

Title: Extrinsic, Intrinsic, and Social Incentives for Crowdsourcing Development Information in Uganda: A Field Experiment

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Abstract: “Crowdsourcing” allows for mass citizen dialogue and direct feedback on development outcomes, and may help repair the broken feedback loop between aid donors and recipients. However, one of its limitations is a lack of understanding on participant motivation. We employed two randomized controlled trials (RCTs) to evaluate which incentive mechanisms best motivate Ugandans to use SMS/text messaging to participate in discussions and transmit development information within UNICEF’s U-Report system. Extrinsic incentives had the largest effects on subjects’ likelihood of response and on the number of texts they sent, while intrinsic and social incentives also significantly increased participation over the control condition. Contra important findings in psychology, the extrinsic material incentives did not appear to dampen the intrinsic motivation to make a difference in the community.

The feedback mechanisms that regulate domestic public spending of foreign aid funds are broken or missing (1). Economics research reveals that only a small portion of the \$150 billion in annual foreign aid actually reaches the intended beneficiaries (2-4). One potential solution to the broken feedback loop in aid involves mass grassroots monitoring or “crowdsourcing,” which gives large groups of citizens a means of reporting directly on relevant conditions in their neighborhoods and villages. Multiple projects and studies have attempted to incorporate grassroots monitoring – from hired or elected community monitors to comment cards to time-stamped attendance photos – as a means to improve development outcomes, but have seen mixed success and limited post-project uptake, largely because of limited or low-quality participation (3, 5-7).

As concluded by the 2010 UN Millennium Development Goals Summit, participant motivation, not technology, is the key constraint to effective crowdsourcing. Crowdsourced information has been very effective in crisis situations, helping to defuse the 2007 election violence in Kenya and to relieve victims of the 2010 Haiti earthquake, among several other successes (8). Personal and community distress motivates individuals in the crowd to share life-saving information, however, little is known about how to activate the crowd in the absence of a crisis, nor sustain reporting over time. We probe whether citizens can be induced to share information on pressing problems in their everyday lives and the normal development conditions they face.

In this investigation we apply a direct test – in a natural field setting with a real-world behavioral outcome – that pits key ideas about human motivation from psychology against economics. Extensive results from psychology lab experiments find that material or “extrinsic” incentives undermine “intrinsic” motives stemming from the value of the task itself or “reputational” reasons to be seen performing a task by others (9-12). Yet multiple field experiments in development economics show that extrinsic material rewards enhance aid project effectiveness (13-18). This study provides what is, to the best of our knowledge, the first field experimental evidence allowing side-by-side comparison of extrinsic, intrinsic, and social incentives to perform pro-social action.

The literature on pro-social behavior suggests there are three types of relevant incentives: extrinsic, intrinsic, and reputational (19, 20). People are intrinsically motivated when they do a task because it is inherently valuable. Extrinsic motivation is at the center of rational choice theory, where people are incentivized by material rewards or punishments. Reputational incentives – such as praise, publicity, and shame – motivate action based on social norms and interactions. Given the complexity of social interactions, social incentives often straddle more than one of these categorizations, particularly intrinsic and reputational motives (e.g. one may attend a party both because it is entertaining and because one wishes to appear popular). For this reason, we discuss social incentives as their own category. Major social science disciplines are divided on which is the strongest, and further, dispute whether there are either multiplier or dampening effects when two motives work together.

Extensive experimental work in psychology suggests that extrinsic rewards stifle intrinsic motivation (9-12). Time and again, when subjects were paid to perform an intrinsically rewarding task, their interest and effort in the task eroded appreciably. Experiments in behavioral economics also support this assertion that extrinsic incentives can crowd out intrinsic motivations for the performance of pro-social activity (21-23).

This has even been shown to be the case in lab experiments using crowdworkers (i.e. Amazon Mechanical Turk workers) (24).

However, in development economics, where field experiments are executed in natural settings, small, non-monetary incentives have been shown to increase intrinsically valuable behaviors with positive externalities, such as immunizing children, by nearly 85 percent (13, 14). The implication here is that small extrinsic rewards might supply additional motivation for individuals to perform tasks they may already be inclined to perform, but tend to procrastinate or free-ride on the effort of others. Some research indicates that social incentives may be even more powerful, but maintains that material rewards do not dampen intrinsic motives (15). Precursory field research on crowdsourcing corroborates these findings, showing that the crowd clearly responds to material incentives, but also may be acting due to a kind of social “addiction” (16-18). The differences between the experimental results in the lab and in the field suggest that systematic and comprehensive research is needed to understand which incentives – extrinsic, intrinsic, social, or a combination – best motivate the crowd. UNICEF’s U-Report system in Uganda provides an ideal field setting to pursue this question.

The innovative technology behind the crowdsourcing system, combined with a real-world setting, enables the collection of extensive experimental evidence. UNICEF’s U-Report system, using an open-source, RapidSMS powered platform, attempts non-crisis crowdsourcing for development on a much larger scale than previous efforts. The U-Report program aggregates text messages from roughly 130,000 citizen monitors in Uganda. UNICEF-Uganda has presented this aggregated information directly to Ugandan Members of Parliament and across the country through media outlets. As the program continues it has the potential to dramatically increase the amount of information available on development projects and outcomes throughout the country.

