PictureCARD: A Storytelling Tool for Task Analysis

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ABSTRACT
This paper discusses the evolution of a CARD-based interactive research tool developed to incorporate cross-cultural users in the process of building a representation of work. The technique is highly visual and interactive and does not depend on capturing information textually, or on ethnographic investigatory techniques. We discuss the context in which the tool was developed and its use in a field study in rural India, as well as the kind of data which was gathered and lessons we learned.

Keywords
PictureCARD, task analysis, cross-cultural, storytelling, participation, India health care

INTRODUCTION
PictureCARD was developed because a suitable technique could not be found that would help reveal context, provide a voice for user-participants, and serve as a solid foundation for the design of technology to be introduced to rural health care workers in Apple's India Health Care Project. There are several cross-cultural constraints of the project for which PictureCARD was developed. These include project members unfamiliar with the target user's language and culture; a limited amount of time available in the field; limited resources accessible while in the field; a widely distributed design team; and a varied and widely distributed user population.

The India Health Care Project (IHC) is a joint effort between the Government of India and Apple Computer, Inc. to design, test and learn from a prototype data capture system for India's rural health care workers. The Apple team for the IHC project is comprised of members of the Apple Research Labs. This paper relates the collaborative development of field methods for the IHC including Michael Tschudy (an IHC team member), and Elizabeth Dykstra-Erickson and Matthew Holloway. The method was then used in the field in India by Michael Tschudy, Alexander Grünstiedl, and Amitabh Pandey. For the purpose of clarity, the co-authors refer to themselves as a Methods team and were a separate entity from the IHC team.

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The Methods team reviewed a number of participatory processes and methods before deciding to develop a new technique based on CARD (Tudor et al., 1993a,b). We modified CARD to depend less on verbal definitions and labels, and more on visual representations and storytelling, in order to help overcome language barriers between the IHC field team and the health care providers. In keeping with cultural norms, we used detailed line drawings to make storytelling more naturalistic.

Some of the issues that the IHC team faced included difficulties with cultural distinctions such as how our participants in India deal with authority figures, how the field team's individual roles would work, and how the participatory exercise we designed would work. The Methods team needed to be confident PictureCARDS could be created and annotated in the field with a minimum of technological assistance. Upon completion of the study, the richness of the field researchers' experience was not easily conveyed to other team members, even with the support of the CARD artifacts. Secondary data filtering and manipulation was required to document the field study findings.

ABOUT THE INDIA HEALTH CARE PROJECT
The Indian government provides preventive health care for its rural population of about 700 million people. At the village level, voluntary workers such as Community Health Guides or Traditional Birth Attendants are the key mediators for all aspects of health care delivery. Health care information at the local level is typically managed using the local dialect. However, this information must be translated into English as it travels up to the state and federal levels. The coordination of medical information documenting 700 million people in sixteen major languages in a single information infrastructure is understandably a daunting problem for the Indian health care program, and a major source of frustration for the current system.

The Indian government identified Ajmer in the State of Rajasthan as a pilot test area for the IHC project. The intent of the India Health Care project is to create prototypes of task-specific computing solutions to assist the health care workers at a local level as well as addressing the related organizational issues at the local, state and federal levels within the overall health care system. The IHC team decided to employ user-centric and participatory design methods to elicit and capture the needs of the workers.

Given that the IHC team is distributed between Cupertino and India, it quickly became apparent this would not be an easy task. In an effort to better understand Indian health care both in terms of practice and the culture at large, several IHC field team members traveled to India to experience firsthand the world of the rural health care providers through site visits that helped them familiarize themselves with the Indian culture and the health care system. This permitted the IHC field team to develop a rapport with some of the local health care workers. Eventually, a broader study needed to be done which would include a representative sample of the rural health care workers in task analyses preparatory to actual designs for the computing solutions prototypes.

The task analyses needed to be comprehensive enough to support a diverse and highly distributed user population while also integrating the needs of a cross-cultural, interdisciplinary development team. This required the development of a new method for task analysis, described below.

