Power to the Peers: Authority of Source Effects for a Voice-based Agricultural Information Service in Rural India

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ABSTRACT

Online communities enable people to easily connect and share knowledge across geographies. Mobile phones can enable billions of new users in emerging countries to participate in these online communities. In India, where social hierarchy is important, users may over-value institutionally-recognized authorities relative to peer-sourced content. We tested this hypothesis through a controlled experiment of source authority effects on a voice-based agricultural information service for farmers in Gujarat, India. 305 farmers were sent seven agricultural tips via automated phone calls over a two-week period. The same seven tips were each voice-recorded by two university scientists and two peer farmers. Participants received a preview of the tip from a randomly assigned source via the automated call, and played the remainder of the tip by calling a dedicated phone number. Participants called the follow-up number significantly more often when the tip preview was recorded by a peer than a scientist. On the other hand, in interviews conducted both before and after the experiment, a majority of farmers maintained that they preferred receiving information from scientists. This stated preference may have been expressing the more socially acceptable response. We interpret our experimental results as a demonstration of the demand for peer-based agricultural information dissemination. We conclude with design implications for peer-to-peer information services for rural communities in India.

Categories and Subject Descriptors

H.5.2 [**User Interfaces**]: Voice I/O User Interfaces; H.5.2 [**User Interfaces**]: Evaluation; H.1.2 [**User/Machine Systems**]: Human Factors

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Figure 1: In this experiment, tips from farmers (left) and scientists (right) were alternately sent to rural Indians through automated phone calls. After hearing the tip, subjects were presented the option to hear more information by calling a phone number. An experiment captured how many follow-up calls were induced by farmers versus scientists.

General Terms

Human-Computer Interaction

Keywords

authority, source, peer, India, rural development, agriculture, online community, dissemination, mobile

1. INTRODUCTION

Indian society has been noted for the prominent role that hierarchy plays in society [6], leading to a tendency to defer to authorities [21]. This deference effect has been demonstrated in a range of scenarios, from the workplace [24] to family life [11]. As broader segments of the population come online, many of them via mobile phones, this social dynamic could also play out online. In contexts that include information sources from all social strata, norms that place pressure to defer to authority figures may lead people to over-value authority sources relative to peer-sourced content.

India has also been characterized as a collectivist culture [26], which has a rich legacy of cooperation and sharing through peer networks. These values are also found within many online communities. Peers have been demonstrated to be a scalable, accessible, trusted and locally relevant source

of knowledge [13]. Earlier work demonstrated that farmers who were provided access to a voice-based information forum for agriculture engaged in rich exchange, and found the information provided highly relevant [16]. However, while farmers enjoyed hearing the questions and experiences of other farmers, most gave a *stated* preference for receiving advice directly from authorities.

This paper investigates how the authority of an information source affects the likelihood that farmers will follow up on the information. In a controlled experiment (see Figure 1), 305 users of Avaaj Otalo forum were called with seven farming tips recorded by two types of sources: peer farmers and scientists from local agricultural universities. To isolate the effect of the source's authority on participants' subsequent actions, the tip content itself was held identical across sources. After a brief introduction from the source, they heard a preview of the agricultural tip, and were told that they would be able to hear the conclusion of the tip recording if they hung up and dialed another number. Participants chose to call back and listen significantly more frequently when the tip was recorded by a peer farmer. Still, farmers continued to state in interviews before and after the experiment that they preferred receiving information from authorities. The stated preferences may have been biased by the fact that the interviewers were perceived as authorities, leading participants to provide a more socially desirable answer. The results indicate the demand for peer-based information dissemination.

1.1 Authority in Indian Society

Some have described social hierarchy as a deep-rooted feature of Indian society [6, 2, 14]. Researchers have observed a "deference syndrome" in the Indian work environment, in which subordinates go against their own better judgement and struggle to express views independent of their boss' [24]. While these observations could have come from any work environment, deferential behavior in India may be especially strong. One study of Indian and American college-age individuals found that Indians adjusted their choices in deference to authorities, even while the decisions went against personal preference, and even when the subject was told that the authority would never know about the decision; Americans, by contrast, did not [21]. In another context, researchers found that videos featuring local high-status or authoritative individuals can be highly effective for persuading healthy practices in villages [19, 15].

While hierarchy is influential, Indian society also has a strong culture of peer-to-peer exchange, rooted in a group orientation [26, 22]. The Honey Bee Network has demonstrated that there is a significant supply of, and demand for, local knowledge and information to be shared amongst [9]. Digital Green found that including peer farmers in videos of new practices led to increased likelihood of adoption [8]. When compared to authorities, peers can more easily establish common ground because they "speak their language". A nation-wide survey by the International Food Policy Research Institute in 2005 found that "other progressive farmers" were the most popular source of information on agricultural technology. Traditional authority sources (agencies, technicians, NGOs) were at or near the bottom of the list [3].

1.2 Information Processing and Culture

Some information processing practices have been shown to vary by culture. For example, studies have found that people in different cultures pay attention [12] and incorporate [10] different contextual information. The elaboration likelihood model (ELM) was developed by social psychologists to explain how people process various cues while processing information [18]. The ELM differentiates between systematic information processing, forming attitudes based on the intrinsic strength, quality, or persuasiveness of the message; and heuristic processing, where they rely on heuristics like "authorities should be trusted", "long messages are valid messages", or "majority opinions are usually true" [4]. The ELM predicts that people will resort to heuristic processing in "low-involvement" situations, where they are not highly personally vested in the outcome.