Working with UNICEF-Uganda in two randomized control trials, we find that between June 2011 and October 2011 extrinsic material incentives caused the biggest treatment effects in increasing recruitment and response rates of U-Report participants. Intrinsic and social incentives also significantly increased participation, compared with the control condition. Furthermore, contrary to important experimental results from psychology, we find little evidence that material incentives dampened subjects’ intrinsic motives to participate in the U-Report program. Rather, extrinsic and intrinsic motives may be additive in this setting.

We completed the study during the early phases of the U-Report program, when roughly 25,000 mostly young Ugandans (mean age = 23.8) were enrolled as U-Reporters. During the study period, all U-Reporters were sent a weekly poll question via SMS concerning development outcomes in their locales. They could then text their responses to the question. The U-Report system was free to use for participants, and worked on all major cellphone networks. For a fuller explanation of the U-Report system, see the supplementary online text. We examine the effects of the experimental interventions on two outcomes of interest: response rates to any query and the total number of responses to all polls. For response rates we simply calculated the number of registered U-Reporters in each condition that answered any single poll over the study period. For the total number of responses we tallied the number of responses to all polls over the study period.

To balance covariates, we employed a district-level blocking procedure and then randomly assigned interventions by administrative district (25).

In Experiment 1, we used radio advertisements for U-Report as a mechanism to convey different incentives to join U-Report in an isolated manner. We compared the effect of radio ads appealing to intrinsic motivation (Radio treatment) to radio ads that combined intrinsic motivation with an extrinsic material incentive (Radio Lottery treatment). In the Radio treatment, over several days, we randomly assigned some districts with broadcasts of radio ads urging listeners to sign up for U-Report so they could “speak out on what is happening in [their communities].” In the Radio Lottery treatment, during a subsequent span of days that did not overlap the Radio treatment, other districts heard an augmented version of the same ad with an additional promise to enter all new U-Reporters into a lottery to win a solar mobile phone charger.

All U-Reporters that enrolled during each respective treatment period in the assigned districts were considered ($N = 61$ for Radio, $N = 33$ for Radio Lottery). A comparison condition where no U-Report radio ads were transmitted was used as a baseline (26). It is important to note, however, that this is not a true control because its composition was not subject to random assignment. The comparison baseline thus consisted of individuals who had signed up for U-Report during earlier phases before the radio advertisements were aired. But the key comparison involves the two treatment conditions, allows us to directly test for any dampening effect that an extrinsic material incentive may exert when received jointly with intrinsic motivation.

Figures 1 and 2 and Table S2 (in the online supplement) present the results from the Radio and Radio Lottery treatments compared to the control condition where no intervention took place. Both the Radio and Radio Lottery treatments significantly increased the reply rates compared to the baseline, from 50 percent to 78 and 87 percent, respectively, and increased the average number of responses, from 2.9 to 4.9 and 5.8, respectively. These results suggest that the Radio Lottery treatment may have induced higher reply rates and number of responses compared to the Radio treatment alone, although the sample sizes are too small to indicate statistical significance. At the very least, the data reveal no significant dampening effect of the extrinsic material incentive on the intrinsic motive. Independent assessment of the quality of responses – compared to the quantity shown here – also suggests no dampening effect. We could detect no discernable differences in the average quality of responses from subjects in the Radio treatment compared to the Radio Lottery treatment.

Figure 1.

Response Rates Across Experiment 1 Conditions. Because all observed and unobserved factors are, in expectation, balanced across experimental treatment conditions, the analysis of experimental data is relatively straightforward and can be displayed simply. Figure 1 displays the proportions for the reply rate – calculated as the percent of registered U-Reporters that replied to at least one poll from UNICEF – for each of the treatment conditions in Experiment 1. Error bars show the 95 percent confidence intervals.

