I	U	N	W	B	K	R	T	M	E	L	D	F	G	J	P	H	S	X	A	C	Y	Q	Z	O
394	478	281	631	420	711	423	948	309	636	760	277	437	838	460	248	344	549	536	713	627	527	588	172	611	989

Encryption Task Practice Results

Thank you for completing the Encryption task practice. You correctly encrypted 0 word(s) in this round.

You will now practice the task again for 1 minute.

Next

Encryption Task Practice

Time left to complete this page: **0:59**

Once you are done encrypting a word, please either click the **SUBMIT** button or **tab from the last letter and press enter** on your keyboard. Please get accustomed with the task during **1 minute**.

Word:	Q	C	R	X	N
Code:					

SUBMIT

L	Q	Y	X	N	E	P	B	M	O	I	A	F	H	D	J	T	U	G	Z	C	K	V	R	W	S
795	501	798	436	582	452	965	447	240	184	945	147	800	575	247	137	541	387	806	806	897	774	902	847	239	110

Encryption Task Practice Results

Thank you for completing the Encryption task practice. You correctly encrypted 0 word(s) in this round.

Next

Attention Check!

This question is for checking your attention. Please select Disagree.

- ○ Disagree
- ○ Somewhat Disagree
- ○ Agree
- ○ Somewhat Agree

Next

Encryption Task Player Roles

In this study, individuals participate in pairs. This means that you will be paired with another individual participating in the study, and that your decisions may impact their earnings, while their decisions may impact your earnings.

Participants have different roles, and to differentiate between them, we have labeled them as the "Blue player" and the "Yellow player".

- You have been assigned to be the **Yellow player**.

- Your counterpart Blue player has been randomly selected. Note that the Blue player has already participated in the study, but the decisions that you make can still affect their final payment. How the payments are affected will be explained on the next screen.

Next

Encryption Task Earnings Instructions

Both Blue and Yellow players engage in the Encryption task for their additional earnings. For each word **you (as the Yellow player)** encrypt correctly, you will **earn 2 tokens**. You are free to earn as many tokens as you can during the 6-minute Encryption task. You will earn nothing for any word encrypted incorrectly. Note that both Yellow and Blue players face the same conditions **except for the payoff scheme**.

The **Blue player** will have **made a choice** between one of the following payoff schemes prior to their participation in the Encryption task:

- For each word encrypted correctly, 2 tokens are added to the Blue player's earnings but **you lose 1 token**.
- For each word encrypted correctly, 1.5 tokens are added to the Blue player's earnings with **no effect on your earnings**.

The Yellow player, on the other hand, will only have one payoff scheme with no effect on the matched Blue player's earnings. As the Yellow player, your earnings are **positively affected** by your performance in the Encryption task, but **might be negatively affected** by your matched Blue player's performance **depending on the payoff choice made by the Blue player**. Note that the Blue player was also told how their matched Yellow player's earnings would be affected before they made their payoff choice.

On the next screen, you will be provided with three different scenarios of what impact your performance and your matched Blue player's performance could have on additional earnings.

Next

Encryption Task Earnings Examples

You will know which payoff scheme the computer program chose until after you've completed the Encryption task. The following are earnings examples based on performance of both players and the computer program's random selection of payoff scheme.

Suppose both you and your matched Blue player were able to encrypt 20 words correctly.

- If the computer program assigned the payoff scheme that would have no effect on your earnings, your earnings would be (20 x 2=) 40 tokens, while the Blue player would earn (20 x 1.5=) 30 tokens.
- If the computer program assigned the payoff scheme that would decrease your earnings, your earnings would be (20 x 2=) 40 minus (20 x 1=) 20 = 20 tokens, while the Blue player would earn (20 x 2=) 40 tokens.

Now, suppose you were able to encrypt 20 words correctly, while your matched Blue player was able to encrypt 25 words correctly.

- If the computer program assigned the payoff scheme that would have no effect on your earnings, your earnings would be (20 x 2=) 40 tokens while the Blue player would earn (25 x 1.5=) 37.5 tokens.
- If the computer program assigned the payoff scheme that would decrease your earnings, your earnings would be (20 x 2=) 40 minus (25 x 1=) 25 = 15 tokens, while the Blue player would earn (25 x 2=) 50 tokens.