The applicability of ELM can be influenced by cultural norms. An ELM experiment investigating the effects of race of information sources found that white American subjects were systematically processing messages in a low-involvement situation when the source of the information was black. In other words, where the ELM would predict that white participants would not pay attention to the content of the message in forming an opinion, they were doing so if and only if the source was black [27]. A follow-up experiment concluded that white participants were strongly motivated to attend to the black source to avoid being perceived as racist [27].

2. EXPERIMENT DESIGN AND METHOD

2.1 Background

An earlier field study showed that 65% of Avaaj Otalo users expressed a preference for receiving answers exclusively from DSC staff and scientists. The remaining 35% of respondents wanted both authority and peer responses; none said they preferred information only from peers [16]. Participants stated that DSC's experts had a greater breadth and depth of knowledge than peers, were more articulate, and that "scientific" knowledge is more reliable than "experiential" knowledge. The prevailing sentiment seemed to be that farmers were not reliable, or even capable of, contributing high quality responses:

> [Only] when these other farmer's questions will be answered by an expert, then I will get to learn from [answers]. Farmers don't know everything, right? What most of what the farmers talk about is common knowledge to us. So I am interested in listening to what the experts say about the questions on Avaaj Otalo.

After the pilot, DSC recruited staff members and scientists from local agricultural universities to participate as "expert" responders for the service. No farmers were targeted in this recruitment. In discussions with DSC staff, they indicated that staff and scientists would be best suited to provide high-quality, accurate advice. DSC's weekly radio program and quarterly newsletter already routinely profiled farmers, highlighting their innovations. DSC's reluctance to include expert farmers as experts was largely based on logistical concerns, including the complexity of managing a larger and more distributed group of experts. But many DSC staff also shared farmers' lack of faith in farmer-provided advice.

2.2 Research Question and Hypothesis

Farmers' stated preference for information from authorities may be a reflection of underlying social norms favoring authorities. On the other hand, many farmers may also not have had prior access to a consistent, high-quality source of peer information. We wanted to determine whether rural Indian farmers would engage equally with information from their peers, if it could be provided with the same quality and consistency as information from experts. To do this, we designed a controlled experiment to answer the following research question:

Given the same informational message, are rural Indians more influenced by the information if it comes from an institutional authority figure, compared to a peer?

Prior field and experimental research [21, 16] suggested the following hypothesis:

Rural Indian farmers are more likely to act upon information presented by an authority than by a peer.

2.3 Participants

Participants were recruited from a pool of 1,014 phone numbers that had called Avaaj Otalo at least once during the prior nine months. Two paid assistants fluent in Gujarati and familiar with Avaaj Otalo recruited participants over the phone over a two week period. Participation in the experiment was introduced as as an opportunity to participate in a trial of a new service, Avaaj Otalo Margdharshan Seva (literally, "Avaaj Otalo's Direct Information Service").

Farmers were told that AO Margdharshan would provide them with recorded agricultural tips delivered via automated voice phone calls from the Avaaj Otalo phone number. Participants were told that the tips would come from farmers and scientists across the state associated with DSC. After hearing the description, farmers were asked if they wanted to subscribe, at no cost to them. If they agreed, basic demographic information was collected and their number was included in the trial. All farmers who agreed to participate were accepted into the study.

N	305
Number of Districts	20 (of 26 in Gujarat)
Age	33 (mean), 30 (median)
Farm Size	10 acres (mean), 7 acres (median)
Education	8th Grade (median)
Grow Cotton?	60%
Other Crops	Peanut, millet, lentils, sesame, beans, corn, castor seed, cumin, mustard, tobacco, wheat, rice (of 26 grown in the state)
Keep Animals?	96%

Table 1: Subjects by demographics.

Basic information for these participants is shown in Table 1. Most participants were small or marginal farmers; all were male since the original pool led to only male callers. Most of the districts and crops grown in the state were represented. 28 users participated in a pilot designed to validate our scripts, that the voice interface was usable and that the information provided was relevant. The analysis below is based on data from the remaining 277 users. After the study, DSC mailed all participants a booklet with all of the tips in full, along with supplemental farming-related articles and DVDs, as a thank-you gift.

	Tip1	Tip2	Tip3	Tip4	Tip5	Tip6	Tip7
Grp1	S1	S2	P1	P2	S1	P1	S2
Grp2	S2	S1	P2	P1	S2	P2	S1
Grp3	P1	P2	S1	S2	P1	S1	P2
Grp4	P2	P1	S2	S1	P2	S2	P1

Table 2: Subjects were randomly assigned one of the four tip schedules specified above. The tips assigned all tips to all sources equally. The tips sources alternated between peer (P1,P2) and scientist (S1,S2) sources.

2.4 Study Design

The experiment was conducted entirely over the phone. Each participant received 7 tips in the same order, and received an even spread of tips from each of the four sources (two farmers and two scientists). Participants were randomly assigned to one of four tip schedules (see Table 2), counterbalancing tips and sources to achieve an equal number of every combination.