METHOD CRITERIA AND SELECTION

The IHC field team needed a broad sample and a method that would allow collecting specific task detail. This led the Methods team to review methods which could be used with a large number of participants, in a limited amount of time, operating within difficult time and space logistics.

The Methods team identified several criteria for the selection of a task analysis method. For example:

- use an artifact-based method wherein the artifacts themselves could generate conversation, criticism, and correction
- treat users as people, not as subjects
- incorporate a high sensitivity to cultural differences
- build relationships with people, including getting to know and trust each other, and not just elicit a detailed analysis of work
- put participants in a position to participate willingly and on as much of an equal footing with researchers as possible
- develop an informal setting where the participants would engage researchers with stories and the researchers would listen
- acquire a large amount of representative data in a very short period of time in the field
- use time efficiently without meandering through investigations, nor taking up too much of the participants' time with opened-ended questioning

The IHC field team planned for a one-week site visit to do task analyses, and imagined different scenarios, such as flooding, local holidays, or illness and how these might affect the study. They needed to be able to interview up to three participants in a day, at no more than two hours a session during the monsoon season, which would push their physical endurance considerably.

The Methods team rejected fairly early the more classic methods such as task hierarchies and entity-relationship models. The Methods team reviewed participatory methods including storytelling (Erickson, 1996), CARD (Tudor et al., 1993a,b), pattern language (Alexander et al., 1977), and the specification game and scripts for action (Ehn & Sjögren, 1991). Each had various merits but none helped to overcome the cultural differences already experienced by the IHC field researchers on initial visits.

DEVELOPING THE PICTURECARD METHOD

The Methods team decided to use CARD as a basis for a new method, which we call PictureCARD. We selected the CARD method as a foundation because it provides an artifact that can serve as the focal point for participatory discussion. CARD also met a number of our other method selection criteria. However, CARD does not lend it self very well to a investigation where the researchers speak another language and are of a different cultural background; because it is heavily text-dependent, it requires all participants to be fluent in the same spoken language. In our case, the IHC field researchers were primarily native English speakers, while the user participants spoke Hindustani (a colloquial Hindi) as well as a number of other Indian dialects. The IHC team employed a cultural intermediary to bridge this language gap. However, at times the translator's services were problematic: it was difficult to filter translator biases in some cases, and we observed some cultural subtleties, such as the difficulty of assessing when yes means no, and no means yes. Overcoming the language barrier was one objective of the new method. The Methods team also explored other factors, such as the proceduralization of the method and contextualizing the data gathering.

In order to develop a process that would be time efficient, collect meaningful data, and be natural to participants, the Methods team reviewed several metaphors which might be useful in the rural India context: task inquiry framed as theater, with actors, plots, and scenes; task inquiry framed as games, with players, pieces, and objectives; and task inquiry as storytelling, using stories as a vehicle for self-expression. We felt that storytelling would be the least rigid, and would also be natural for our rural health colleagues. The theatrical metaphor was also useful, in that it could provide props as focal points.

To contextualize our data, we determined that we would need to find out about work under several different sets of conditions. On examination, we decided that at least six distinct conditions may be significant to characterize the differences the field team might find in their data: Person, Action, Season, Tool, Event, and Location (PASTEL; an acronym had to come into play here somewhere!). To reflect these distinctions, the Methods team extended the CARD structure by focusing on a literal, pictorial representation of work, rather than primarily on a textual (or verbal) one. This helped the IHC team to leave interpretation by the participants more open. This also helped avoid confusion and criticism in naming by essentially avoiding naming

issues, and helped the IHC field researchers to allow participants to get beyond misunderstandings in content (and thus, intent). The pictorial representations helped generate multiple interpretations of the work activities, and helped provide focus to the field researchers' questions of the health care providers while in the field. Finally, the PictureCARDs gave all of the participants in the field study "the same language," making the data much easier to organize and analyze. The PictureCARDs helped the entire IHC field team frame the conversation, aiding the translation process with concrete images, and clarifying the goals of questioning *in situ*. Ultimately, the Methods team developed a storytelling model whose product was stories told by the health care participants in a very engaging and sometimes theatrical manner.