As a last example, suppose you were able to encrypt 20 words correctly, while your matched Blue player was only able to encrypt 5 words correctly.

- If the computer program assigned the payoff scheme that would have no effect on your earnings, your earnings would be (20 x 2=) 40 tokens, while the Blue player would earn (5 x 1.5=) 7.5 tokens.
- If the computer program assigned the payoff scheme that would decrease your earnings, your earnings would be (20 x 2=) 40 minus (5 x 1=) 5 = 35 tokens, while the Blue player would earn (5 x 2=) 10 tokens.

Back

Next

Encryption Task Understanding Check

To check you have understood the instructions, please answer the following questions. You may go back and read the instructions as many times as you want. **If you answer any question incorrectly, the computer program will automatically take you back to the instructions screen.**

Your earnings are expected to be higher the better your performance is.

- True
- False

You are randomly and anonymously paired with a Blue player.

- True
- False

The computer program will have randomly assigned one of two payoff schemes to your matched Blue player.

- True
- False

How many tokens will you earn for each word you encrypt correctly?

- 1
- 2
- 4

How many tokens will you lose for each word the Blue player encrypts correctly if the computer program assigned the payoff scheme that could have decreased your earnings?

- 1
- 2
- 4

Back Next

Begin Encryption Task

Please proceed to the Encryption Task.

You will not be able to pause the task, so please make sure that you are available for the next 6 minutes without any interruption.

Begin Encryption Task

Encryption Task

Time left to complete this page: **5:59**

Part of your earnings will be determined by your performance in this task. You will not be able to go back and change your answer once you have submitted.

Word:	Z	H	G	K	N
Code:					

SUBMIT

Y	F	M	E	N	K	R	B	U	J	V	P	W	I	A	D	T	L	G	C	S	Z	Q	X	H	O
298	251	459	585	333	786	982	870	310	332	983	833	499	101	955	767	712	996	298	241	504	293	118	131	909	372

Encryption Task Complete

You have completed the Encryption task, and your earnings will be displayed on the next page.

Next

Encryption Task Earnings

Your earnings are -23.0 token(s).

Next

Encryption Task Survey

Note that your earnings in this task were based on your performance and the performance of your matched Blue player **only if the Blue player chose** the payoff scheme that would **decrease your earnings**. Remember that if the Blue player chose this payoff scheme, your earnings were reduced by 1 token for each word your matched Blue player encrypted correctly.

Now, please answer the following question.

Do you think your matched Blue player chose the payoff scheme that would decrease your earnings?

- ◯ Yes
- ◯ No

SUBMIT

CONDITIONALLY DISPLAYED IF PRIOR QUESTION ANSWERED "YES"

Encryption Task Survey

Since you answered yes, please also answer the following questions.

1. We would like to know how much you think you would have earned if the Blue player's performance had no impact on your earnings. Please express the amount in tokens, and type in numbers only:

2. Now, we would like to know how much you think your matched Blue player reduced your earnings by. Please express the amount in tokens, and type in numbers only:

SUBMIT

Attention Check!

This question is for checking your attention. Please select Somewhat Agree.

- ◯ Disagree
- ◯ Somewhat Disagree
- ◯ Agree
- ◯ Somewhat Agree

Next

PAIRED WITH BLUE PLAYER WHO CHOSE NO EXTERNALITY

Encryption Task Earnings Information

Recall that your matched Blue player completed the same Encryption task as you, but that the Blue player had a choice to make between two payoff schemes prior to participating in the task.

The Blue player CHOSE the payoff scheme that WOULD NOT decrease your earnings.

This means the Blue player decreased your Encryption task earnings by 0 token(s) while exerting effort in the task.

Therefore, your earnings are 0.0 tokens.

Next

PAIRED WITH BLUE PLAYER WHO CHOSE EXTERNALITY

Encryption Task Earnings Information

Recall that your matched Blue player completed the same Encryption task as you, but that the Blue player had a choice to make between two payoff schemes prior to participating in the task.

