

# **Adapting user-centered design methods to design for diverse populations**

## **Abstract**

User-centered design methods such as personas and scenarios are useful tools for communicating extensive user research to designers. However, intensive data collection and onsite fieldwork required for personas and scenarios development can present a barrier for user researchers and designers working on technology innovations for diverse populations, including those in developing regions. This paper presents a model that demonstrates how user researchers and designers can use data collected for other purposes to source personas and scenarios and substantively adopt user-centered design approaches. We demonstrate our methods through a case study based on research in Kyrgyzstan.

## **Introduction**

As designers and researchers who have worked both in settings in the United States and in developing regions, we have come to recognize that traditional approaches to User-Centered Design (UCD) methods are difficult to deploy in developing regions (Kam, et al., 2007; Maunder, Marsden, Gruijters, & Blake, 2007). These difficulties are not confined to developing regions, but also apply to any potential users from a substantively different cultural context (i.e. diverse populations) in which technology design occurs. UCD is part of the multidisciplinary field of Human-Computer Interaction (HCI) and embraces many disciplines including (but not limited to) computer science, cognitive psychology, anthropology, and design. While HCI broadly explores how humans interact with technology, UCD is a design philosophy that emphasizes the importance of keeping user's needs, goals and desires in mind when creating

products or services. This paper reports on our attempt to adapt two traditional UCD methods (personas and scenarios) so that they are more easily adoptable for researchers working with diverse audiences and/or in developing regions and who want to communicate their research to designers. This work is also a recognition that it is difficult and resource intensive to conduct user research in developing or culturally distant regions, and our goal is to demonstrate ways that researchers can use unconventional data sources to communicate with designers about end-users.

A persona is an archetypal character that represents a group of users who share common goals, attitudes and behaviors when interacting with a particular product or service (Cooper, Reimann, & Cronin, 2007; Mulder & Yaar, 2007; Pruitt & Aldin, 2006). A design scenario used in a UCD context is a story describing a character in an activity in relation to a product (Carroll, 2000; Go & Carroll, 2004; Quesenbery, 2006; Rosson & Carroll, 2003). While there is debate within the UCD community about the persona and scenario approach (see Chapman & Milham, 2006; Portugal, 2008), this paper starts with the assumption that personas and scenarios are useful in certain circumstances, and we address how to make these design approaches more viable in diverse design settings. Traditional research employed to create personas and scenarios has focused on users in relationship to a specific product or service. Our research, however, did not fit the traditional mold because it was not associated with a specific product. Rather, it was culled from existing general social research. We model that research approach in this paper.

As part of the Central Asia + Information and Communication Technology project (CAICT), a multi-year study of the use of information and technologies in Central Asia, we have collected thousands of data points pertaining to attitudes, behaviors and goals in relation to technologies used throughout the region. In other words, CAICT's field research was not about a specific product or service. Rather, it was general research, some with a design focus, but that

was geared to larger social issues. However, since the research included technology usage and trends we realized that the data we have collected could be leveraged to build personas and scenarios to communicate about Central Asian end-users, and then expanded to communicate about users in other settings who share certain characteristics. Summarizing user research into usable and actionable documentation for design teams is always challenging; it is even more challenging when relating information about a culture or group that designers/developers do not know. Our analysis and discussion focus on the developing world, but this approach can be used when designing for diversity in general, whether for economically disadvantaged users, or other resource constrained communities.

The personas and scenarios approach resonated with our general sense of how designers might use data. In looking at how most of the literature discusses personas and scenarios, however, it became clear that adapting those methods would be necessary if our data was to be useful. In other words, we had a very rich dataset that was not collected to create personas and scenarios but that nevertheless allowed us to generate these traditional UCD approaches. We believe the ability to leverage existing data sources to create personas and scenarios expands the utility of UCD methods. Since many existing data sources (e.g. World Values Survey or the World Internet Project) are readily available we argue that this case study is generalizable to other design projects for developing regions or resource constrained or diverse communities. Additionally, following the method would allow user researchers and designers to repurpose the qualitative work from anthropologists, sociologists, and other academics.

## **Background**

This section discusses personas and scenarios and the claims regarding their utility in the design process. We next briefly describe Kyrgyzstan and the product concept that inspired this

case study. Finally, we outline our research approach for leveraging existing data to create Kyrgyz personas and scenarios.

## Personas

Proponents claim that personas are effective for describing users and user requirements because they increase empathy, focus, and communication and help design teams avoid stereotypes (Cooper, et al., 2007; Kuniavsky, 2003; Mulder & Yaar, 2007; Pruitt & Aldin, 2006). Some of the commonly cited benefits of personas include:

**Increased empathy.** Grudin (2006) argues that at least some of the power of personas lies in our ability to empathize with fictional characters. Just as we are engaged by fictional characters in movies and books, Grudin argues, the more a designer engages in the persona fiction, the more aligned his mental models will be with that of the user and, therefore, the more aligned the user interface and interaction will be with real user goals and needs.

**Tighter focus.** Focus emancipates designers from problems that might arise when considering a full spectrum of users. It allows designers to concentrate on the highest priority set of user goals and needs of a specific user or subset of users. Cooper et.al. (2007) argue that it is better to design specifically for one person than vaguely for everyone.

**Better communication.** Personas are communication conduits for conveying a broad range of quantitative and qualitative data (Pruitt & Grudin, 2003). This results in better communication about users among design team members and aids decision making. By making the assumptions about users explicit, personas also provide a clear benchmark for later usability studies. Personas and scenarios thus allow the design team to have better communication about end users.