2.5 Study Materials

The phone calls for the experiment were executed over an ISDN primary rate interface (PRI) line connected to a commodity Unix server. PRI lines support up to 30 simultaneous calls, and a single line can map 90 distinct phone numbers. We recorded and assigned a distinct phone number to each tip-source combination (7 x 4 = 28), logging the identity of each inbound call to count the number of follow-ups.

The tips and the previews themselves were developed by agricultural staff members at DSC, and were reviewed for accuracy by outside scientists. The tips were designed to be factually accurate, clearly articulated, offer practical information and relevant for a wide range of farmers. It was also important that the tip content would be equally plausible coming from either a scientist or a farmer. To achieve this, DSC staff members recommended using "farmer-friendly language", which is colloquial, playful, and avoids technical jargon. Two tips dealt with cotton, which is grown by a large portion of Gujarati farmers. Two other tips dealt with animal husbandry, which is relevant to nearly all farmers, as most keep animals for home dairy consumption, manure, and/or labor. The other 4 tips discussed disease management, orchard promotion, drip irrigation, and soil testing. An appendix provides the original Gujarati and English translations of the tips.

We recorded two different speakers for each source type to mitigate individual effects. The scientists were both retired professors; one from soil science, the other from agronomy. Both were in their 60s and had prior experience recording scripted agricultural messages for radio programs. The farmers were from two different districts in Gujarat. Both had attended DSC-organized events in the past. One was in his 50s, farmed 3 acres of land, and had been formally schooled to the 10th grade. The other was in his mid-20s, farmed 1 acre, and was also schooled until the 10th grade.

The four selected individuals had no prior official designation within DSC, or within the Avaaj Otalo service. The tips were recorded in quiet office spaces, using a Macbook Pro's built-in microphone. We asked the sources to study and practice each tip carefully before recording to ensure a smooth delivery. We also asked them to internalize the message as if they had generated the tip themselves. The tips were re-recorded when a speaker misspoke, stuttered, or wasn't otherwise natural in his delivery.

2.6 Procedure

The original automated call provided background and motivation for a topic, but was limited to a problem statement or high-level description of a prescribed practice. To learn the full solution, including implementation details, participants could learn more information by calling the provided phone number. The AO Margdharshan "system" voice interface was similar to the Avaaj Otalo service participants had previously used. If the participant placed a return phone call at their own expense it provided a real-world measure of the participant's assessment of original message's value. While adoption of the advice is the theoretical gold standard for influence, this approach allowed us to test our hypothesis within a reasonable timeframe and budget.

Figure 2 shows the structure of the automated phone calls used for the experiment. Each call begins with a welcome prompt reminding the user about the service and emphasizing that the tips come from scientists and farmers from across the state of Gujarat. The tip source then introduces himself. Farmers spoke their names and location: village, block, and district. Scientists spoke their name (preceded by the title "Doctor"), university affiliation, and introduced themselves as retired professors. Next, they recited the tip, ending with instructions on how to follow up for more information by calling the provided phone number. We marked the initial call as complete if it stayed connected to this point. After that, the source re-stated their name to sign off. This repetition, along with limiting farmer introductions to simply name and location, was intended to create a strong authority manipulation. Finally, the system repeated the follow-up phone number and provided the option to listen to this message again. This prompt repeated automatically three times before the call self-terminated.

The seven tips were sent to subjects over the course of two weeks, with a new tip every two days. Twenty-eight participants were randomly selected to pilot the experiment. The pilot confirmed that most of the phone calls were indeed being received and completed, and that the follow-up rate was within an acceptable range for data analysis. Pilot participants also responded that that the tips were useful, credible, and that the callback procedure was convenient and affordable. Based on this satisfactory feedback, calls for the remaining 277 participants were scheduled. We began with an initial reminder call about AO Margdharshan, urging subjects to pick up the following calls from this number and listen to tips carefully. The seven tips were then delivered over a two-week period according to the assigned tip schedules.

3. RESULTS

Out of 1883 total attempts to contact the 277 participants, 1316 (70%) calls were successful, with the person who picked up listening to the full tip preview and instructions at least one time through. 72 out of 667 (10.8%) successful calls from a peer farmer source resulted in a follow-up. For the scientist-recorded tips, 53 out of 649 (8.2%) successful calls resulted in a follow-up. We analyzed the data using logistic hierarchical models, treating tip calls as nested within participants. This analysis accounts for dependencies in response likelihood within each farmer, since some farmers might be more likely to respond to any given tip than other farmers. At the same time it assesses the impact of the experimental manipulation on response likelihood [20]. A dummy variable indicating whether participants called back in response to the tip was the trial-level dependent measure; the source of the message was the trial-level predictor variable. There was a significant effect of source indicating that farmers were significantly more likely to call back after hearing a message from a peer than from a scientist (log odds = - .47, odds ratio = .64, z = 2.08, $p < 0.05$, see Figure 3). Follow-up logistic HLMs confirmed that the two peers elicited a similar rate of response (log odds = -.10, odds ratio = .90, z = 0.35, p = .73), as did the two scientists (log odds = .34, odds ratio = 1.40, z = 1.04, p = .30).

