

---

# Replicating Residential Sustainability Study in Urban India

**Mohit Jain**

IBM Research Labs  
Bangalore 560045 India  
mojain13@in.ibm.com

**Yedendra B. Shrinivasan**

IBM Research Labs  
Bangalore 560045 India  
yshriv@in.ibm.com

**Tawanna Dillahunt**

School of Information  
University of Michigan  
4340 North Quad  
105 S State Street  
Ann Arbor, MI 48109  
tdillahu@umich.edu

**Abstract**

Despite the global nature of problems such as rapid depletion of fossil fuels and water resources, most of the solutions being developed to address these issues are based on studies done in the developed world. We conducted a study of energy, water and fuel conservation practices in urban India, replicating the work of Dillahunt *et al.*, a qualitative study that explored the current practices, beliefs and attitudes of low-income households in two distinct U.S. locations. We used the same method, a photo-elicitation interview study, with 11 participants living in Bangalore and Hyderabad, India. Our study highlights *deep conservation* actions, which were influenced by the cultural context and different from the original work. Participants in our study shared motivations to conserve with participants in the previous study including scarcity, money, comfort and religion.

The purpose of this paper is to shed insight on our replication study. We discuss the purpose for conducting the replication study and describe the procedures we followed; we also provide information regarding access to procedures and data analysis techniques used from the original study. We discuss subtle differences in our procedure and how this may have affected our results and discuss key findings from our replication.

### **Author Keywords**

Energy; Sustainability; Developing World.

### **ACM Classification Keywords**

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

### **General Terms**

Human Factors; Design; Measurement.

### **Introduction**

The goal of our study was to elicit a detailed picture of consumption and conservation practices and beliefs in Indian households. Like some of the prior work conducted in developed nations (primarily in the U.S. e.g. **Error! Reference source not found.**, [1], [3],[7], [8]), we were interested in understanding motivations behind the conservation practices and challenges our participants faced around resource management. We decided to conduct our study in a developing nation as there was little information about whether or how prior results applied to other geographies, cultures, and socioeconomic groups. Further, we chose to focus on middle and high-income households because they consume resources in more diverse ways (e.g., own multiple types of appliances). Since our study was exploratory in nature, we chose to replicate a study conducted to understand energy consumption among low-income households in two U.S. locations [1].

### **Replication**

The original study conducted used photo-elicitation interviews **Error! Reference source not found.**, which produces a different kind of information provoking feelings and memories. This information is

not as easy to gather using standard interviewing techniques. Further, pictures provide a focal point of conversation, which helps to alleviate any awkwardness an interviewee may feel **Error! Reference source not found.** Further, photo-elicitation interviews make it easy to agree on categories when analyzing data [2].

We analyzed the data using the same technique described in Dillahunt, *et al.* [1]. We coded and analyzed our interview data in an iterative fashion following methods taken from informed grounded theory [6].

Though photo-elicitation interview studies have been conducted in the past and well documented, in replicating the original study, we identified some aspects of the study that needed to be taken into account across various populations. For example, we made some changes in the protocol to factor in new contexts such as cultural differences.

Next, we discuss our method and differences that may have affected the results between the two studies.

### *Methodology*

Prior conducting our study, we contacted the original researchers for their IRB material. This included recruiting detail, the surveys used to collect demographic information, and the specific script researchers read to participants. We made slight variations in the survey to accommodate for cultural context, such as the types of household appliances and transportation options. For example, we did not include dryers in our appliance list, as they were not as common among our population; we also added water heaters (Geyser) to the list. To understand

conservation behavior we asked questions such as whether participants left the fan on to dry clothes, use solar water heaters to heat water, conduct regular refrigerator maintenance, and/or use inverters (UPS). We also removed questions related to religion and spirituality as few participants were offended or felt uncomfortable answering those questions (though we made answering those questions optional). One such question was if they were motivated to conserve resources to protect God's creation. Access to this information helped in replicating the study method in its original form.

#### *Differences in protocol*

Despite being able to replicate all aspects of the study, there were some subtle differences that may have affected our results. These included the technology used to capture photos, payment, recruitment and the type of researchers conducting the study.

In the original study, participants used disposable cameras and at least one participant had never used a camera before the study. Our participants used either a digital camera or the cameras on their personal phones. Our participants had prior experience using the cameras. With these differences, participants using their own (digital) cameras may have felt more comfortable taking pictures and they may have been less concerned with running out of exposures. Though this unlikely had an impact on the results, it is a difference that should be considered.

The original study compensated participant for the time they spent during the interview. We had a different payment model. We did not pay our participants directly because we found during our interviews that

participants were not interested in receiving payment. Instead, we paid our participants 2500INR to a charity organization for every 50 participants to complete our online survey (the results of our survey were removed from our final paper submission).