ANATOMY OF A PICTURECARD

Designing the cards

The six contextualizing categories (Person, Action, Season, Tool, Event, Location) were used as a rough framework for developing a PictureCARD deck. From the prior field work and discussions with the Administrators of the Indian Health Care System, the IHC team built a rough model of work for the rural health care providers. However, it was the intention of the IHC field team to validate this model and to get a better understanding of where it could be improved. Indeed, it was the intention of both the Methods team and the IHC field team to have the health care workers create their own model, using PictureCARD as their main means of communication.

Each participant would be working with their own unique deck of cards; therefore, the system was designed to allow participants as well as researchers to write notes directly on the cards themselves, eliminating the administrative task of using stickies or additional pieces of paper in the field.

The Methods team decided not to use icons for the images on the PictureCARDs because it would be too difficult to construct a meaningful, comprehensive set of icons in the time allotted for development of the field materials.
Instead, the images used on the cards were line drawings traced from photographs or still video images depicting scenes which, based on their prior experience with the health care workers, the IHC team knew to be important and representative. Line drawings, rather than photographs or abstracted icons, were selected for use in the PictureCARDs since it was felt that participants would more easily generalize from line drawings than from specific photographs and be in keeping with established cultural norms. Additionally, photographs would be far more difficult to modify in the field than a drawing.

Each of the cards contain four basic pieces of information: an identification code, which located them in the overall organization of the deck; an image to serve as a depiction of an action, person, tool, event, etc.; and two captions, one for the image in the native Hindi, the other its English equivalent (see Figure 1).

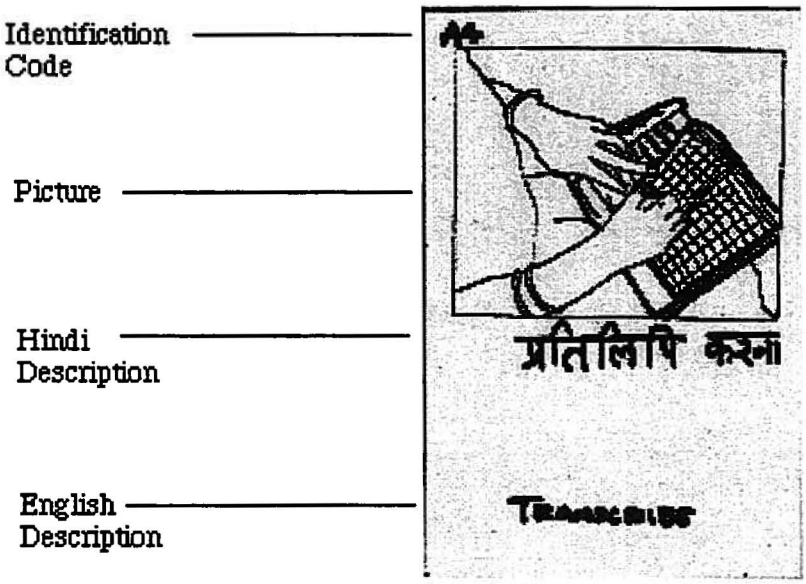

Figure 1: Anatomy of a PictureCARD

Making a PictureCARD

For the PictureCARDs used in India, the Methods team used 4"x6" inch blank note cards. During previous trips other members of the IHC field team had collected quite a number of video images of the health care workers, their work, their surroundings and the tools they used. The Methods team went through the footage and, following the PASTEL model, picked out images of People, Actions, Seasons, Tools, Events, and Locations which they felt were representative. Then, using Adobe Photoshop™ these images were digitized and formatted to a standard size of 3-1/2 inches x 2-7/8 inches, which was also (happily) the same dimensions as a Polaroid photograph—this would allow images to be easily added to the PictureCARD decks later in the field. The images were then converted to gray scale, saved, and printed on a laser printer (see Figure 2).