**Avoid stereotypes.** Lacking user research, designers have only their assumptions and intuition to guide their work. Goodwin (2002) argues that “the whole point in creating personas is to get past our personal opinions and presuppositions” (Goodwin, 2002). Personas therefore replace naive assumptions and stereotypes that the design team might hold about end-users.

If personas achieve these benefits, then, proponents assert, designers will have a useful image of the end user and an improved user experience is expected. Empathy will lead to the creation of an interaction experience that is more aligned with the user’s needs and goals. A clear focus will lead to a consistent interaction experience with salient cues to guide the high priority uses. Good communication will lead to better decision-making between design team members. Avoiding stereotypes forces designers to dismiss their assumptions and consider real user goals and needs. If all these benefits are achieved, an improved user experience is expected. This dynamic is precisely what can lead to more effective designs for diverse populations, including the ICTD space.

## Scenarios

Quesenberry(2006) suggests that stories are an important augmentation to personas because stories are effective at communicating culture and transmitting persona information into a memorable format (Quesenbery, 2006). Where personas describe the individuals that will interact with a product, scenarios in HCI describe the content and context of the interaction. Proponents suggest scenarios in HCI are effective because people are pre-wired to receive complex information through storytelling (Grudin, 2006). Advocates of scenarios stress the inclusion of typical and significant user activities that reflect user goals when interacting with a specific product or service (Carroll, 2000; Go & Carroll, 2004).

Depending on the discipline and granularity of detail the scenario is designed to depict, the term “scenario” can have many different meanings that cause confusion in the HCI context. Other disciplines that use scenarios include strategic planning, requirements analysis and engineering, and object-oriented design (Go & Carroll, 2004). Examples of scenario use include companies that use strategic planning scenarios to describe “what-if” possibilities that allow decision-making about alternative approaches to possible events years in the future (Kahn 1962); HCI scenarios used for requirements analysis and engineering that tell the story of a computer interaction from a system’s perspective and are concerned with the moment to moment interactions at the task level (seminal work in this field includes the “Inquiry Cycle model” (Potts, 1995); and object-oriented design approaches, like those used in requirements analysis, including the “use cases,” which describe a possible path a user might take through a system (citation here), “Responsibility-Driven Design” (citation here) and automated system modeling (citation here). (Jacobson, 1995; Koskimies, Systä, Tuomi, & Männistö, 1998; Wirfs-Brock, 1993). The differences in these types of scenario use are (1) the perspective from which the scenario is written and (2) how far into the future the reader is asked to imagine possibilities.

For this paper, we created HCI scenarios that Cooper et. al., call “context” or “a day in the life” scenarios in their “goal-oriented design” approach. These scenarios are told from the user (persona) perspective and focus on a specific user goal. Context scenarios are created at an early phase of development (compared to other HCI scenarios) and can be used to “explore, at a high level, how the product can best serve the needs of the personas,” and “help create initial user requirements before the specifics of the product are understood” (Cooper, et al., 2007). In Cooper et al.’s approach, context scenarios are followed by “key path scenarios” and “validation

scenarios,” both of which are analogous to the more detailed scenarios used in other HCI approaches.

In summation, personas and scenarios help design team members think about the perspective of the user. Whereas personas help design teams understand who the users are, scenarios help them understand what users want to do.

### Kyrgyzstan

Kyrgyzstan is a post-Soviet country transitioning to a capitalist economy. Its population, estimated at 5.5 million (about the same as the state of Minnesota), is concentrated in the capital city, Bishkek, in the north and in the heavily agricultural Ferghana Valley in the south. The country’s population is literate (literacy rate of 99%) and young, with a median age of 24.2 years (U.S. median age is 36.7). The ethnicity of the population is mostly Kyrgyz (65%), followed by Uzbek (14%) and Russian (13%). Most Kyrgyz (about 75%) consider themselves Muslims (“CIA World Factbook,” 2008).

Face-to-face social networks are critically important in the region (Kuehnast & Dudwick, 2004). Social networks serve as avenues for gathering and sharing information, assistance and goods. Additionally, social networks offset the lack of reliable and trusted information from public institutions such as the government, police and court system (*citation omitted to remove identifying information*). We have also found that technology is positively associated with an individual’s use and trust of their face-to-face (family, friends and neighbors) social network for multiple types of information seeking (*citation omitted to remove identifying information*).

In addition, technology growth in Central Asia has not followed the same pattern as in the West. As shown in Figure 1, Internet and computer use remain relatively low, while mobile phone use has increased at a rate of about 25% a year. Mobile phone usage includes negligible

levels of mobile Internet. Combined with the importance of social networks, rapid mobile phone adoption provides opportunities for designing appropriate technologies that leverage existing patterns. This goal inspired our initial product concept, a Mobile Social Software directory (MoSoSo directory).