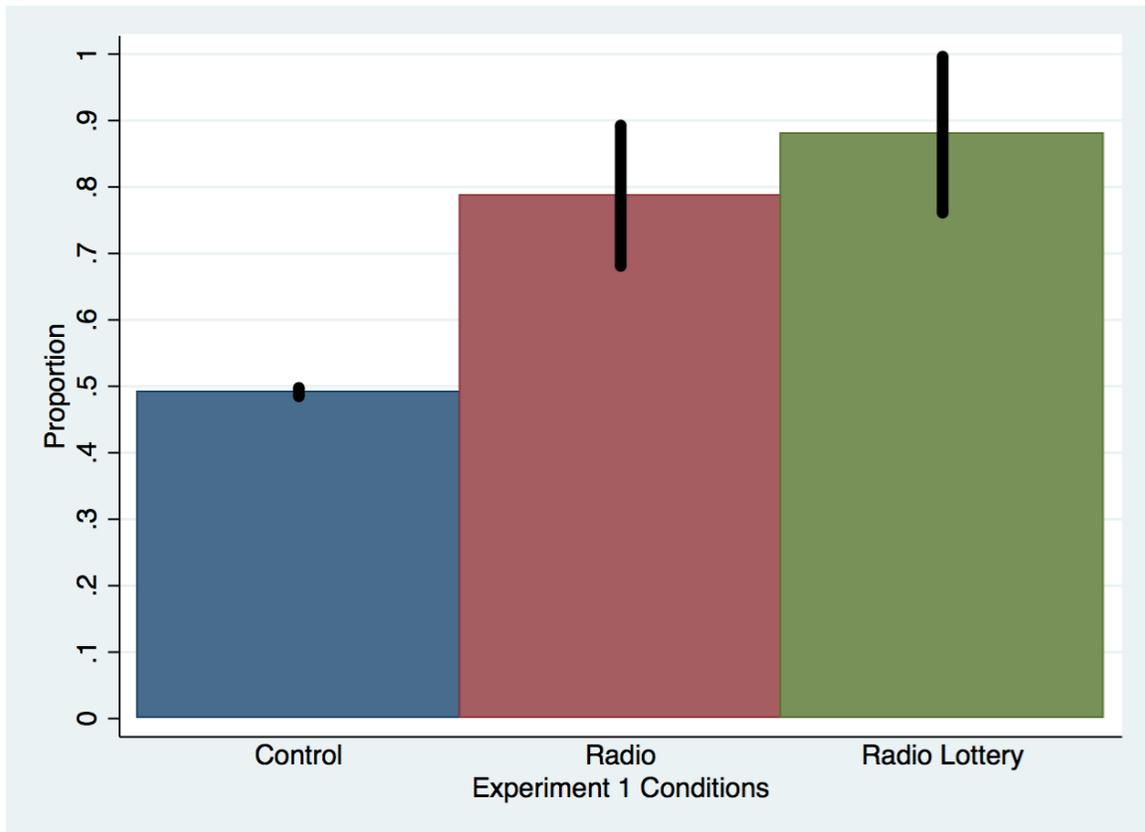
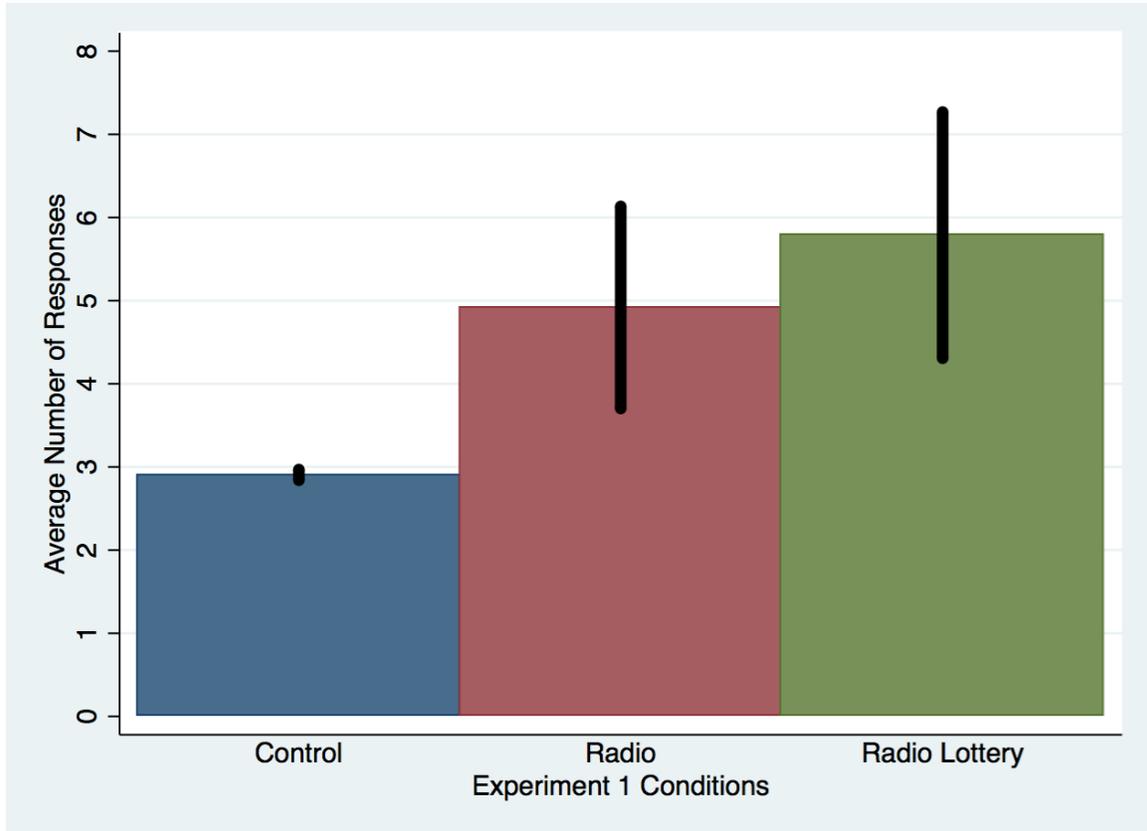


Figure 2.

Average Number of Responses Across Experiment 1 Conditions. Figure 2 displays the mean number of SMS responses to all polls per U-Reporter, for each treatment in Experiment 1. Error bars show the 95 percent confidence intervals.