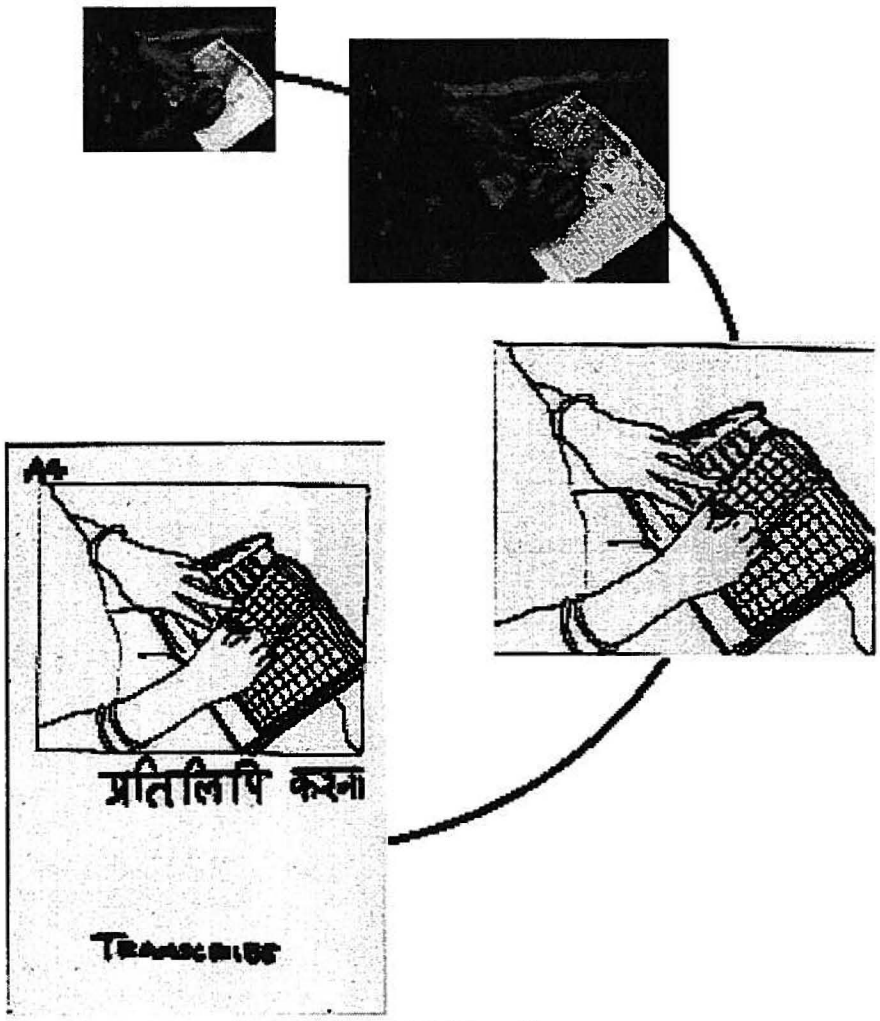

Figure 2: PictureCARD creation process

Each card was then marked with a letter code that identified its location in the PictureCARD deck. For example, in the Person section, P1 was Husband; in the Action section, A7 was Motivate; in the Season section, S1 was Winter; in the Thing section, T7 was Daily Diary; in the Event section, E4 was Birth; and in the Location section, L2 was Village Home. Then to complete the cards, one or two word captions that best described the image were added in both English and Hindi. Many of the captions were derived from terminology which previous IHC field teams had heard the participants use to describe events and practices. By far the most difficult aspect of the preparation was the translation of the English captions to their Hindi equivalent. The translations were done by an Apple employee who had attended school in this particular region of India.