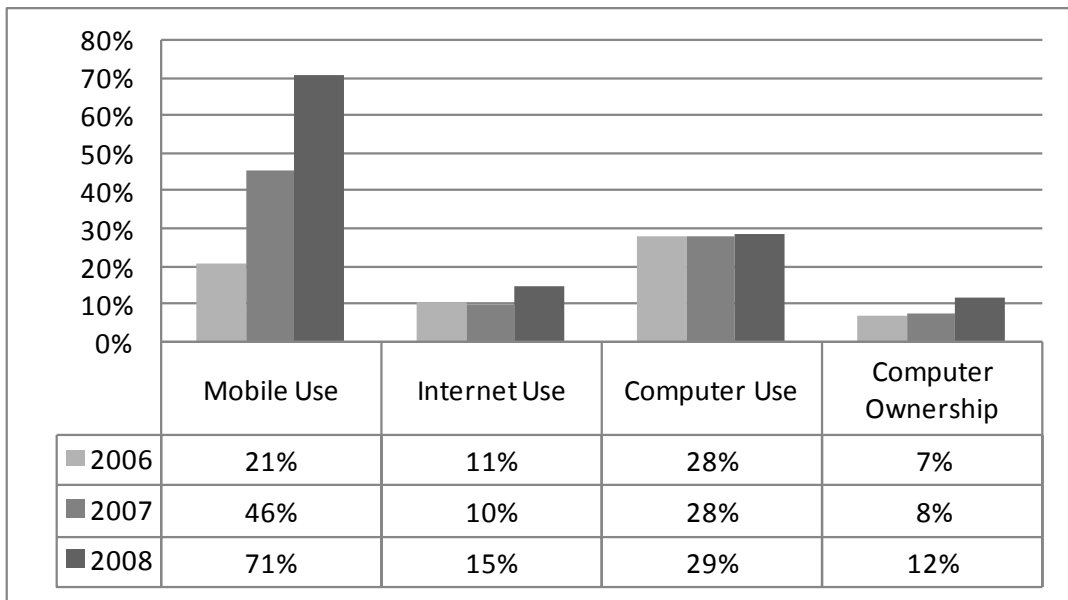


Figure 1: Technology trends in Kyrgyzstan (based on survey data collected by the CAICT group)

### MoSoSo directory concept

Focus groups, interviews, and survey responses of people in Kyrgyzstan prompted the idea for a mobile software service that would act like a yellow pages delivered via the mobile phone and that would leverage social networks. During Soviet times, information directories were available, but the same publications no longer exist. Foreigner-focused or NGO-focused business directories can be purchased in some bookstores, but these are not listings of everyday services. Throughout our work the theme of scant public information directories has been mentioned, and a technological solution that leverages the possibility of user generated content seemed a likely grassroots solution to the information scarcity problem. Specifically, we identified a need for a



service that would fill a niche currently solved in the United States through recommendation Internet sites such as "Angie's List" and recommendation tools found on many online retailers such as Amazon. With low Internet penetration, we argue that Internet-based solutions would not have the volume of users to make them useful or trustworthy. Moreover, although two free information lines operate in the country (similar to 411), respondents complained that it could take all day to get through to an operator and it is expensive to call the landline-based information service with a mobile phone. An appropriate solution to the same information problem would instead leverage mobile phones.

In summation, three key factors inspired the shape of the service: (1) no standard phone directories are available in the country, (although there are two free information lines, participants in interviews complained that it could take all day to get through to an operator); (2) Kyrgyz highly value close social networks for information, assistance and goods (Kuehnast & Dudwick, 2004); and (3) there is a strong upward trend in mobile phone use and ownership in Kyrgyzstan while the growth of computer and Internet use is relatively flat. Ideally, after we identified the MoSoSo directory as a tenable concept, we would then have conducted field studies to elicit specific user requirements and collected data specifically for personas and design scenarios. However, because of timing and economic constraints, we were unable to collect such data and instead leveraged data already available to us.

### Research for personas and scenarios

The creation of personas and scenarios commonly uses face-to-face interviews and observation studies to examine current and possible future uses of a specific product or service (Cooper, et al., 2007). When designing products for the developing world or other diverse communities, however, these common research methods are not always viable for many reasons:

budgets are limited, the ability to perform firsthand onsite research can be challenging without extensive local knowledge, and product cycle timeframes can limit the feasibility of field research. Each of these factors might prevent the in-depth study of a target market that would be typical in traditional approaches to persona and scenario creation.

One solution to these challenges is to use data that is otherwise available. Many countries, market research firms, and academics conduct social survey work and ethnographies. Global projects such as the World Values Survey or the World Internet Project provide overviews of populations, their attitudes, and patterns of media and technology usage. Anthropologists produce ethnographies about societies around the world, and sociologists conduct in-depth studies that designers could repurpose if they had a methodology to do so.

In this paper, we present personas and scenarios of mobile phone users in Kyrgyzstan. They were created using data from two previous CAICT studies: (1) a 2007 survey of 1000 respondents in Kyrgyzstan, and (2) sixteen interviews (with twelve participants). Neither study focused on user requirements or the creation of personas and scenarios for a specific product or service. The survey was conducted to identify attitudes and behaviors associated with technology use, and the focus groups and interviews were conducted to identify how mobile phones support existing and new social networks.

Using statistical analyses of the survey data and information from the interviews, we created three personas, each with an accompanying context scenario to communicate user requirements for the proposed MoSoSo directory application. This case study demonstrates that researchers can use accepted UCD methods, such as personas and scenarios to help designers make appropriate technology design decisions, even when they lack the resources to conduct firsthand research on a given product or service. Our effort thus acknowledges the constraints

facing many researchers and design teams who lack institutional support and/or budgets that allow for research studies focused on a product under development.

## **Data Collection Methods (existing data)**

Without the luxury of conducting primary research focused on the MoSoSo directory, we used two sets of previously collected data to create the personas and scenarios. Neither data collection was focused on user requirements for a specific product or service. The characteristics of each dataset are described below.