The original study was conducted as a university study, whereas we were industry researchers conducting the same study. We were studying two distinctly separate populations, which makes it unclear how this may have influenced participant attitudes. As both studies were conducted in participant households, this may have alleviated any differences participants felt in terms of how comfortable they were in being interviewed. Our methods for recruiting were limited because we conducted our study as a private organization. As a result, we did not advertise publically—we relied on word of mouth and snowball sampling, which may have added bias to our participants.

From an internal organizational perspective, the "IRB" process for working with participants is slightly more difficult than in university settings. Industry is concerned about privacy issues such as IP; however, whether or not this is transparent to participants and affects their attitudes was not well understood.

#### **Results**

Many of our participants' conservation practices and motivations matched key categories of actions noted in the original study; however, as expected, the findings were not identical. We were able to contribute new categories and also leverage a vocabulary described in a more recent study, which provided evidence that the authors' framework generalized across different populations and cultures [3].

We also saw how our results generalized with the study we replicated and past studies of home energy consumption in developed regions. For example, participants in our study shared motivations to conserve with participants in past studies of typical **Error! Reference source not found.**[3] and low-income households [1] including money, comfort and religion. Barriers to conservation such as money, comfort and safety also overlapped past studies. We highlighted two key differences between our findings and others in our final paper [5]. These include the impact of resource shortages (*scarcity*) and the value of *eco-feedback*.

When looking to generalize across lower-income U.S. households, our participants did not mention many common conservation behaviors. Our examples included re-using plastic drinking bottles for storing oils instead of buying dedicated containers, packing a family of 5 or 6 onto a single moped, and washing dishes using sand, ash, or coconut husk where water is in short supply—all findings unique to Indian culture. However, India has wide socio-economical, cultural, and demographic diversity, which makes it difficult to know exactly how broadly these findings generalize even within the country.

The major reason for differences among our work and the work replicated [1] is the shift in the cultural context. Hence we obtained many conservative actions, related to the Indian culture, but may not be relevant for developed countries.

### **Key Insights**

We believe we can offer three key insights from our replication study. First, having access to scripts that

describe the research method, the surveys conducted, recruiting material, and access to a responsive original author, simplified our process. This information is often available in research Institutional Review Board documentation (IRBs); however, it is unclear whether this material is typically shared among researchers. Further, we are somewhat limited in our recruiting efforts due to the rigor required to advertise publically. This limited the types of participants that we could recruit and perhaps biased our results. Nevertheless, we found similarities between our results and the original study's results, as well as similarities between other home consumption studies.

Finally, in our study, we found the need to modify our demographic and baseline survey to account for cultural differences that existed between our study population, such as the types of resources used.

### **Discussion**

Our replication was somewhat atypical as it was a replication of a qualitative study. However, our aim was not to replicate prior results. Our study was exploratory and we expected to see some conflicting results because of cultural and socioeconomic differences between the two populations; however, we anticipated some overlap as well. One topic for discussion is whether we can truly “replicate” a qualitative study. What exactly does it mean to replicate a qualitative study? Another question to consider is if using the same surveys was limiting in any way? We had to modify the survey based on cultural differences but was having the original material as a starting point a limitation?

- [1] Dillahunt, T., Mankoff, J., Paulos, E., and Fussell, S. It's not all about "Green": energy use in low-income communities. *Ubicomp 2009*, 255-264.
- [2] Harper, D. 2002. Talking about pictures: A case for photo elicitation. *Visual Studies*, 17(1), 13-26.
- [3] Pierce, J., Schiano, D.J., and Paulos, E. Home, habits, and energy: examining domestic interactions and energy consumption. *CHI 2010*, 1985-1994.
- [4] Rao, N., Sant, G., and Rajan, S.C. An overview of Indian Energy Trends. 2009. Prayas, Energy Group, Pune, India.
- [5] Shrinivasan, Y., Jain, M., Seetharam, D., Choudhary, A., Huange, E., Dillahunt, T., Mankoff, J. *CHI 2013*, (to appear).
- [6] Thornberg, R. Informed grounded theory. *Scandinavian Journal of Educational Research*, 56, 2012, 243-259.
- [7] Vyas, D. Domestic Artefacts: Sustainability in the context of Indian Middle Class. *ICIC 2012*, 119-128.
- [8] Woodruff, A., Hasbrouck, J., and Augustin, S. A bright green perspective on sustainable choices. *CHI 2008*, 313-322.
- [9] World Population Data Sheet 2012. [http://www.prb.org/pdf12/2012-population-data-sheet\\_eng.pdf](http://www.prb.org/pdf12/2012-population-data-sheet_eng.pdf)