The Blue player CHOSE the payoff scheme that WOULD decrease your earnings.

This means the Blue player decreased your Encryption task earnings by 18 token(s) while exerting effort in the task.

Therefore, your earnings are -18.0 tokens.

Next

Decision Task Instructions

Thank you for completing the Encryption task. Recall that in that task, you were matched with a Blue player who chose the payoff scheme that would NOT decrease your earnings. We now turn to the Decision task.

In this task, **you (as the Yellow player)** are matched with the **same Blue player** you were matched with for the Encryption task. You will now be given **30 tokens**, while your matched Blue player will be given **15 tokens**. However, you now have an opportunity to change their earnings.

You can transfer tokens to, or take away tokens from, your matched Blue player. You can transfer a **positive amount** in 1 token increments **up to a total of 30 tokens**, or you can take away/transfer a **negative amount** in 1 token increments **up to a total of 15 tokens**. Positive and negative transfer examples are provided on the next screen.

Next

Decision Task Examples

For the **positive transfer** example, suppose you wanted to transfer 10 tokens to your matched Blue player. Your earnings in this task would be (30 - 10=) 20 tokens, while the Blue player would earn (15 + 10=) 25 tokens.

For the **negative transfer** example, suppose you wanted to take away 10 tokens from your matched Blue player. Your earnings in this task would be (30 + 10=) 40 tokens, the Blue player would earn (15 - 10=) 5 tokens.

Your total payment from this study will be the sum of your participation fee for completion of the study, your earnings from the Encryption task, and your earnings from this Decision task.

Likewise, the matched Blue player's total payment from this study will be the sum of their participation fee for completion of the study, their earnings from the Encryption task, and their earnings outcome from this Decision task.

Next

Decision Task

You will not be told who you were matched with during or after this experiment, and your matched counterpart will not be told who you are either during or after the experiment. **The decision made will be strictly anonymous and cannot be linked to you in any way.**

Please choose the transfer amount:

-15 -10 -5 0 5 10 15 20 25 30

You have selected to transfer **0** tokens to the blue player. Your earnings from this part will be **30** tokens.

SUBMIT DECISION

Decision Task Earnings

Your earnings from the Decision task are 30 tokens.

Next

Encryption Task Survey

Thinking back to the Encryption task only, how would you rate the fairness of that task? Please answer by using the slider below.

Very unfair	Somewhat unfair	Neither fair nor unfair	Somewhat fair	Very fair

---

How would you rate your enjoyment of participating in the Encryption Task? Please answer by using the slider below.

Very nenjoyable	Somewhat unenjoyable	Neither enjoyable nor unenjoyable	Somewhat enjoyable	Very enjoyable

SUBMIT

Thank You!

Thank you for your participation!

Your earnings for the Encryption task are **0.0 tokens**.

Your earnings for the Decision task are **30 tokens**.

Recall that one token is equal to £0.05. Therefore, your total additional earnings will be **£1.50**.

You have now completed the study, and your additional earnings will be processed within 21 days.

Next

YELLOW UNTREATED

Welcome!

Thank you for agreeing to take part in this Prolific study. The study is being run by researchers at the University of East Anglia. Any data which is collected about your participation in this study will be anonymous, and will not be linked to you in any way. If you have any concerns at any time during the study, or would like to withdraw from the study, you may contact the lead researcher Deanna Karapetyan, by sending an email to d.karapetyan@uea.ac.uk.

Please note that if you withdraw from the study you will not receive payment for your participation. The study you are about to take part in has received approval from the School of Economics Research Ethics Committee at the University of East Anglia. If you would like to make a formal complaint please contact the chair of the Research Ethics Committee, Dr. David Hugh-Jones (d.hugh-jones@uea.ac.uk).

Before we begin, please enter your Prolific ID.

Your Prolific ID:

Next

Consent

Please review the following information, and state whether you would like to provide your consent to continue below. If you do not provide consent, please return to Prolific and mark this study as 'Returned'.

- I am at least 18 years old.