### **Survey Data**

The first set of data was from an April-May 2007 large scale social survey of 1000 respondents, age 15 and older, administered in urban and rural areas from several regions in Kyrgyzstan. The survey sample was based on government census information on age, gender, ethnicity, and geographic location. The sample includes 50 sampling locations; 12-29 respondents were interviewed in each location. The survey instrument was designed by a team of researchers from the (*location omitted here to remove identifying information*). BRIF Research Group located in Kazakhstan administered the survey. Households were selected by a random walk procedure. Each household respondent was chosen using the Kish grid method, a common technique to assure a random selection of household members (Kish, 1949).

### **Focus Group and Interview Data**

The second set of data used to inform the personas and scenarios were from focus groups and interviews conducted by three (*location omitted here to remove identifying information*) researchers in two sites in Kyrgyzstan: the capital city and a smaller suburban city, Kara Balta. Researchers conducted two sessions in each location: each session involved a focus group and individual interview of three individuals, for a total of twelve adult participants. The interviews

identified mobile phone usage patterns that inform the upkeep and maintenance of social networks.

## **A model for using existing data**

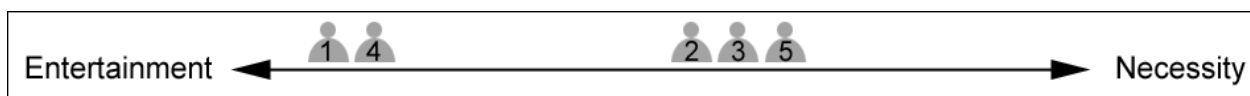
The following discusses how we modified traditional user requirement research approaches for creating personas and scenarios as they are discussed in the literature. While there is no one recipe for creating personas and scenarios, the literature agrees on three basic steps: (1) collect data about users; (2) segment the users; (3) create a persona for each user segment and develop context scenarios for each persona (Cooper, et al., 2007; Pruitt & Aldin, 2006). Context scenarios should illustrate the persona interacting with the product and reflect a usage goal that persona has for the product or service (Carroll, 2000). *Since we were using existing data, the first step was complete.*

Because the data collection was completed, steps 2 and 3 became more complicated and required modification from common approaches discussed in the literature. The next section quickly compares the traditional methods for persona and scenario creation (Steps 2 and 3) with our approach. In so doing, we provide a roadmap for others who might want to build user requirements with limited data sources and present them via personas and scenarios.

### **Segment the users (Step 2): What the literature suggests**

While marketing segments are typically defined to hone a message for increasing sales aimed at the consumer (buyer), segments for personas focus on the person(s) who will ultimately use a product (user). Demographics, psychographics (psychological factors that drive behaviors) and job roles are common approaches for marketing segmentation (Barlow-Busch, 2006). These approaches are also valid in persona segmentation, but the literature stresses focusing on differences in uses of the product by persona segments.

Mulder & Yaar (2007) argue that the best dimension on which to segment users is according to the goals they have when using the product (Mulder & Yaar, 2007). Cooper et. al. (2007) advocate the use of interviews for data collection using a clustering method to put each interview subject on spectrums of opposing attitudes or behaviors concerning the specific product. For example, when segmenting users for a software product, they used attitudinal extremes of necessity versus entertainment, as shown in Figure 2. Interview subjects are placed along various spectrum extremes, and then clusters of users are identified.



**Figure 2: Example of Cooper et. al. attitude spectrum in relation to a product**

### segment the users: what we did

As previously discussed, our data sources were much different than those typically used in two key areas: (1) only rarely have others used data not collected in relationship to a specific product; and (2) one dataset was from a survey which led us to use several quantitative methods. Using quantitative methods in the creation of personas is rarely discussed in the dominant literature, and there are limited examples (see Chapman, Love, & Alford, 2008; Mulder & Yaar, 2007).

### Persona segmentation using the survey data

In our survey results, 460 respondents owned mobile phones. We segmented them based on survey questions most closely pertaining to goals. These questions asked respondents whether they agreed or disagreed with twelve different motivations for why they acquired a mobile phone. Respondents could agree to multiple motivations, as shown in Table 1. This was our first modification to cited methods: where research would typically inform goals in relationship to a

specific product, we focused on motivations related to the technology that would deliver the service.

Using Phi correlations, we discovered significant positive relationships that broke into three logical groupings: (1) the motivation to replace a home phone; (2) practical motivations including a need to make calls and mobile phone affordability; and (3) social motivations, which included a desire to receive calls and a need for a mobile phone because friends had them.

**Table 1: Phi correlations for motivations to acquire a mobile phone**

*Notes: Positive significant correlations are bolded. Statements are re-ordered here to emphasize groupings; the last three statements were not significantly positively associated with any of the three groupings so were omitted from evaluation.*