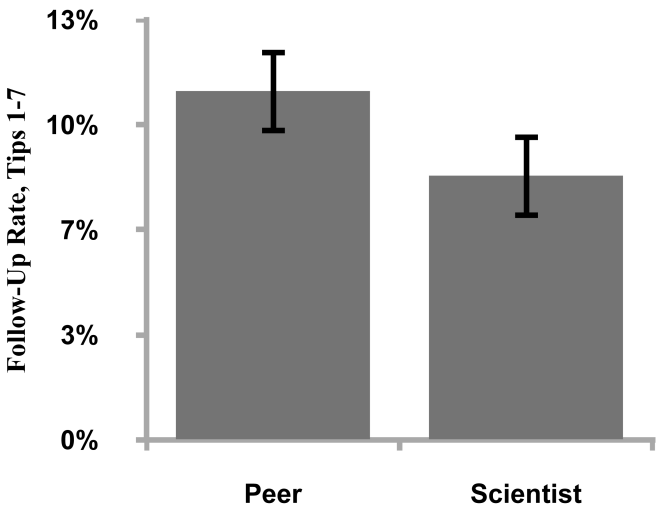

Figure 3: Aggregate follow-up rates by source for all tips.

3.1 Follow-ups by Age, Farm Size, and Education

Logistic HLMs also showed that participants' age did not predict their likelihood of calling back, nor did it influence the difference between the peer and expert conditions. The size of their farmland also did not predict their likelihood of calling back, nor did it influence the difference between the peer and scientist conditions. Farmers with more education (eighth grade education or higher) were significantly more likely to call back in response to the tip (log odds = .122, odds ratio = 1.13, z = 2.26, $p < 0.05$), and were marginally more responsive to peers than to scientists (log odds = -.115, odds ratio = 0.89, z = 1.75, p = 0.080). To explore this interaction further, we split the data by median education

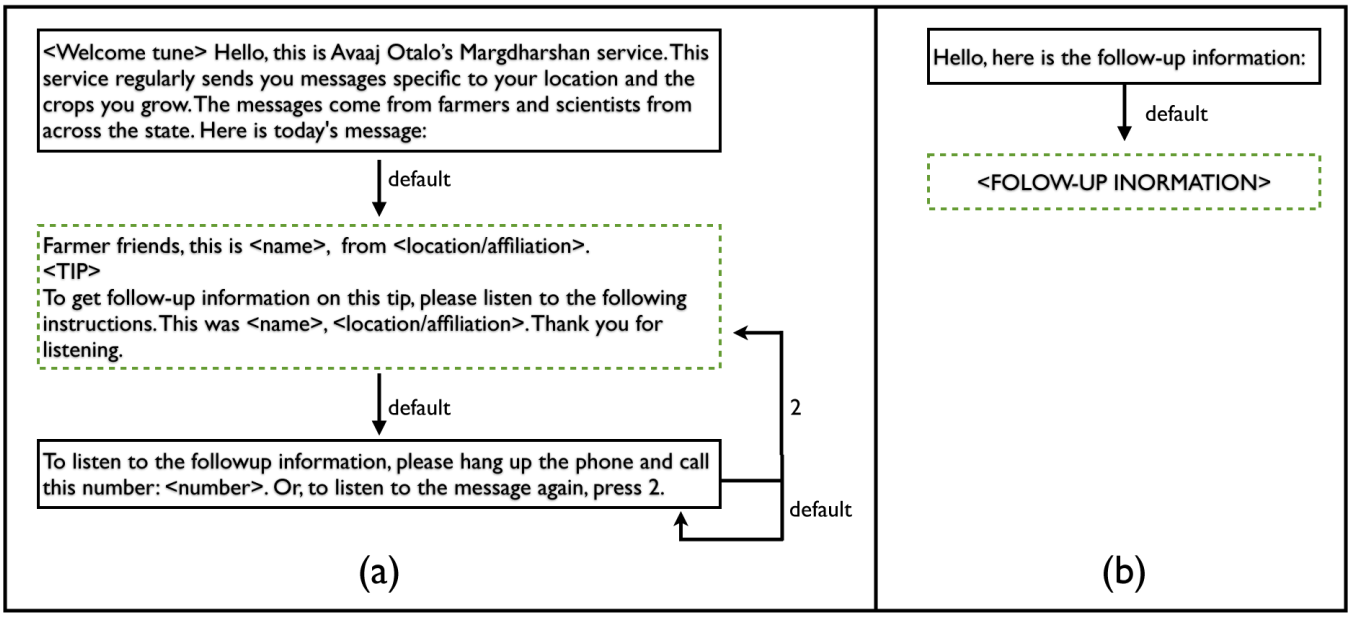

Figure 2: The prompt flows for the inbound tip (a) and outbound follow-up information (b) phone calls. The solid boxes contain prompts spoken by a voice representing the AO Margdharshan Seva tip service, and the dotted boxes are the voices of either the peer or authority source. The voice on a tip would be the same voice heard on the corresponding follow-up call.

and found that whereas farmers with less then eight years of education were equally likely to respond to peers and scientists, farmers with more education were significantly more likely to respond to peers than to scientists (log odds = -.99, odds ratio = 0.37, z = 3.32, p = 0.001, see Figure 4).