- My participation in this study is voluntary, and I will have the opportunity to earn additional money based on my decisions during this study.

- I understand that data generated by my participation in this study will be analysed by researchers at the University of East Anglia, and will be stored in accordance with the University of East Anglia data protection guidelines.

- Anonymized data generated by my participation in this study may be used for research purposes, which includes being shared with other researchers and appearing in future publications.

- The researcher will collect my anonymized demographic information which I have previously provided to Prolific, and which will be linked to data generated by my participation in this study.

If you consent to participation, please choose "I consent" below.

Consent

Next

Overview of Study

Here is a brief overview of the study.

What will I have to do?
This study will consist of two tasks along with brief survey questions, and should take an average of 30 minutes to complete in total.

How much payment will I receive for my participation?
You will receive £2.50 as the participation fee for completing the study.

You will also have the opportunity to earn additional money.

In this study, we will be using a currency called "tokens". These tokens will determine your **additional earnings**, which will depend on your performance and the decisions you make. For each token you earn, you will be paid £0.05. As an example, if you earned 100 tokens in total, you would be paid £5 (100*£0.05).

Your total payment from this study will be equal to the participation fee plus your additional earnings. So, if you earned 100 tokens in total for the two tasks, you would be paid a total of £8.75 (£3.75 + £5).

Next

Overview of Study

How will payment be made?
You will receive the participation fee of £2.50 plus your additional earnings **only if you complete** the study.

Once you complete the study, you will receive the participation fee payment first.

Once all participants complete the study, your additional earnings payment will be made via the Prolific platform within a maximum of 21 days from the conclusion of the study.

Please note!
There will be several **Attention Check** questions throughout this study meant to test whether you are paying attention.

If you fail to correctly complete two or more of these Attention Check questions, you may not be paid.

Finally, please note that this study **does not employ deception**. This is regulated by the researchers' institutional ethics committees.

Next

Attention Check!

This question is for checking your attention. Please select Agree.

- Disagree
- Agree
- Somewhat Agree
- Somewhat Disagree

Next

General Instructions

You will now participate in two tasks:

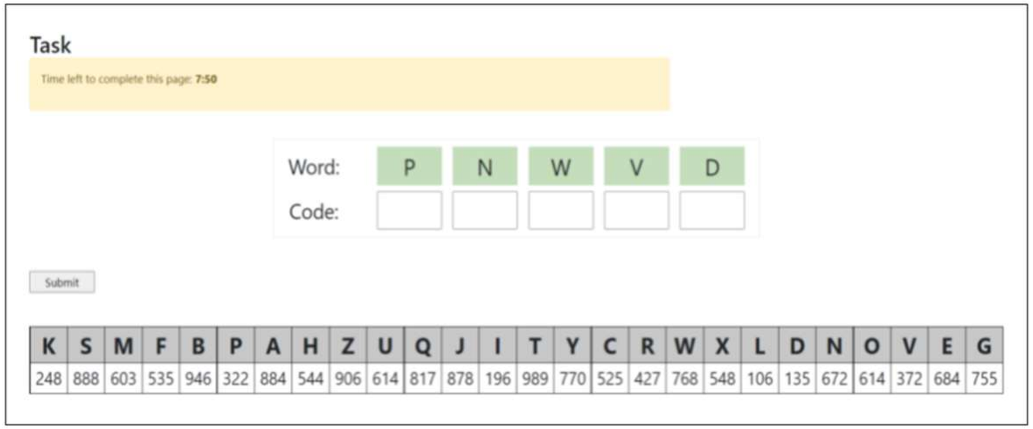
1. An **Encryption task**, where you will encrypt a sequence of 5-letters ("words") into numbers. You will encrypt as many words as you can within **6 minutes**. Instructions will be provided on the next screen. You will have a chance to practice the task for 2 rounds, with each round lasting 1 minute. **During the practice, you will not earn any additional money**.

2. A **Decision task**, with instructions for the task provided to you after the Encryption task has already been completed.