The card decks were created using an assembly line approach. To begin, a 4"x6" note card was formatted as a template by cutting a window in one end of the card — 3-1/2 inches x 2-7/8 inches exactly — where the image was to be placed. Then, by laying this template card on top of the other index cards and tracing around the inside of the opening with a marker, new cards were easily formatted with the picture border. Next, these formatted cards were aligned over one of the laser printed images, and the image was traced onto the card.

In tracing the image it was important to include enough detail so that the participants would be able to recognize and identify with the image. By using a broad tip marker to accentuate selected elements within the image, emphasis was added to certain critical elements in each image. In some cases, parts of multiple images were combined to achieve the desired representation.

Since the IHC field team needed to have a clean deck of cards for each participant, the completed originals were pasted to a large sheet and photocopied onto card stock. These photocopied duplicate cards were then cut to size and the individual decks were assembled. All of the tools necessary to make replacement or additional cards in the field fitted neatly into hand luggage or a backpack: a laptop computer, a portable printer, a Polaroid™ camera, a small light table, paper and pens were all that was necessary to create new PictureCARDs or modify existing ones. The IHC research team has since made the production of their PictureCARDs an all-digital process that allows them greater ability to create and/or modify cards in the field.

Building a PictureCARD deck

To begin constructing the PictureCARD deck, the IHC research team first subdivided the idealized model of the health care workers' daily routine by reviewing video footage from previous visits. Following the PASTEL categorization, cards were then created for the six categories. As the process continued the IHC team quickly grew the number of cards in their deck to almost 50. The large number of cards was due in part to the team's desire to maintain maximum flexibility in the use of the PictureCARD method while insuring its being as comprehensive as possible in terms of addressing all the possible activities of the people interviewed. The items in the deck were portrayed in varying degrees of detail and abstraction. For example, the event Paperwork was subclassed into Reviewing and Transcribing. Questioning the participant for further detail afforded more subclassing and the creation of more detailed cards. This degree of scalability allowed the participants, as well as the researcher, to control the scope as well as the depth of the conversation in the interviews (see Figure 3 for examples of PictureCARDs).

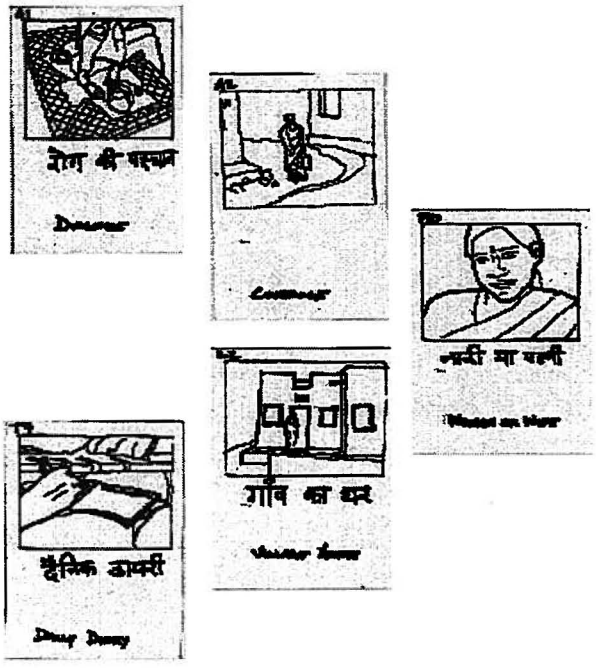

Figure 3: Examples of PictureCARDs

To better understand the construction of a PictureCARD deck , see the conceptual matrix (Figure 4) which serves as an explanatory device. The width of the matrix can be used to manage things such as the overall flow, either temporally or sequentially, of the activity being described by the participant. Or it can simply be used to manage larger chunks of the participant's world, e.g., people, locations, etc.

This focal control is critical in allowing the researcher and the participant a clear and easily understood model of what is in the PictureCARD deck. This matrix framework was key to their ability to use the deck to portray detailed stories. The complete PictureCARD deck is typically comprised of series of these matrices which, depending on the topic(s) being discussed, are interrelated and co-dependent on each other.