	<i>n</i>	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. I do not have a home phone	460	--											
2. My home phone is bad quality	460	.08	--										
3. It takes too long to get a home phone	460	<b>.20 **</b>	<b>.19 **</b>	--									
4. To make calls when away from home	460	-.25 **	-.04	-.06	--								
5. It is cheaper than a home phone	460	.03	-.03	-.03	.06	--							
6. I got a good price	460	.04	-.04	-.04	<b>.19 **</b>	<b>.36 **</b>	--						
7. My friends all have mobile phones	460	.02 *	-.01	.03	-.02	<b>.35 **</b>	<b>.32 **</b>	--					
8. I like to receive voicemail	460	-.02	<b>.19 **</b>	-.02	-.06	-.03	.09	<b>.26 **</b>	--				
9. I like people to reach me at all times	460	-.14 **	.03	.02	-.32 **	.09	<b>.17 **</b>	<b>.13 **</b>	.05	--			
10. Easier to make international calls	460	-.01	-.03	.05	-.19 **	-.04	-.05	-.04	-.03	-.09 *	--		
11. I need it for work	460	-.26	-.01	-.10	-.01	-.01	-.02	-.03	-.01	-.05	-.01	--	
12. Convenience	460	-.08	-.03	-.03	-.03	-.04	-.05	-.04	-.04	-.04	-.04	<b>.17 **</b>	--

## Final groupings

We next placed the respondents in one of three groups based on their responses. We found that 354 of the 460 respondents who owned mobile phones claimed motivations that fell into one of the three final motivation groups without overlap. Our final three groups were:

**Replacement group:** In the final segmentation model there were 46 (13%) individuals in the replacement motivation group. A large majority (84%) of this group reported not having a phone at home, 7% said their home phone line was bad quality, and 9% felt that home phones took too long to install. Therefore the primary driving replacement motivation of this group was *a lack of a home phone*.

**Practical group:** There were 195 (55%) individuals in the practical motivation group. Almost all members of this group (99%) gave a need to make calls when away from home or work as the motivation for acquiring a mobile phone, 2% were also motivated by mobile phones being cheaper than land lines and 2% by getting a good price for the phone. The primary driving motivation of this group was a *desire to make outgoing calls* when they were away from landlines at home or work.

**Social group:** There were 113 (32%) individuals in the social motivation group. A majority (85%) wanted people to reach them at all times, 19% of this group got their mobile phone because their friends had them, and 4% wanted to receive voicemail. Therefore the primary driving motivation of this group was a *desire to receive incoming calls at all times*.

Note that the primary motivation of each group was significantly negatively associated with the other primary motivation statements. These negative associations confirmed the logic of our initial persona segmentation groupings. In sum, we first looked for an appropriate survey question that captured how users would utilize the MoSoSo directory and approximate user goals when using the product. After choosing “user motivation for acquisition of their mobile phone,” we determined if there were indeed distinct groups through significant Phi correlations. Once satisfied that the groups were potentially different, we determine if the three groups differed in other areas as detailed in the next sections.

### Persona group differences

We analyzed the survey data through the lens of our proposed three groups to look for important group differences. . Using MANOVAs we conducted omnibus tests on three constructs relevant to our personas:

**Construct 1: Demographics.** There were ten variables in this construct including age, years of schooling, living in an urban versus rural location, household size, gender, marital status, number of children, self-reported socio-economic status (SES), employment status, and student status.

**Construct 2: Mobile phone attitudes, behaviors and experience.** There were 22 variables in this construct. Ten variables asked respondents to rate several attitudes about mobile phones on a scale of 1-4. Eight variables asked respondents to report on possible mobile phone usage behaviors. One variable focused on the respondent's actual mobile phone usage patterns. One variable explored how respondents acquired their first phones,<sup>1</sup> another question asked respondents how much they would miss their phones if they no longer had them,<sup>2</sup> and the last variable in this construct examined the frequency of mobile phone use.<sup>3</sup>

**Construct 3: Other technology.** There were seven variables in this construct including computer ownership, computer and Internet use, frequency of computer and Internet use, landline ownership, and cable or satellite TV availability in the home.

Several steps were taken to assure assumptions for the MANOVA were met. Homogeneity of variance/covariance was tested through Box's test of equality (Tabachnick & Fidell, 2007). The first two constructs met the Box test requirements, but not the last so Construct 3 could not be used in a MANOVA. Consequently, items for Construct 3 were analyzed using univariate ANOVA and Chi-square tests with a Bonferroni adjusted alpha.

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<sup>1</sup> This variable was dummy coded (0,1): received as a gift (the most common answer) was coded as 1

<sup>2</sup> Most (52%) said they would miss their phone "a lot" skewing the data; therefore, the variable was dummy coded so that "a lot" was coded as 1 and all other answers coded as 0.

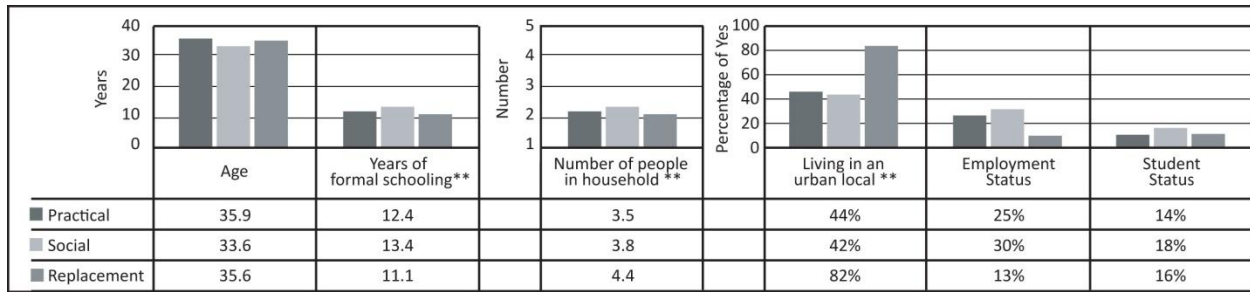
<sup>3</sup> Most (73%) used their phone several times a day, which introduced skew; therefore, the variable was dummy coded so that "several times a day" was coded as 1 and all other answers were coded as 0.