Next

Encryption Task Instructions

In this task, you will be shown a **sequence of 5-letters (a "word")** that you will encode into 5 numbers. As you can see in the screenshot below, the first letter in the word is "P". The letter "P" corresponds to the number "322" in the encoding table at the bottom of the screen. To complete this letter correctly, you should put the number "322" into the box below the letter "P", either by **typing the number or using copy-paste**. You need to complete encoding all 5 letters correctly to have a correct answer.



After you finish encoding a word, the computer program will prompt you with another word to encode. You are free to encode as many words as you can.

You will now have a chance to practice the task in 2 different rounds, with each round lasting 1 minute.

The practice rounds will notify you whenever errors are made, while the earnings round will not.

Next

Encryption Task Practice

Time left to complete this page: **0:58**

Once you are done encrypting a word, please either click the **SUBMIT** button or **tab from the last letter and press enter** on your keyboard. Please get accustomed with the task during **1 minute**.

Word:	M	L	I	Q	F
Code:					

SUBMIT

V	I	U	N	W	B	K	R	T	M	E	L	D	F	G	J	P	H	S	X	A	C	Y	Q	Z	O
394	478	281	631	420	711	423	948	309	636	760	277	437	838	460	248	344	549	536	713	627	527	588	172	611	989

Encryption Task Practice Results

Thank you for completing the Encryption task practice. You correctly encrypted 0 word(s) in this round.

You will now practice the task again for 1 minute.

Next

Encryption Task Practice

Time left to complete this page: **0:59**

Once you are done encrypting a word, please either click the **SUBMIT** button or **tab from the last letter and press enter** on your keyboard. Please get accustomed with the task during **1 minute**.

Word:	Q	C	R	X	N
Code:					

SUBMIT

L	Q	Y	X	N	E	P	B	M	O	I	A	F	H	D	J	T	U	G	Z	C	K	V	R	W	S
795	501	798	436	582	452	965	447	240	184	945	147	800	575	247	137	541	387	806	806	897	774	902	847	239	110

Encryption Task Practice Results

Thank you for completing the Encryption task practice. You correctly encrypted 0 word(s) in this round.

Next

Attention Check!

This question is for checking your attention. Please select Disagree.

- ◯ Disagree
- ◯ Somewhat Disagree
- ◯ Agree
- ◯ Somewhat Agree

Next

Encryption Task Player Roles

In this study, individuals participate in pairs. This means that you will be paired with another individual participating in the study, and that your decisions may impact their earnings, while their decisions may impact your earnings.

Participants have different roles, and to differentiate between them, we have labeled them as the "Blue player" and the "Yellow player".

- You have been assigned to be the **Yellow player**.

- Your counterpart Blue player has been randomly selected. Note that the Blue player has already participated in the study, but the decisions that you make can still affect their final payment. How the payments are affected will be explained on the next screen.

Next

Encryption Task Earnings Instructions

Both Blue and Yellow players engage in the Encryption task for their additional earnings. For each word **you (as the Yellow player)** encrypt correctly, you will **earn 2 tokens**. You are free to earn as many tokens as you can during the 6-minute Encryption task. You will earn nothing for any word encrypted incorrectly. Note that both Yellow and Blue players face the same conditions **except for the payoff scheme**.

The **computer program** will have randomly assigned **the Blue player** to one of the following payoff schemes prior to their participation in the Encryption task:

- For each word encrypted correctly, 2 tokens are added to the Blue player's earnings but **you lose 1 token**.
- For each word encrypted correctly, 1.5 tokens are added to the Blue player's earnings with **no effect on your earnings**.

The Yellow player, on the other hand, will only have one payoff scheme with no effect on the matched Blue player's earnings. As the Yellow player, your earnings are **positively affected** by your performance in the task, but **might be negatively affected** by your matched Blue player's performance **depending on the computer program's random assignment**. Note that the Blue player was also told how their matched Yellow player's earnings would be affected before they began the task.

On the next screen, you will be provided with three different scenarios of what impact your performance and your matched Blue player's performance could have on additional earnings.

Next

Encryption Task Earnings Examples

You will know which payoff scheme the computer program chose until after you've completed the Encryption task. The following are earnings examples based on performance of both players and the computer program's random selection of payoff scheme.