Experiment 2 compared two social motivations for participating in the U-Report program with an extrinsic material reward: again, the promise of entry in a lottery to win a solar mobile phone charger. These interventions were randomly assigned by district to U-Reporters who had already enrolled in the system. Here, the comparisons of the social and extrinsic motives are in contest. In the first treatment, Human Response ($N = 376$), researchers answered U-Reporters' texts directly, either inviting U-Reporters to augment their responses or nudging them back to the assigned poll topic (26). This treatment was intended to increase both the intrinsic social and reputational social motivation to send reports. Knowing that a real person was reading and responding to the U-Reporters' messages likely increased their feelings of efficacy, and it also invoked social norms to respond as in a conversation.

The second treatment, Response Lottery ($N = 270$), was similar to the Radio Lottery, in that it promoted an extrinsic material incentive. U-Reporters were told that if they answered all poll questions, they would be entered into a lottery for the solar mobile phone charger. The final treatment, Thematic Networks ($N = 317$), explored the "Twitter™ Effect," i.e., the social incentives present in social networks. U-Reporters were invited to join a network focused on a select development topic (such as Health and Sanitation or Corruption – for a full list see Table S1 in the online supplement), and would then be able to send and receive messages within that thematic network. This treatment was also designed to increase the intrinsic social motivation to actively participate in the U-Report system, as U-Reporters connected around a common interest should feel a social pressure to send respond messages. All treatments were compared to a control condition ($N = 23,199$), where no intervention was assigned. Unlike in Experiment 1, the control here is a true experimental control, subject to random assignment.

Figures 3 and 4 and Table S3 (online) display the results for Experiment 2. Again, we find that the extrinsic material incentive to potentially win a solar mobile phone charger in the Response Lottery treatment caused the greatest increases in U-Report participation, boosting both the reply rate and the average number of responses to a significant degree compared to the control. The Human Feedback treatment also caused a significant increase in both the reply rate and the number of responses compared to the control condition. The Thematic Networks treatment appeared to increase only the number of responses to a statistically significant degree.

Importantly, the Response Lottery treatment also caused a significant increase in the reply rate and number of responses compared to the other two treatment conditions ($p < .01$), by a degree of 16.6 to 21.5 percent in reply rate and by 1.52 to 1.82 in response number (Table S3). The Human Feedback and Networks treatments were not statistically significantly different from each other. Achieved in a real-world field setting, the finding that an extrinsic incentive (the Response Lottery) induced more pro-social action than the social treatments, appears to contradict an array of lab experiments in social psychology (11). It is, however, consistent with other field experiments in development economics: small extrinsic incentives appear to significantly improve development outcomes.

Figure 3.

Reply Rates Across Experiment 2 Conditions. Figure 3 displays the proportions for the reply rate—calculated as the percent of registered U-Reporters that replied to at least one poll from UNICEF—for each of the treatment conditions in Experiment 2. Error bars show the 95 percent confidence intervals.