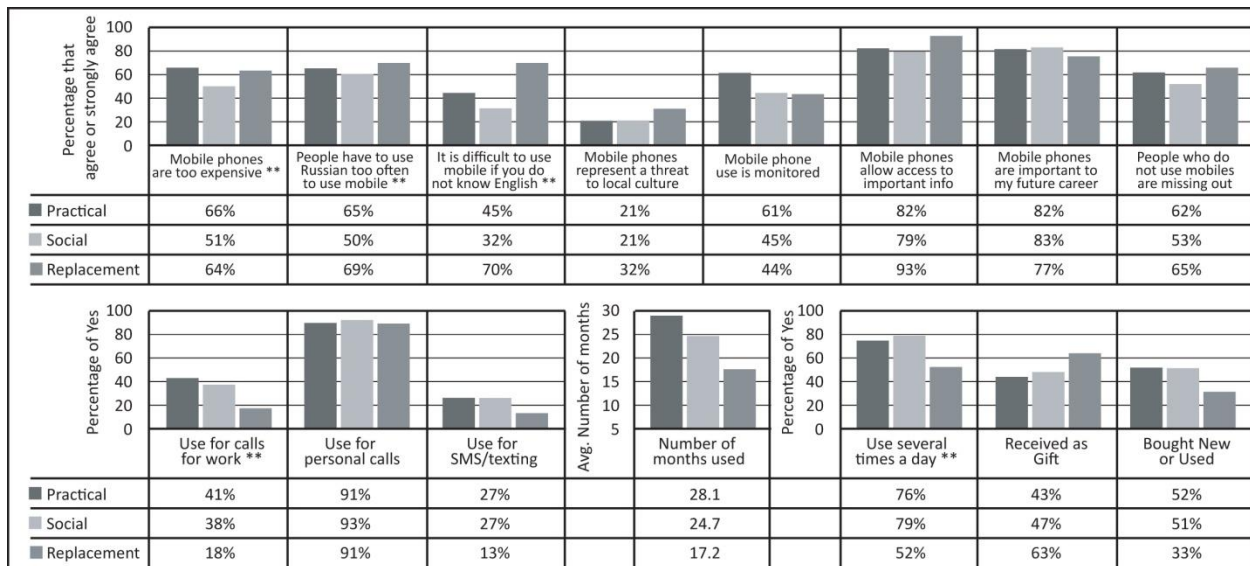
## Construct One: Demographics

The groups differed on the best linear combination of the ten demographic outcomes, Wilks'  $\Lambda = .868$ ,  $F_{(20, 684)} = 2.52$ ,  $p < .001$ ,  $\eta^2 = .069$ , meaning approximately 7% of the variance is accounted for by demographic group differences. Follow-up pair wise comparisons using a Bonferroni adjustment showed that groups differed significantly on three of the ten variables in the construct: years of schooling, living in an urban versus rural location and household size. In Figure 3, we also show findings that were important to the persona descriptions, but were non-significant in the MANOVA model, including average age, employment status and student status.

It is important to note that while we are using inferential statistics to analyze the quantitative data (and are careful to control type one error inflation for each construct), significance for a variable is a fairly high bar to pass. An alpha of .05, means that group differences need to be so extreme that they would only happen by chance in fewer than 5% of cases. Additionally, using a Bonferroni adjustment means that in the univariate follow-up test the 5% alpha is distributed among **all** the variables in the construct. And while this type of rigor is very important in evaluating experimental data, personas are ultimately descriptive tools. Consequently, we feel that descriptive data describing group differences that does not reach the bar of statistical significance should be included in the personas to increase the overall breadth of their descriptions; especially data that follows clear but non-significant trends, for example, see employment in Figure 3.



**Figure 3: Construct One: notable differences in demographics**  
 \*\* = significant differences found in the MANOVA omnibus test



**Figure 4: Construct two: notable differences on attitudes, behaviors and experience**  
 \*\* = significant differences found in the MANOVA omnibus test

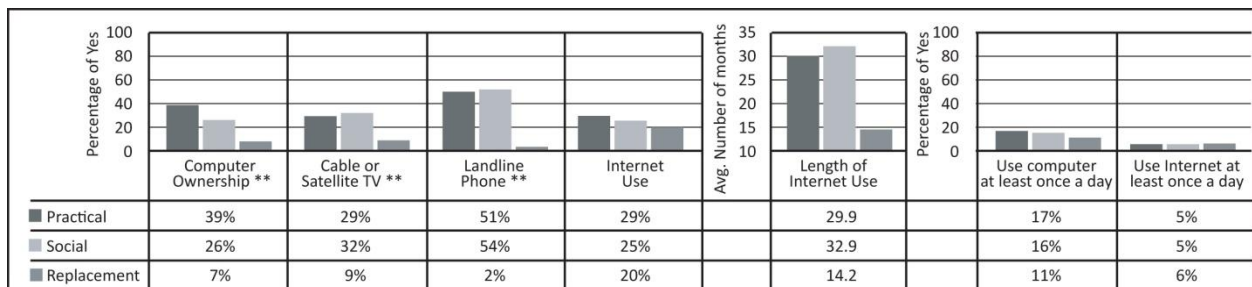
### Construct Two: Mobile phone attitudes, behaviors and experiences

The groups differed on the best linear combination of the 22 mobile use outcomes, Wilks'  $\Lambda = .665$ ,  $F_{(44, 378)} = 2.95$ ,  $p < .05$ ,  $\eta^2 = .185$ , meaning approximately 19% of the variance is accounted for by mobile phone attitudes, behavior and experience group differences. The variables in the mobile phone construct accounted for almost three times the variance in group differences when compared the demographic construct and was an important validation of the segmentation model. In other words, the groups differed more on their mobile phone attitudes and usage than they did on demographics. Follow-up pair wise comparisons using a Bonferroni

adjustment showed that groups differed significantly on five of the 22 variables in construct two, see Figure 4.