3.2 Post-Study Interviews

Starting one week from the end of the study, 34 randomly selected participants were interviewed over the phone using a semi-structured protocol. The interview was conducted in Gujarati by a native speaker. At two different points in this protocol, participants were asked to state whether they preferred to receive information from scientists or from peers. 42% explicitly stated a preference for scientists, 19% for farmers, and 39% said that either they have no preference, or that both are preferable. On the other hand, 26% of interviewees were able to recall some detail about the identity of at least one of the farmer sources (such as name or where they were from), compared to 13% recollection for the scientist sources. The sample was too small for these differences to be significant.

Those in favor of farmer information cited their practical knowledge and ability to speak from experience:

> I usually go by my experience and when farmers talk about their experiences I like that better. We have spent most our lives farming so naturally I would like information from farmers.

> Advice from farmers is important as they have local information. Different areas have different crops so local experience is important. Scientists have to discover or invent new things in order to give advice. Farmers have experiences every 10-15 days which they can talk about. Scientists take longer to do their experiments and get their results.

> [I prefer information from] farmers, because they are experienced. I can give you any information because I am experienced... without experience how can I give you advice? This is farming, anything can happen, whether it rains or floods is in the hands of God. Such situations can only be handled by an experienced person.

Several respondents said they preferred information from peer farmers because they spoke in a more understandable language (despite the tips being provided in the same language for both):

> Information given out by farmers is more clear. Scientists will not be able to explain clearly like ordinary farmers. Farmers talk in our language.

> When farmers give the message I feel that I can understand, but when scientists speak it is difficult as they speak differently. I like the farmers as they talk in a simple language. Maybe the information from the scientists is better but I can't understand their high-level language so what's the point of listening to them?

At the same time, farmers appreciated that information coming from scientists was backed by the latest facts and more rigorous experiments:

> I trust scientists and authorized people more as they are dependable. Farmers do trial and error which is not very dependable.

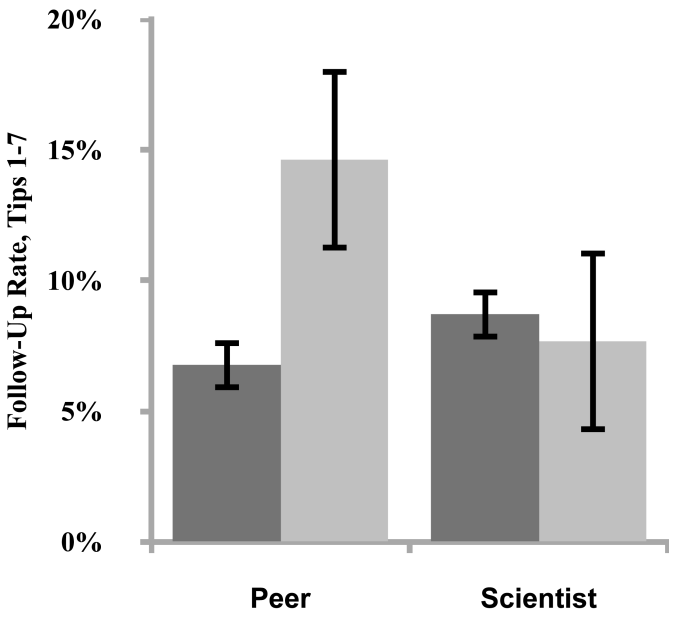

Figure 4: Follow-up rates for each source, split by level of education. More education participants followed up significantly more when tips came from peers.

> I think scientists give better information. These days agriculture and farming have become a very scientific process.

A notable number of interviewees found information from both sources valuable. These participants added how the theoretical knowledge of scientists and practical, experience-based knowledge of farmers were complementary to one another:

> Both [provide good information], as scientists give information which they get from their lab experiments and farmers speak of their actual experience.

> [I value] both, as a farmer is also a type of scientist as he has real life experiences.

> I would prefer messages from those people who have tried it and done things practically. Scientists conduct experiments and get results and farmers also have actual experiences. So information from both of them will prove to be useful.

3.3 Enthusiasm for the Service

Interviews also provided other feedback about what participants liked and didn't like about the service, whether the tips were useful, and any other issues or concerns they faced. The service was generally received enthusiastically, with many reporting that the quality and practical usefulness of information provided was its best aspect.

> The information is very useful and was delivered in a timely manner. Animal rearing information was especially useful. When I got the first call I thought the service wouldn't be [very] useful but I changed my opinion as more information came through the subsequent calls.

For one illiterate participant, the service was useful enough to go to significant lengths to keep track of the various callback numbers:

> Yes, I had no problems listening to the message. In fact I have been waiting eagerly for these phone calls for many days. The service seems to have stopped since few days, why is that? I used to write the number on the phone and ask someone to type in the numbers as I am illiterate and cannot recognize letters. I sometimes assign a character to every phone number so that I recognize that it is from that particular person. In fact I saved [AO's] number that way when you had called me previously, so this time when you called I knew it was you. I store very few numbers so this system works.

The most common complaint from participants was that the full informational message was not provided in a single call, requiring them to use airtime for the follow-up call:

> The information in the message is not complete and we have to call the number which we get charged for. I have made several calls and I have lost fifty to sixty rupees credit in getting this information.