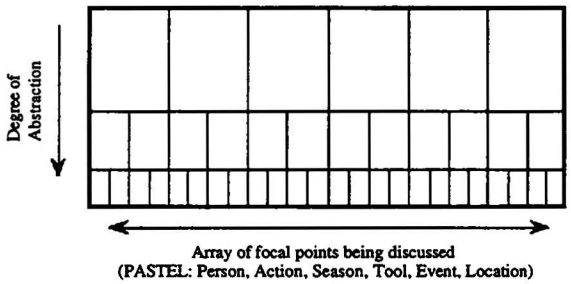

Figure 4: Conceptual matrix of a PictureCARD deck

The depth of the matrix is the degree of abstraction for things discussed within a focal point. The upper rows, being a more generalized set of representations for the things discussed (i.e. Work), are intended to allow participants to create and/or correct a contextual framework. It is through these frameworks that the participant and the researcher establish areas of focus. The bottom rows are a more detailed depiction of the events within that framework (i.e. bookkeeping, writing reports, etc.) or the things which support them (i.e. pens, paper, typewriter, etc.). This allows the participant to create a very specific description of the events in their lives and the individual elements with which they are built, and the subsequent influences which affect them. The degree to which an event is decomposed down through the matrix is dependent on the researcher. Since participants are ideally free to add cards to the PictureCARD deck, the researcher only has to provide the basic framework of the event, and resources for creating new cards.

The researcher can guide a participant's story towards areas of interest by using the deck (and the various focal points and abstraction sets within it) to manage the rate at which they describe an event. Once an overall context has been established by the participant, the researcher can return to a card or cards for further exploration either by having the participant use more of the cards or by working with them to create new ones. With this technique, the researcher is able to facilitate the development of a more detailed representation of the overall event. It should be noted that story-telling typically necessitates working with two or even three focal points and a number of layers of abstraction at one time to insure adequately rich information (see Figure 5).

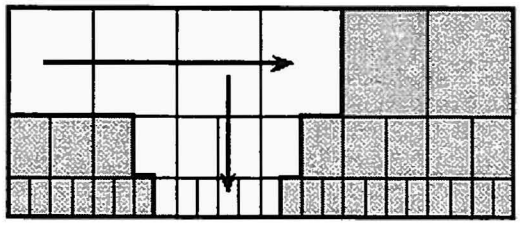

Figure 5: Focal control within the PictureCARD deck

During the field research, the IHC field team found that starting at some abstractions (such as Season) caused participants to become confused or lose their focus on events and narration. A better place to start, for example, was Morning, allowing participants to think chronologically about their day. The field team could then modulate the narration to higher or lower levels of abstraction.

THE METHOD IN USE

The goal of the PictureCARD method is not to generate quantitative data for detailed analysis; rather, it is a generative means of collectively building an understanding with the participants of how they do their work and where they would like to see it improved. Putting PictureCARD into practice is time intensive in terms of the initial preparation, building a basic model of the subjects' world, collecting images, creating the cards, etc. Given its effectiveness in overcoming cross-cultural barriers such as language, the result is well worth the time spent in preparation.

The PictureCARDs actually worked the way we all had envisioned them working; they provided the participants with the tools necessary to tell us their story. It was especially exciting to the IHC field team when the participants grouped a number of cards together, conveying an almost cinematic quality to their story: "I talk to the wife (card) and the husband (card) about birth control (card) and family planning (participant created card)" (see Figure 6.)

Lessons learned

Both the Methods team and the IHC field team made a few mistakes and learned a lot, and we all exercised our ideas about field methods and participatory task analysis. Following are a few items the authors would like to share about the method and its use. Many of these learnngs are generally applicable to cross-cultural field studies.

Figure 6: Exploring the PictureCARDs

Be prepared for mistakes
Any time a researcher goes into the field with a new data collection technique it is likely that some things will be forgotten or omitted due to the circumstances of working under tight schedules, managing new tools and simply being in the field.