### Construct Three: Other technology

We created the technology construct because it is commonly advised to include computer, Internet and other technology usage in persona development if the product is technologically based (Mulder & Yaar, 2007). Items for the last construct were analyzed using univariate ANOVA and Chi-square tests with and Bonferroni adjusted alpha for each variable in the construct (.05/7 variables = adjusted alpha of .007). Computer ownership, having a landline phone and cable/satellite TV were all significantly different between the three persona groups. Figure 5 also shows computer and Internet use details that were not significantly different but were incorporated in the final personas; many of these details describe interesting trends among the three user groups such as Internet use and length of Internet use.



**Figure 5: Construct three: notable differences in other technology use**

\*\* = significant differences found in Chi-square tests

In sum, the segmentation model provided a lens through which we evaluated the multiple variables in the survey and provided an interesting depiction of mobile users in Kyrgyzstan. Our steps were to: (1) find a meaningful segmentation model that would affect how users would utilize the MoSoSo directory their motivation (goal) to acquire a mobile phone; and (2) investigate if our initial segments demonstrated significant differences in three constructs that

were important for persona creation that might affect how, when or if individual respondents would use the MoSoSo directory. To encapsulate this data into a set of memorable personas, we needed more than simple statistical differences. We needed realistic back stories and scenarios based on people's real experiences that would illustrate user requirements. To create these stories, we turned to focus group and interview data.

#### Persona segmentation of the interview participants

We segmented the twelve interview participants into the three established user groups, based on their descriptions of: (a) telephone use, both land lines and mobile phone; and (b) how they used their mobile phone and other technology in their daily lives. See Table 2 for interview identifications and descriptions. In the next section we describe how the interview data was integrated and used for the final persona and scenario creation.

**Table 2: Interview participants by motivation group**

Interview ID	Location	Participants	Roles	Primary motivation
KG_UF1	Bishkek	Urban Family	Father (KG_UF1_F1)	Practical
			Youngest son (KG_UF1_S2)	Social
KG_UY1	Bishkek	Urban Youth	Female Friend 1 (KG_UY1_F1)	Social
			Female Friend 2 (KG_UY1_F2)	Social
			Male Friend 1 (KG_UY1_F3)	Social
KG_RF1	Kara Balta	Rural Family	Father (KG_RF1_1)	Practical
			Mother (KG_RF1_2)	Did not own a mobile phone
			Younger brother (KG_RF1_3)	Practical/Social
KG_RY1	Kara Balta	Rural Youth	Male Friend 1 (KG_RY1_1)	Social
			Male Friend 2 (KG_RY1_2)	Practical/Social
			Female Friend 1 (KG_RY1_3)	Social

### **Create the personas & scenarios (Step 3): *What the literature suggests***

The literature suggests a few basic guidelines on persona content. These include the use of a non-posed photo (Mulder & Yaar, 2007; Pruitt & Aldin, 2006), a personal name beginning with the first letter of the segmentation group name, a biographical profile, and personal information that affects usage patterns in relation to the product (Pruitt & Aldin, 2006).

Additionally, it is commonly advised to include computer, Internet and other technology usage if the product is technologically based (Mulder & Yaar, 2007). Finally, user goals for the product are considered critical (Cooper et. al, 2007).

Personas are presented through many different mediums, including posters and 8.5 x 11 sheets of paper (Pruitt & Aldin, 2006). Others have experimented with more interesting mediums including action figures (Nieters, Ivaturi, & Ahmed, 2007), creating living spaces in which the design team interacts in the same types of physical spaces as the personas (Goodwin, 2006) and placing a summary persona on reference cards (Pruitt & Aldin, 2006). Pruitt and Grudin (2003) suggest creating a “foundation document” that explicitly links the final persona to the supporting data to emphasize their connection to the underlying empirical research.

Context scenarios are intended as a simulation of the persona interacting with the product that focuses on usage patterns and persona goals in a specific context. They need three basic elements: (1) setting where the action takes place; (2) an actor(s) (i.e., personas); and (3) a plot that details a sequence of events and actions (Carroll, 2000). Scenario representations can be presented as storyboards, prototypes, videos, or in a sequenced narrative (Carroll, 2000; Cooper, et al., 2007),

#### Kyrgyz case study: What we did

We followed the guidelines above as closely as possible to create our personas and scenarios. We used photos from interview participants, and gave our personas Kyrgyz names where the first letter matched the first letter of the segment group. The culturally appropriate names also clearly identify the personas as representatives of a non-Western audience. We used our interview data for the biographical and personal content and the survey data to identify technology usage patterns. Identifying user goals, however, was more difficult. Since we were unable to travel to Kyrgyzstan to re-interview participants regarding their goals for a MoSoSo service, we inferred goals from our existing data.