Suppose both you and your matched Blue player were able to encrypt 20 words correctly.

- If the computer program assigned the payoff scheme that would have no effect on your earnings, your earnings would be (20 x 2=) 40 tokens, while the Blue player would earn (20 x 1.5=) 30 tokens.
- If the computer program assigned the payoff scheme that would decrease your earnings, your earnings would be (20 x 2=) 40 minus (20 x 1=) 20 = 20 tokens, while the Blue player would earn (20 x 2=) 40 tokens.

Now, suppose you were able to encrypt 20 words correctly, while your matched Blue player was able to encrypt 25 words correctly.

- If the computer program assigned the payoff scheme that would have no effect on your earnings, your earnings would be (20 x 2=) 40 tokens while the Blue player would earn (25 x 1.5=) 37.5 tokens.
- If the computer program assigned the payoff scheme that would decrease your earnings, your earnings would be (20 x 2=) 40 minus (25 x 1=) 25 = 15 tokens, while the Blue player would earn (25 x 2=) 50 tokens.

As a last example, suppose you were able to encrypt 20 words correctly, while your matched Blue player was only able to encrypt 5 words correctly.

- If the computer program assigned the payoff scheme that would have no effect on your earnings, your earnings would be (20 x 2=) 40 tokens, while the Blue player would earn (5 x 1.5=) 7.5 tokens.
- If the computer program assigned the payoff scheme that would decrease your earnings, your earnings would be (20 x 2=) 40 minus (5 x 1=) 5 = 35 tokens, while the Blue player would earn (5 x 2=) 10 tokens.

Back Next

Encryption Task Understanding Check

To check you have understood the instructions, please answer the following questions. You may go back and read the instructions as many times as you want. **If you answer any question incorrectly, the computer program will automatically take you back to the instructions screen.**

Your earnings are expected to be higher the better your performance is.

- ◯ True
- ◯ False

You are randomly and anonymously paired with a Blue player.

- ◯ True
- ◯ False

The computer program will have randomly assigned one of two payoff schemes to your matched Blue player.

- ◯ True
- ◯ False

How many tokens will you earn for each word you encrypt correctly?

- ◯ 1
- ◯ 2
- ◯ 4

How many tokens will you lose for each word the Blue player encrypts correctly if the computer program assigned the payoff scheme that could have decreased your earnings?

- ◯ 1
- ◯ 2
- ◯ 4

Back Next

Begin Encryption Task

Please proceed to the Encryption Task.

You will not be able to pause the task, so please make sure that you are available for the next 6 minutes without any interruption.

Begin Encryption Task

Encryption Task

Time left to complete this page: **5:59**

Part of your earnings will be determined by your performance in this task. You will not be able to go back and change your answer once you have submitted.

Word:	Z	H	G	K	N
Code:					

SUBMIT

Y	F	M	E	N	K	R	B	U	J	V	P	W	I	A	D	T	L	G	C	S	Z	Q	X	H	O
298	251	459	585	333	786	982	870	310	332	983	833	499	101	955	767	712	996	298	241	504	293	118	131	909	372

Encryption Task Complete

You have completed the Encryption task, and your earnings will be displayed on the next page.

Next

Encryption Task Earnings

Your earnings are -23.0 token(s).

Next

Encryption Task Survey

Note that your earnings in this task were based on your performance and the performance of your matched Blue player **only if the computer program assigned** the payoff scheme that would **decrease your earnings**. Remember that if the computer program assigned this payoff scheme, your earnings were reduced by 1 token for each word your matched Blue player encrypted correctly.

Now, please answer the following question.

Do you think the computer program assigned the payoff scheme that would decrease your earnings?

- Yes
- No

SUBMIT

CONDITIONALLY DISPLAYED IF PRIOR QUESTION ANSWERED "YES"

Encryption Task Survey

Since you answered yes, please also answer the following questions.

1. We would like to know how much you think you would have earned if the Blue player's performance had no impact on your earnings. Please express the amount in tokens, and type in numbers only:

2. Now, we would like to know how much you think your matched Blue player reduced your earnings by. Please express the amount in tokens, and type in numbers only:

SUBMIT

Attention Check!