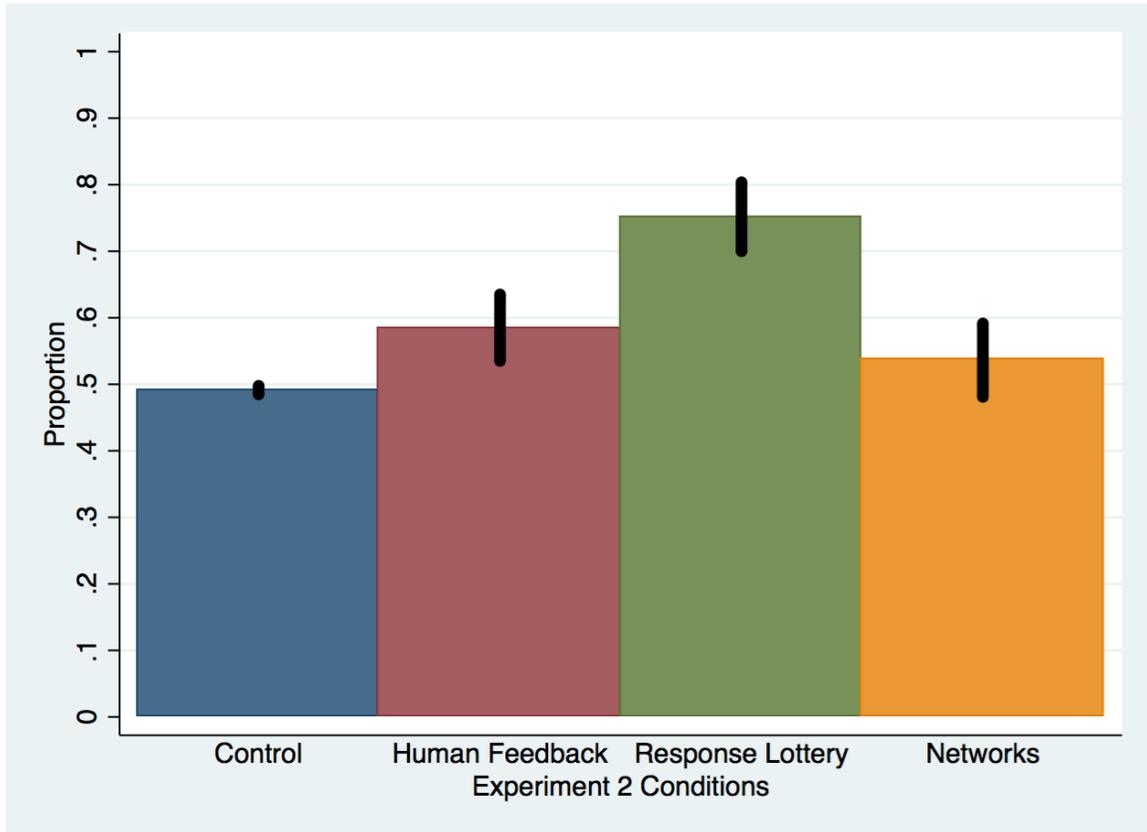
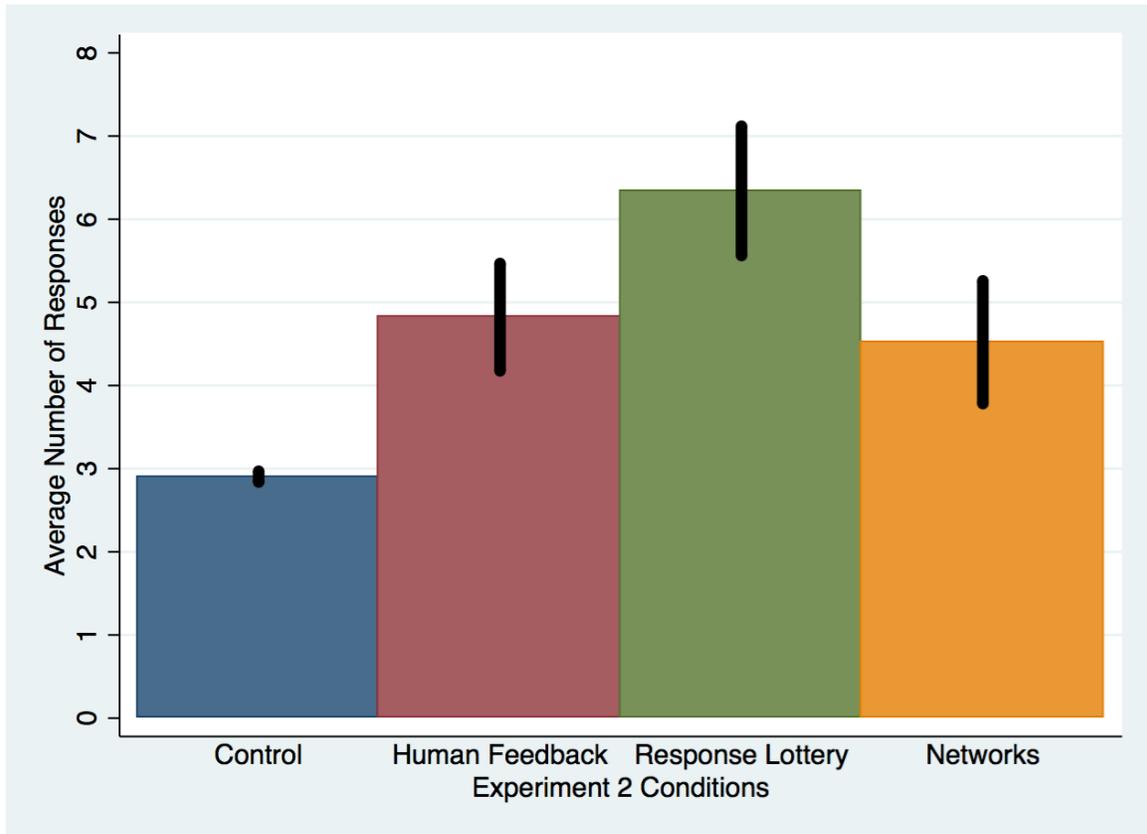


Figure 4.

Average Number of Responses Across Experiment 2 Conditions. Figure 4 shows the average number of SMS responses to all polls per U-Reporter, for each treatment in Experiment 2. Error bars show the 95 percent confidence intervals.



Despite unexpected complications in execution (27), as is part of any field trial, the overall evidence helps clarify the debate surrounding incentives and illuminate the motivations of the crowd. As shown in both Lottery treatments, adding an extrinsic incentive increases both the reply rate and the number of messages received, confirming prior development economics experiments. Contrary to key findings from social psychology, extrinsic incentives display no stifling effect in normal, real-world settings.

The human response treatment also increased replies compared to the control condition. It seemed to matter to U-Reporters that their messages were being read and appreciated and that they valued interacting with other individuals, indicating that social motivations do have an impact. Overall, it appears that social, intrinsic, and extrinsic incentives are all effectual, but extrinsic incentives are the strongest in motivating individuals towards pro-social crowdsourcing behavior.

This report starts to shed light on the crowd's motivations to participate in such schemes. We hope it may be referenced in the design of future crowdsourced monitoring in order to ensure an evidentiary basis for system planning. As the designs improve, we anticipate the effectiveness of the monitoring will also improve. As many scholars and practitioners have argued, improved monitoring should improve development outcomes—helping to repair the broken feedback loop between donors and the crowd on the ground.