44% percent of interviewees mentioned that the cost of the outbound phone call factored into their decision of whether to follow-up. Several participants reported that they wanted to call back, but were either concerned about their airtime balance, or didn't keep any balance at all, using their phone only for inbound calls. Few reported difficulty in recording the callback phone numbers, which was done either with pen and paper or by entering the number directly on the phone.

Some callers not included in the original recruitment also called the follow-up numbers (these callers are not included in the data analysis). These farmers had gotten the numbers from a friend or relative who was a participant. Interviews also revealed that participants were using call recording facilities built into their phones to store the tips, later playing the tips for friends, family, or for themselves.

The enthusiastic response to AO Margdharshan Seva prompted DSC to retain it as a regular service after the study, with tips recorded mostly by staff members, and farmers permitted to record responses.

4. DISCUSSION

This study's main finding is that the information source indeed *mattered* for farmers, albeit not in the expected manner. Farmers followed up significantly more frequently when presented the same information by peer farmers compared to authorities. In this section, we discuss our results, and provide some explanations for the discrepancy between farmers' behavior and stated preferences as collected from interviews.

4.1 Authorities in Word, Not in Deed

Farmer responses during the interviews may have reflected some social desirability bias [7]. Farmers may have been answering based on what they believe to be the most socially acceptable answer, or that which reflects most positively on themselves. There could also have been a response bias — answering questions based on what the interviewee thinks the interviewer wants to hear [17]. Subjects likely viewed the researchers, who were conducting the interviews, as scientific authorities as well. On the other hand, the decision to follow up on on a tip was made without social sanctioning from authorities. Researchers have noted that social norms are situationally activated, particularly *injunctive norms* that guide behavior based on how one thinks others perceive their actions [5].

4.2 The Power of Peers

Agricultural extension programs in India focus on training agricultural scientists from universities to disseminate technologies and practices. This experiment showed that farmers acted upon information provided by peers more than the same information from scientists. This study corroborates prior work [16, 8, 9] suggesting that farmers should be more deeply integrated into the knowledge diffusion process for effective knowledge transfer in agriculture. A common sentiment expressed during interviews was that experience-based knowledge from other farmers is a necessary complement to the hard evidence-based recommendations of scientists. In recent years, the Indian government has experimented with more participatory approaches to extension, including working through local farmer groups, NGOs, and even enlisting local government (panchayat) officers as para-extension workers [25].

While farmers commonly exchange advice informally with friends and neighbors [3], this word-of-mouth can lead to misinformation. Relying on one's immediate friends, relatives and acquaintances limits the potential quality and breadth of information that can be obtained. We have directly observed farmers not aquainted with knowledgeable and innovative farmers living just a few kilometers away, often farming the same crop. This study shows that receiving information from peers can have higher demand than from scientists. Combining crowdsourced ratings and moderation to these rich peer-to-peer exchanges represents a "best of both worlds" scenario, ensuring quality while maintaining consistency, scale, diversity and breadth.

Most ICT4D projects are coordinated with local partners that are embedded in the target communities. It is common for ICT4D researchers to defer to the expertise of these local partners, particularly in matters related to local practices or culture. Throughout our partnership, DSC has relied on well-trained staff that they trust to answer questions and to provide content for Avaaj Otalo. While this approach has been successful in providing a useful and efficient service to farmers, our results indicate that together we may have under-estimated the demand for peer information exchange. We are now working with DSC to design ways for farmers to participate more effectively in responding to questions and content. This includes providing incentives and recognition, and by lowering the costs and other barriers, for farmers to participate.

4.3 Did the Tip Content Inherently Favor a Source?

If the tips' content or linguistic structure was not believable for the speaker, then a participant may been motivated to call out of curiosity or incredulity ("does this farmer know what he's talking about?"). There was no evidence in the post-study interviews that the credulity of the tips' sources was in doubt. As an additional check, the tip content was independently rated by twenty Gujarati readers on Amazon's Mechanical Turk [1]. The Turkers were presented each tip's introduction in Gujarati script. The task first asked for a summary of the tip as a check to make sure it was understood and were putting in sufficient effort into the task. They were then asked to answer two questions for each tip:

1. Who is most likely to have given this tip: a scientist, or a farmer?

2. Who is more appropriate to provide the resolution information to this tip: a scientist, or a farmer?

For each each question, seven options were given. The first option was "A farmer is very likely/very much more appropriate to give this tip/resolution", and the seventh option was "A scientist was very likely/very much more appropriate...". The intermediate options substituted "moderately", "slightly", and "equally" as descriptors for likelihood and appropriateness. For the 15 surveys that provided correct summaries for the tips, no significant deviation was observed for either question when t-tests were applied comparing the mean and variance to the midpoint of the scale. We caution that these results are only suggestive, given the small sample size and ambiguity about how qualified the participants were to judge the content.

4.4 Limitations of the Study

Future study will investigate what feature of peer-sourced information yielded a higher follow-up rate. Farmers may have been more attracted by the familiarity of the accent, the novelty of the source, and/or out of a sense of camaraderie with fellow farmers. Participants may have been curious to hear from a farmer for advice they typically would receive from an outside expert.