This question is for checking your attention. Please select Somewhat Agree.

- ◯ Disagree
- ◯ Somewhat Disagree
- ◯ Agree
- ◯ Somewhat Agree

Next

PAIRED WITH BLUE PLAYER WHO HAD FORCED NO EXTERNALITY

Encryption Task Earnings Information

Recall that your matched Blue player completed the same Encryption task as you, but that the computer program assigned a payoff scheme that would have either decreased your earnings or the earnings of your matched Blue player.

The computer program assigned the payoff scheme that WOULD NOT decrease YOUR earnings.

This means the Blue player decreased your Encryption task earnings by 0 token(s) while exerting effort in the task.

Therefore, your earnings are 0.0 tokens.

Next

PAIRED WITH BLUE PLAYER WHO HAD FORCED EXTERNALITY

Encryption Task Earnings Information

Recall that your matched Blue player completed the same Encryption task as you, but that the computer program assigned a payoff scheme that would have either decreased your earnings or the earnings of your matched Blue player.

The computer program assigned the payoff scheme that WOULD decrease YOUR earnings.

This means the Blue player decreased your Encryption task earnings by 6 token(s) while exerting effort in the task.

Therefore, your earnings are -6.0 tokens.

Next

Decision Task Instructions

Thank you for completing the Encryption task. Recall that in that task, you were matched with a Blue player who chose the payoff scheme that would NOT decrease your earnings. We now turn to the Decision task.

In this task, **you (as the Yellow player)** are matched with the **same Blue player** you were matched with for the Encryption task. You will now be given **30 tokens**, while your matched Blue player will be given **15 tokens**. However, you now have an opportunity to change their earnings.

You can transfer tokens to, or take away tokens from, your matched Blue player. You can transfer a **positive amount** in 1 token increments **up to a total of 30 tokens**, or you can take away/transfer a **negative amount** in 1 token increments **up to a total of 15 tokens**. Positive and negative transfer examples are provided on the next screen.

Next

Decision Task Examples

For the **positive transfer** example, suppose you wanted to transfer 10 tokens to your matched Blue player. Your earnings in this task would be (30 - 10=) 20 tokens, while the Blue player would earn (15 + 10=) 25 tokens.

For the **negative transfer** example, suppose you wanted to take away 10 tokens from your matched Blue player. Your earnings in this task would be (30 + 10=) 40 tokens, the Blue player would earn (15 - 10=) 5 tokens.

Your total payment from this study will be the sum of your participation fee for completion of the study, your earnings from the Encryption task, and your earnings from this Decision task.

Likewise, the matched Blue player's total payment from this study will be the sum of their participation fee for completion of the study, their earnings from the Encryption task, and their earnings outcome from this Decision task.

Next

Decision Task

You will not be told who you were matched with during or after this experiment, and your matched counterpart will not be told who you are either during or after the experiment. **The decision made will be strictly anonymous and cannot be linked to you in any way.**

Please choose the transfer amount:

-15 -10 -5 0 5 10 15 20 25 30

You have selected to transfer **0** tokens to the blue player. Your earnings from this part will be **30** tokens.

SUBMIT DECISION

Decision Task Earnings

Your earnings from the Decision task are 30 tokens.

Next

Encryption Task Survey

Thinking back to the Encryption task only, how would you rate the fairness of that task? Please answer by using the slider below.

Very unfair	Somewhat unfair	Neither fair nor unfair	Somewhat fair	Very fair

How would you rate your enjoyment of participating in the Encryption Task? Please answer by using the slider below.

Very nenjoyable	Somewhat unenjoyable	Neither enjoyable nor unenjoyable	Somewhat enjoyable	Very enjoyable

SUBMIT

Thank You!

Thank you for your participation!

Your earnings for the Encryption task are **0.0 tokens**.

Your earnings for the Decision task are **30 tokens**.

Recall that one token is equal to £0.05. Therefore, your total additional earnings will be **£1.50**.

You have now completed the study, and your additional earnings will be processed within 21 days.

Next