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25. More detail on blocking and randomization methods is available as supplementary material on *Science Online*, text 1.
26. We discuss the experimental design and protocol further in text 2 of the supplementary online material.
27. We address the limitations of the study in text 3 of the supplementary online material.

Supplementary Materials for

**Extrinsic, Intrinsic, and Social Incentives for Crowdsourcing
Development Information in Uganda: A Field Experiment**

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This PDF file includes:

Supplementary Online Text

Tables S1 to S3

Supplementary Online Text

1. Description of U-Report Program

UNICEF's U-Report seeks to repair the feedback loop between the government and its citizens, while also linking development project beneficiaries to the project's donors. The system currently uses open-source, RapidSMS technology to engage more than 130,000 U-Reporters in SMS based dialogue, with results posted to the website www.ureport.ug. SMS reports are sent to a toll-free shortcode (8500) that works across all telephone networks in Uganda. U-Reporters use their own, personal phones to participate, and receive no training.

In the earlier phase when this study was completed during July and August of 2011, there were roughly 25,000 U-Reporters using the system. During the study period, all U-Reporters were sent a weekly poll question probing development outcomes in their locales. UNICEF Uganda crafted the questions with the collaboration of several partner organizations, including the Uganda Scouts Association, World Vision, BRAC, and others. These polls were then sent to all U-Reporters. Response rates varied between 15 to 40%, depending on the question. Each poll was usually open for five days. After the poll closed, UNICEF staff aggregated the answers and shared them with the U-Report community via SMS and other media, as well as partners and other relevant parties.

Before this study began, UNICEF and partners had already recruited U-Reporters through several different methods. First, UNICEF publicized the system through the partner organizations. Meetings were held throughout the country to train members of the organizations. These U-Reporters are flagged in the system for the group from which they were recruited. Many of the U-Reporters in the study come from the membership of these partner organizations. Figure 1 displays the breakdown of the number of U-Reporters by partner organizations.

U-Reporters that came from other methods of recruitment are classified under Other U-Reporters. Most of these participants joined during a sustained media campaign, which began in May 2011. Advertisements were run on NTV, a Ugandan television station, and in the *Daily Monitor* and *New Vision*, two nationally circulated English language newspapers. Plans were made for a national radio launch, but it was not executed until after the study period, which enabled random assignment of radio ads in the study, discussed in the main text and below. At the time, the largest share of U-Reporters came from partner organizations, primarily from the BRAC group, which is a young women's association that focuses on micro-finance but also serves a social club for its members. Subsequently, the number of "Other U-Reporters" in the database has grown to numbers larger than those linked to partner organizations.

After recruited individuals texted "join" to the RapidSMS shortcode, the U-Report system asked them a series of registration questions via SMS. This allowed UNICEF to link metadata (such as age and sex) and GPS coordinates (via identifying geographic locations, such as Health Centres, that U-Reporters use) to their phone numbers. This allowed for detailed analysis and disaggregation of data, despite the fact that information was being transmitted via SMS. However, the system could not compel all the registrants to answer the questions, so there were necessarily some holes in the demographic data.

From the information gathered, U-Reporters in July of 2011 were predominantly female; 27 percent of them were male. The heavy recruitment among BRAC membership created this demographic imbalance. U-Reporters in the study were also young. The average age was 23.8 years, and 96 percent of Ureporters were between the ages of 18.6 and 29.0 years old. While Uganda has one of the youngest populations in the world with a median age of 15 years, U-

Reporters were nevertheless skewed toward young adults. As a consequence, we emphasize that the U-Report community does not represent a random sampling of all Ugandans, nor are the results of polling necessarily representative of the larger population.

Grassroots monitoring by concerned community members may be one of the keys to improving development outcomes. “U-Report is a game-changing application,” said Sharad Sapra, UNICEF Uganda Country Representative in March 2012. “Not only for Uganda, or for UNICEF, but for improving all development agencies’ and NGOs’ ability to assess progress in processes aimed at achieving various development indicators.” For UNICEF, it enables us to harness community information for level-three monitoring so we can judge the effectiveness of our programs in meeting identified needs. It also engages our aid beneficiaries in monitoring programme progress.

Since the period during which this research was conducted, U-Report has embraced many of the key findings found in this report, including broadening its use of media to disseminate information back to core constituencies and conducting localized, real-time discussions on key topical areas (such as an outbreak of Nodding Disease in Northern Uganda) between government, development partners and community members. As a result, U-Report has seen dramatic uptake across every part of the country, with during the last six months approximately 300-500 new U-Reporters joining every day.

With U-Report’s success in Uganda, this initiative is now being taken up by UNICEF’s Executive Director, Anthony Lake, as a key intervention for global scaling. “This is not simply about youth being able to communicate with each other,” Mr. Lake said of the U-Report system in April 2012. “This is about their becoming a virtual community that really is changing lives all around Uganda.”

2. Experimental Design

Blocking Procedure

Before randomly assigning the conditions, we employed a blocking procedure in an attempt to balance covariates across experimental units. We used the official Ugandan administrative districts as the units of randomization because covariate data at the district level provided the most disaggregated information that was also the most complete. We constructed the treatment blocks based on the penetration of cell-phone technology; the reach of the U-Report system; and an index combining income, health, and education levels.