Participants may also have been unclear about what would happen in the follow-up call, especially the first time they decided to follow up. The initial call did not explicitly state that the follow-up call would deliver the conclusion, and that it would be another recorded message. Participants may have called back with the expectation that the tip would be delivered by a different person, or perhaps that they would be speaking with a live person. On the other hand, these uncertainties would have been resolved for any farmer that called back the first time. In post-study interviews, no participant indicated that such a confusion existed at any time, which was asked explicitly in several interviews.

To avoid disclosure of the design in advance of the experiment, study participants were invited to opt into a trial of a new information service, rather than a research study. After the study, DSC sent all participants a booklet with the full content of all the tips along with supplemental articles and DVDs as a thank-you gift. DSC had used scripted content in other media projects without explicitly disclosing this scripting to people; this study elected to do the

same. The design was approved through a standard university IRB process. However it is important to note that the researchers considered the steps taken above appropriate given the beneficial nature of the content and the tips provided, and given our experience working with the partner organization and participant community. Using subjective judgement for a study's appropriateness relieves some of the incompatibilities between the nature of ICT4D research and IRB process [23]. However, going this route puts the onus on researchers to vet their choices with local partners to employ ethically appropriate procedures.

Future research is required to generalize these results, as the Gujarati farmers may not be representative of all farmers. In particular, their perceptions of authorities and willingness to seek information may differ from farmers in India. These specific farmers, who were all connected to DSC in some manner as early adopters of Avaaj Otalo, may not even be representative of farmers in Gujarat. The way in which users interact with the message board is also likely to change and evolve over time, reflecting their experiences and learnings within and outside the system.

5. CONCLUSION

This paper presented a controlled experiment testing the influence of authority on agricultural information dissemination to rural Indian farmers via a voice-based phone information service. Contrary to stated preferences, farmers followed-up significantly more to agricultural tips when they were delivered by peer farmers, as compared to when the same information was presented by agricultural scientists. This result demonstrates that there is a significant unmet demand for high-quality peer information for farmers in rural India; in some sense greater then that for information from established authorities.

6. ACKNOWLEDGEMENTS

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8. APPENDIX: TIPS AND FOLLOWUPS

All tips are listed below in translated English from the original Gujarati. In the recorded versions, each tip's introduction began with "Farmer friends, this is this is <name> from <affiliation>.", and ended with, "This was <name> from <affiliation> speaking, thank you for listening". The conclusion portion of the tip was heard if the caller chose to follow up by calling a number specified in the introductory call. All of the technical terms below are rendered in official scientific names; in Gujarati, each was referred to by their common, colloquial name.

8.1 Tip 1: Vaccinations

8.1.1 Introduction

Your animals are very much prone to several serious diseases like hemorragic septacimia and foot and mouth disease with varying frequency. Once the animal gets sick, there are so many troubles. You need to call the vet, you need to spend money on visits and medicines, it is very much time consuming for you and sometimes your agricultural activities get delayed. If the sickness is more serious, and the animal gets weakened, then it is a long-term damage. For milking animals like cow and buffalo, milk production will go down. If you want to save your animals from all these troubles and want to ensure health of animals, the very simple and cheap way is timely vaccinations. To receive information on which vaccinations should be done for which disease, when, and where the service is available, listen to the following instructions.

8.1.2 Conclusion

In Gujarat, we need to vaccinate the animals, especially for foot and mouth disease and HS. The germs of HS may cause the disease while the animal grazes on moist grasses, especially in July and August. The animal should be vaccinated for this disease in the month of April and May. But don't worry if you have missed it, you can do it even in this month. If your area has experienced this disease in previous years, better to vaccinate it every 6 months.

While the foot and mouth disease generally occurs in summer, and the vaccination should be done between October and December, better would be to vaccinate the animals at 6 month intervals. To protect the animal from bruselosis, heifers with four to nine months of age should be vaccinated once in a lifetime. Vaccination service is freely available from the state government. Please contact the nearest animal dispensary.

8.2 Tip 2: Mealybug in Cotton

8.2.1 Introduction

Cotton is considered white gold. Cotton is a very precious and remunerative crop. Cotton crop encounters many pest and disease problems. And recently, mealybug are becoming very common problems. Even at the early stage of the crop, mealybugs do attack. They suck up the sap, leading to stunted growth. Once the plant is infested with mealybug, it remains weak for the whole season, which affects the production. To find out which pesticides should be applied, when, and at what dosage to protect your valuable crop from mealybug, listen to the following instructions.

8.2.2 Conclusion

Controlling mealybug requires a integrated approach. If cultural practices like burning crop remains, deep plowing in the summer, crop rotation, mixed cropping, and cleaning borders and hedges are done on time, mealybug infestation can be avoided. But if mealybug has already caught your crop, then the easiest way is to remove the infested plants and place into some container, ensuring that they donâĂŹt disperse elsewhere in the field, and burn them outside the field. But donâĂŹt forget to spray the soil around the removed plant with methal perethione 2% powder. In the early stage of infestation, spraying neem oil with emulsifier-like soap at the weight of 70ml in 15 liters of water can be useful. One can also use bio-control agents like verticylium laykani at the rate of 70 grams or 15L water. Please ensure that spraying should be done while the climate is moist, preferably in the evening. As a last resort, one can use chemical pesticides as per the following dosage in 15L of water: Prephenophous 50 EC, 15 ml Quenalphous 20 EC, 30 ml Chlorpyryphous 20 EC, 30 ml

Spraying should be done for the whole plant including stand and also on the soil. Please add 15 grams of detergent in 15L of water while preparing the solution.