On top of conducting research on technology, that is more commonly done in an office rather than a rural setting, Indian cultural subtleties made doing the IHC field work amusing, difficult, and at times awkward. Yet at the same time, the concern about doing the study "right" sapped a great deal of our concentration, to the point where the field researchers forgot to do things that they would have done automatically at home. For example, the IHC field team neglected to position a stable camera to record the entire PictureCARD session and instead used a hand-held camera sporadically through out each session. This resulted in incomplete video footage that was difficult to map to the cards. They also did not take an audio recording of the participants 'story' in Hindi to be translated more accurately at a later date.

Be aware of interruptions and organizational level-consciousness
On one occasion, the field team was conducting a PictureCARD session with a participant when her supervisor came into the room. This greatly distracted her from the story that she was telling at the time. The interruption allowed the IHC field team to better understand the hierarchical relationship between the participant and her supervisor, and because everyone was surprised by his visit, this showed that the field team was not there to check up on her at the bidding of her superior.

Listen and understand
The typical reaction from participants was "No one asks us what we think about things. You people were the first people to sit down with us and listen to us." The field team tried to frame their presence as individuals who did not know anything about how the participants did their job, and that the researchers needed the participants to help them understand. This provided a forum in which the participants could speak freely. The PictureCARDs afforded a format and a focal point for gathering information: they kept the conversation to higher-level issues in the beginning, then to more specific questions.

Be prepared to change and adapt
Both the Methods team and the IHC field team expected to forget some tasks or artifacts in the initial decks of cards. What no one expected was that the IHC field team would omit a significant tool that the participants used as an integral part of their job. Early field observations had confused a notebook that the participants use on a daily basis with a document that they use less frequently; this error was present in the card decks. Four out of the six participants identified this error. As a result, the IHC field team created a new card to represent this tool. Several new cards were created for each rural health worker, which the IHC field team believe helped demonstrate their willingness to accommodate the participants' point of view.

The initial plan was for Amitabh Pandey, to annotate the PictureCARDs while the participants told their story. It turned out that this took too much time and disturbed the rhythm of the discussion between himself and the participant. Instead, the cards were annotated as Amitabh later stepped through the story interpretation. This involved the field team more directly in the process and let Amitabh listen to the participants' story.

Expect to be surprised
Both the Methods team and the IHC field team were concerned that cards might box the participants into literally interpreting the images and the meaning of the images on the cards. The IHC field team was pleased to see that this was not the case. In several situations the participants looked at a card that portrayed a child birthing gurney that was specific to a hospital. The participants interpreted this card to represent cleanliness during the home birthing process, hospital births, and childbirth in general. This gave us some idea that the participants felt free to generalize and interpret the images on whatever level they felt comfortable. They also would create new cards when none met their needs.

Expect procedural variation
Depending on the strategy that the participant took when examining the cards, there were almost too many cards. The Methods team had envisioned laying out the cards in a structure similar to that represented in Muller's work with CARD. However, when the participants spread the cards out initially, they became a bit overwhelmed with the number of cards and were unable to easily arrange the cards until they had created enough unique groupings. The PictureCARD deck was most easily managed by the participants when they physically held the entire deck and shuffled through it one card at a time. This allowed them the opportunity to orient themselves with the content on each card and then arrange them in their preferred order by shuffling the cards back and forth.

One of the Methods team's PASTEL categories is Event. The intent was to embed the participant's story in a particular season or holiday. By changing the season or holiday card, we hoped that the participant would change their story according to the uniqueness of each season and its implications on the participant's job. For example, we knew that during the summer, the participants must collect census material; in the monsoon season, they have to manage malaria outbreaks; and in the winter they must deal with influenza and family planning quotas. This turned out to be too abstract a concept with which to start a PictureCARD session, and as a result the IHC field team abandoned this seasonal distinction. Instead, the session started with a card representing Morning.