The measure for penetration of technology was a binary variable equal to “1” if the cellular provider Orange had placed a tower in the district, “0” otherwise. Orange is a high-quality mobile phone provider in Uganda that possesses a virtual monopoly on mobile Internet in the country, but it has not yet placed towers in every district, and so it provided a good indicator of the degree of technological penetration throughout the country. The reach of the U-Report system was measured with the number of U-Reporters in the district. We again created a binary variable if there were more (= “1”) or less (= “0”) than 100 U-Reporters in the district. Finally, a binary variable for high (above the mean) or low (below the mean) human development was created through factor analysis. In the index we included the number of health clinics, malaria rates, enrollment rates, primary-school passing rates, and total population for each district.

These three binary factors created eight groupings of districts. Because the eighth stratum included too few districts to receive an array of treatments, we dropped it from consideration. We therefore assigned the experimental conditions randomly within the seven remaining strata. We designed two experiments to probe the effects of extrinsic and intrinsic incentives to participate in U-Report.

Experiment 1

Radio Advertisement Treatment

The first treatment called for a thirty-second radio advertisement to be played five times a day for five days in assigned districts. This radio spot advertised U-Report and invited listeners to sign up to be citizen monitors, or U-Reporters. The UNICEF Uganda communications department crafted the radio message and matched the targeted radio stations to the assigned treatment districts.

Because radio signals cannot be fully isolated geographically, the treatment areas took in broad regions involving the randomly chosen district, the three additional districts where the stations’ signal is strongest, and all other districts that share a common border with the selected four. Care was taken to verify that the randomly-assigned radio districts did not overlap the radio lottery districts and that there were broad regions of the country untouched by the ads.

Also, to further isolate conditions, the two treatments were staged temporally, with the Radio treatment occurring over a five-day period, followed by a three-day period with no Ureport radio ads anywhere in the country, followed by a five-day span with the Radio Lottery ads. The only way to verify that the targeted stations produced uptake of U-Report in the randomly assigned districts is to look for clusters of new U-Reporters in the assigned districts during the treatment periods. Such clustering indeed occurred in both the Radio and Radio Lottery districts and was largely absent in the control districts, suggesting that the randomly assigned targeting had its intended effect. A transcript of the radio spot is provided below.

“**Voice one:** This water is dirty. It’s not safe.

Voice two: So why don't you report it?

One: To where?

Two: To U-Report.

One: What is that?

Two: It's free SMS that allows you to speak out on what is happening in your community.

One: Who's it for?

Two: For young Ugandans.

One: How do I join?

Two: Just SMS the word "join" to 8500. It's free. U-Report voice message."

The advertisement completes three tasks. First, it explains the U-Report premise, which is that there are issues in local communities that need to be reported to someone and asserts that young people should "speak out on what is happening" in their neighborhoods and villages. Second, it introduces the system. Third, it explains how to join. There is no extra incentive or explanation to join other than the system's premise, which encourages participants to "speak out on what is happening in your community." This captures the intrinsic motivation to perform a pro-social activity.

Radio Lottery Treatment

The second treatment supplements the existing radio advertisement with a lottery. This treatment also occurred over five-day period in additional districts that were likewise randomly assigned. After transmission of the content of the intrinsic-motivation ad, an additional message was appended that promised to enter all newly registered Ureporters in a lottery to win a solar mobile phone charger. The addition stated: "Sign up now and you will be entered into a lottery to win a *free* Solar Charger! Register today! There is no age limit. Individuals may only enter once. Multiple entries will result in disqualification. Winners will be contacted by 12th August 2011."

The Radio Lottery treatment thus combines the intrinsic motivation contained in the Radio treatment with an extrinsic, material incentive. Of course, subjects are not guaranteed that they will receive the charger but merely are promised a chance to win in a lottery. So, in this sense, the Radio Lottery treatment is a much weaker material incentive than a direct cash payment or other guaranteed non-cash prize.

Of course, as is often the case with elaborate field experiments in developing countries, the procedures do not always work as planned. The Radio and Radio Lottery advertisements were broadcast as designed in the treatment districts, but the U-Report system itself experienced two malfunctions that shut down the receiving system during one day of the Radio treatment and three days of the Radio Lottery treatment. Thus, the subject pools for both treatments are smaller than anticipated. Nevertheless, as far as we can determine, these omissions occurred at random and should still allow for relatively straightforward interpretation of the results (albeit with more uncertainty given the small samples).

Experiment 2

Human Feedback

In the first treatment in Experiment 2, researchers answered U-Reporters texts directly, either inviting U-Reporters to augment their responses or nudging them back to the assigned poll topic. We first divided U-Reporters from the selected districts into ten subgroups. A researcher

was assigned to each of the subgroups. Upon assignment to the condition, the assigned researchers introduced themselves by text to the U-Reporters. After introducing themselves as the UNICEF partners that would be reading and responding to the U-Reporters through SMS, researchers read and responded to every SMS that arrived from their subgroup members. The Uganda Scouts Association provided American researchers with cultural information as well as other assistance while completing this treatment. On average researchers responded to texts twice per week.