8.3 Tip 3: Pest Prevention (Egg Stage)

8.3.1 Introduction

There are some ways to control insects at low cost, in a timely manner, and without much tension. One of them is controlling insects at egg stage. Destroying eggs ensures reduced population of insects. If you want to know how to control insects at egg stage, listen to the following instructions.

8.3.2 Conclusion

Insects like the caterpillar moth lays eggs in a bundle. Remove such infested leaves and burn them. Many of the eggs are parasitized by trichogramma wasp. The wasp lays eggs into the eggs of harmful insects. Using tricho card kills

the eggs. One can also avoid egg-laying by using light and pheromone traps. Besides, planting marigold and castor as a trap crop and using neem-based pesticides leads to reduced insect population.

8.4 Tip 4: Root Rot and Wilt in Cotton

8.4.1 Introduction

All farmers would wish to have a bumper cotton crop. If we can avoid loss of production due to reduced plant stand, we can harvest more profit. The plant stand can be maintained by avoiding soil borne diseases like wilt and root rot. There are some control measures for these diseases. And now is the right time to take these measures. To find out what are the steps to be taken, how and when, listen to the following instructions.

8.4.2 Conclusion

If you find your plant getting suddenly wilted and the disease is spreading in a circular fashion, the diseased plant can be uprooted easily and the bark of the root appearing brown and can be removed easily, then it is considered that your plant is infected with root rot. While the same kind of disease is wilt, which may occur at any stage, but especially at the boll formation stage, in this case leaves become pale yellow and in severe infection the whole plant defoliates. To avoid both diseases, treat your seeds, rotate your crop, and apply enough of cowyard manure and cakes. Using tricoderma at the rate of 1.5KG in 60KG of farmyard manure while preparing the furrow is a good preventative measure. But if the field is infected with the disease, you should use 15 grams of bavistine (carbon dezime) in 15L of water around the infected plants.

8.5 Tip 5: Orchard Promotion

8.5.1 Introduction

Many farmers want to disengage from growing seasonal crops like cotton, millet, castor, moong, sesame. One one side, there is scarcity of labor and water, irregular electricity, requires organizing work daily. On the other side, encroachment of blue bulls and wild boars, infestation of new diseases and pests, and deterioration of ground-water quality leads to increase cost of production, tension, and mental stress. So, many farmers dream of having an orchard, or fruit crops. Managing orchards is less cumbersome, and once trees are grown, you can manage with less water too. To find out which government schemes and subsidies are available for orchard cultivation, listen to the following instructions.

8.5.2 Conclusion

There are many schemes offered by the state government's horticultural department to promote orchard cultivation. Subsidies from Rs.2700 to Rs.24000 for new plantation of any fruit crop including mango, chikoo, lemon, guava, pomegranate, and ber, are available for all farmers in all districts. In another scheme, farmers from scheduled tribes can avail 50per plant to be plant in the back yard or in the borders. Apart from this, many schemes are available for plantation of orchard, processing, storage, and preservation of food crops, to conduct educational programs and tours, and organic demonstrations by the state government, national horticultural board, and APEDA. Please contact the deputy director for horticulture of your district and national horticultural board office located at Sardar Patel Market, Jamalpur, Ahmedabad with phone number <number>.

8.6 Tip 6: Soil Testing vs. University Recommendations

8.6.1 Introduction

Many farmers are confused about recommendations of fertilizer dosage. The government recommends standard dosages of fertilizer for each crop. But others say that the dosage of fertilizer should be based on soil tests. So the confusion is whether to apply fertilizers as per government recommendation or as per soil test. To get a resolution to this confusion, listen to the following instructions.

8.6.2 Conclusion

It's easy to remove the confusion. Those farmers who apply chemical fertilizers without getting their soil tested should use the government recommendations. But those who have gotten their soil test should apply fertilizers as per recommendations in the mailed reports. In fact, while the report is made, government recommendations are taken into consideration and so it is more precise. So if you have tested your soil, go as per the report.

8.7 Tip 7: Unconventional Animal Feed

8.7.1 Introduction

The true farmer maintains his cattle like a family member. To maintain good health, you will to need to provide good nutrition. Generally we provide nutrition by supplying fodder and cattle feed which ensures health, strength, and productivity leading to healthy animals. But cattle feed is costly and generally need to be purchased from market while there are several nutritious wild plants around capable of providing nutrients at near-zero cost. If you would like to know the names of such plants and how to use them, listen to the following instructions.

8.7.2 Conclusion

Low-cost, unconventional feed includes seeds of Umadhia, which contains 18% protein and could be fed up to 10% to milking animals and up to 15% to bullock. They should be used after cooking or boiling. The pods of gandho bowad and desi bowad are easily available which contains 30% protein and can be fed up to 15% to milking animals and 35% for bullocks. If you can find cake of Movada, you can feed it 1-1.5 kilogram per day to the milking animals. The flowers of Movada can also be fed up to 20%. Besides, pods of rain tree, tubers of banana, cake of jowad, salseed, or karanj, can also be given as a good source of nutrition.