Use redundant methods
In the case of using the PictureCARD method, one of the things to keep in mind is that while this method generates a strong narrative it should not be used exclusively of other data collection techniques. Video taping, audio recording and even hand written notes and photographs are all important means of collecting data and should be considered as a way to augment the data collection process. By employing these redundancies the field researcher is able to capture both the event(s) being discussed via the PictureCARDs as well as the use of the cards themselves. Redundant methods for data capture are especially important if the field researcher must rely on translators to manage the dialog between themselves and the participants. By capturing the interview itself one can return later to the interview tapes and spend more time on the translation to confirm the original field interpretation of the participants' comments.

Watch for the impact of card images
It is easy to assume that the use of images on the PictureCARDs cause participants to feel constrained in their interpretive latitude. One might suggest that by using this technique, the researcher is overtly leading the participants to a foregone conclusion. However, the experience of the IHC field team indicates this is not the case. During their interviews, participants did not seem to feel compelled to limit their story telling to the cards at hand or to modify their story to include all the cards. Because of this, the IHC team felt that this method worked well to allow each participant to voice their opinion clearly and confidently. It was apparent during the investigation that the PictureCARD images were open to interpretation. At times participants commented that some of the captions were incorrect and offered to change them. The IHC field team understandably took advantage of these offers. The researchers found this not only permitted them to collect richer and more representative stories from the participants; it also had two other effects: this confirmed that the images had a positive impact on the process, and given the opportunity to respond to changes initiated by participants, this helped to establish a more trusting, participatory environment for the PictureCARD exercise. It was the participants' interpretation of the images which the IHC team felt added the most meaning to their research, since it allowed the individual participants to focus on those issues which they felt were the most important.

FOR THE FUTURE

We learned from our experience developing PictureCARD that establishing a field method means developing some procedural and collateral constraints, and then letting the field experience test what is useful and what isn't. By putting our infrastructure in place via the PictureCARD method, the IHC field team was able to react more naturally and quickly to the inevitable dynamics of working in the field.

PictureCARD was developed as means of facilitating discussions across cultural as well as language barriers, to work in conditions that have very poor infrastructure, and to be a highly portable field tool. The key findings generated from this methodology were fundamentally the same as those generated from a CARD study. However, given that many of Apple's IHC project team members were generally unfamiliar with the native language in Rajasthan, it was felt that the PictureCARD method helped them circumvent this issue during their investigation while providing them with a means to collect detailed information on the work practices of the rural health care workers. The addition of images to the cards was seen to have a positive impact on the participants' storytelling. By permitting the process to be less dependent on shared verbal definitions and more dependent on visual representations, the IHC team felt that the PictureCARD method permitted them to develop an

understanding of the participants and their world which another method would not have. Additionally, based on the positive reaction from the participants, the researchers felt the images on the cards and the method in general aided in the language translation process, and helped clarify the participants' questions.

The PictureCARDs are self-contained; the modest amount of equipment required to modify cards made it easily usable in the rural India environment. The PictureCARD method allowed the IHC field team to expand the scope of their data collection gracefully, as new cards were easily added to the decks and existing cards were changed on the fly with only a minimal impact on the participants.

The PictureCARD method provided an excellent tool to conduct and facilitate cross-cultural interviews in order to reach a shared understanding of the participants' tasks and activities. It was initially thought that the PictureCARD "stories" would provide a great deal of meaning and benefit to the design process as a stand- alone artifact. However, the PictureCARDs require extensive analysis. While PictureCARD as a method is effective in providing a consistent and broad basis for analysis of context, we are continuing to develop its value in informing the design of technology. The continuing analysis of the PictureCARD "stories" from the India Healthcare Project will support further iterations of a prototype data collection instrument for the rural health care workers.

The co-authors would like to continue our work with PictureCARD to make it an even more condensed and computerized of a process. For the continuing studies with the India rural health care workers, as well as other future cross-cultural studies, we would like to borrow from other domains to add to PictureCARD to create an ecology of integrated cross-cultural field methods.

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