Research assistants followed a simple protocol when responding to messages. If the message concerned the week's poll question, research assistants thanked the U-Reporter for the contribution and sought additional information on the topic. For example, if the week's poll asked in which grade students in the U-Reporters' locale typically drop out of school, the researcher would follow up with a U-Reporter answering, say, that grade seven was the common the dropout year; researchers would inquire why students drop out in primary seven. If the message was off-topic for the week, the research assistant nudged the U-Reporter back to the topic.

Finally, in less than five instances during the treatment's month-long application, researchers received a Ureport about a serious situation that was outside of the scope of the week's poll. In these situations, research assistants sent a response, explaining that the system was a "social monitoring" service and referring the U-Reporter to an institution, usually an NGO, that works in the area of interest. Overall, the human response focused on indicating that an actual human being was reading and responding to the messages, increasing feelings of efficacy (an intrinsic motive) and invoking social norms of conversation (a reputational incentive).

Response Lottery

As in the Radio Lottery treatment, we executed an additional treatment condition probing the effects of an extrinsic material incentive. U-Reporters assigned to this condition were asked to answer all poll questions and, if they fulfilled the condition, were promised that they would be entered into a lottery to win a solar charger. After two weeks, the U-Reporters were reminded of the incentive.

Thematic Networks

In the final treatment we created several social networks through SMS and allowed U-Reporters assigned to the treatment to select the topic they would like to discuss by SMS with other interested U-Reporters. In societies that actively use TwitterTM, hash tags connect people so that they can exchange information on similar interests. This treatment was intended to create a similar effect. We sent a message to U-Reporters in selected districts, inquiring if they were interested in a list of topic areas. Topics included health and sanitation, education, corruption, gender issues, HIV/AIDs, and child protection. From these messages, thirteen groups were formed around topic interests and geographic areas. Table S1 lists the SMS groups.

We expected that this treatment would also increase the intrinsic social motivation to actively participate in the U-Report system. When U-Reporters are connected around a common interest, they should feel a social pressure to send in messages. It should be noted that this treatment potentially created a selection bias. U-Reporters who agreed to participate in the groups were arguably already more likely to respond to the weekly polls. Therefore, we considered all U-Reporters in the assigned districts when performing the statistical analysis, not simply those who joined the networks. Most U-Reporters in these districts chose not to

participate in the groups. Nevertheless, the invitation to participate in these digital groups may have sparked increased interest in the system.

3. Some Limitations

During the execution of the experiment, several technical irregularities occurred. We discuss these irregularities to be fully transparent, but we do not believe that any of them compromised the validity of the study. Usually the U-Report system sends an automated thank you message after receiving any response. During the first two weeks of the Human Feedback and SMS group treatments, the U-Reporters received automated responses after every submission to the system. This irregularity may have most confounded the human feedback treatment. U-Reporters in these groups received the automated message and the human response. However, based on the message log the U-Reporters appeared unaffected by the double response. They seemed to ignore the automated messages, so this technical problem appeared not to affect the validity of the treatment.

Another technical problem affected the groups included in the treatments. The system was unable to display the message history for U-Reporters who were part of the BRAC group or reach them with the treatment conditions. Therefore, BRAC members were removed from the primary analysis. We did, however, consider this missing BRAC group in a robustness check assessing the “treatment effect on the treated” where the results were adjusted to account for the failure to treat the BRAC group. This robustness check produced qualitatively similar findings to those reported.

Table S1.

Thematic Network Topics

Topic	Location
Health & Sanitation	Ntoroko & Kibaale
Health & Sanitation	Hoima
Corruption	Hoima
Corruption	Kibaale
Corruption	Kubuku
Child Protection	Hoima
Child Protection	Kibaale
HIV/AIDS	Hoima
HIV/AIDS	Kibaale
Gender Issues	Hoima & Ntoroko
Gender Issues	Kibaale
Education	Hoima
Education	Kibaale

Table S2.

Experiment 1 Results. Table S2 displays the cell sizes, proportions, and significance levels for the reply rate and number of responses across all three conditions.

Condition	N	At Least One Reply	Reply Rate	Difference in Reply Rate from Control	Average Number of Responses	Difference in Number of Responses from Control
Control	23199	11399	49.1%		2.90	
Radio	61	48	78.7%	29.6%***	4.92	2.01***
Radio Lottery	33	29	87.9%	38.7%***	5.79	2.88***

Significant in difference of means test: *.1, **.05, ***.01

Table S3.

Experiment 2 Results. Table S3 displays the cell sizes, proportions, and significance levels for the reply rate and number of responses across all four conditions.

Condition	N	At Least One Reply	Reply Rate	Difference in Reply Rate from Control	Average Number of Responses	Difference in Number of Responses from Control
Control	23199	11399	49.1%		2.90	
Human Feedback	376	220	58.5%	9.4%***	4.82	1.92***
Response Lottery	270	203	75.2%	26.0%***	6.34	3.44***
Thematic Networks	317	170	53.6%	4.5%*	4.52	1.62***

Significant in difference of means test: *.1, **.05, ***.01