To make these inferences, we examined respondents answers to focus group questions. One question, in particular, asked participants to describe a recent task that was hard to complete. Based on these specific pain-point stories, we imagined how the MoSoSo directory could have been part of a solution to their problems. We also included details from individual participant interviews in which participants described their experiences from the previous day.

For the persona presentation, we designed for an 8.5 x 11 sheet of paper. Additionally, we created a detail sheet for each persona that tied each data point for the persona to the specific data from which it was extracted. This detail sheet was a simplified stand-in for the “foundation document” discussed above (Pruitt & Grudin, 2003). We present our context scenarios here as numbered sequences (Cooper et al.,2007).

### **Findings: User requirements, personas and scenarios**

Our resulting three personas were: Parxat, the practical user, Shirin, the social user, and Roza, the replacement user. Each of the one-page persona presentations included: (1) a photo that looked like a “real” person, e.g. not a model (Mulder & Yaar, 2007; Pruitt & Aldin, 2006); (2) key differentiators (Mulder & Yarr, 2007); (3) personal information as a bullet list (Mulder & Yarr, 2007); (4) computer and Internet usage that characterize the technical abilities of each persona (Mulder & Yarr, 2007) and illustrate significant behavior patterns (Cooper & Reimann, 2003); (5) a personal profile in prose (Mulder & Yarr, 2007; Pruitt & Aldin, 2006); and (6) user goals for the product that emphasizes end goals (Mulder & Yarr, 2007; Pruitt & Aldin, 2006). We also encapsulated several critical user requirements for the MoSoSo directory in the context scenarios.

## User requirements reflected in the context scenarios

We identified six key user requirements for the MoSoSo directory that allowed individuals to: (1) add/edit business entries in a public directory via SMS/text; (2) create and join private group directories that are shared by family or friends to support social networks via SMS/text; (3) broadcast (push) or post (pull) information within their private shared group directories via SMS/text; (4) contribute and rate services in both the public directory and in private shared directories via SMS/text; (5) retrieve recommendations or information from the public directory and from shared private directories via SMS/text; and (6) retrieve information from the service without using SMS/text. Each scenario highlights specific user requirements as suggested in the literature (Carroll, 2000; Cooper, et al., 2007)

## Practical Parxat

Parxat's background story as an owner of a computer club is largely based on interview participant KG\_RY1\_2 who, at the time of the interview, was a 25-year old computer game club owner. Since the persona segment represented 55% of the survey respondents, we identified him as the primary persona whose goals and needs are the most important for the MoSoSo directory to meet. See Figures 6 and 7.

We identified three defining characteristics for the Parxat persona: (1) he uses his phone for work calls, which reflects the fact 41% of practical users in the survey data use their phone for work; a rate higher than any other group; (2) he purchased his phone, which reflects the practical group's greater likelihood to have bought their phones than any other group; and (3) he is more tech savvy than the other two personas based on his higher likelihood of owning a computer. We made Parxat a little bit older than the mean age for the practical group (35.9 years) to emphasize the difference with the social group. All other personal data was based on survey data.



Parxat’s technical information and mobile phone use was mostly based on survey findings. We found, however, that our interview participants were more likely to use text messaging than the 27% rate of use from the survey. Since the MoSoSo service needs some text interfacing, we exaggerated Parxat’s texting ability to align it with the reported text use of an interview participant (KG\_UF1\_S1), who we had placed in the practical segment.

The quotes presented in Parxat’s persona are directly from the interview participants, and emphasize his strong reliance on friends. As a small business owner, Parxat’s goals for the MoSoSo directory are inferred from the interviews.

**Parxat’s context scenario**

For Parxat’s context scenario we focused on two specific user requirements: (1) add business entries; (2) contribute and rate services in both the public directory and in private shared directories via SMS/text. See Table 3.

**Table 3: Parxat's primary context scenario**

1	When Parxat arrives at his small computer club in the morning, he sees a flyer advertising the MoSoSo directory. The flyer explains that as a small business owner he can advertise his shop in the public information space where users can vote to recommend shops and services.
2	Parxat calls the service and discovers that listing a service requires using text.
3	Navigating the service through a phone tree system, he first decides to locate his shop under the public information space heading of “Computer cafe/club”. The entry system allows Parxat to set up two types of advertisements, one for users who utilize text and one for users who do not use text.
4	Later, Parxat asks one of his clients, Ilzat, to call the service and submit a positive vote. Ilzat already has a friends group that he belongs to in the MoSoSo directory and offers to not only give Parxat’s shop a good vote in the public information space, but to also add it as a recommended computer club in his group’s information space.

**Social Shirin**

The context scenario for the social user came from participant KG\_UF1\_S2, who conveyed a story of a student group in which he functioned as both a member and organizer. Shirin was also identified as primary persona because her segment represents 32% of the survey respondents. See Figures 8 and 9.

We identified three key characteristics for Shirin: (1) she uses her phone to primarily call friends, which emphasizes the fact that 93% of social group members use their phones for social calls; (2) she is the least likely to feel mobile access is too expensive, which reflects our the fact that only 50% of the social group felt that mobile phone use was too expensive (significantly less than the other two groups); and (3) she is somewhat tech savvy, which is based on our finding that the social group had the second highest experience with computers and the Internet. We made Shirin a little younger than the mean age for the social group (33.6 years) to emphasize the group's difference from the practical group. All other personal data was based on survey findings.

Like Parxat, we also exaggerated Shirin's texting enthusiasm and based her texting rate on an interview participant (KG\_RY1\_1), who we had placed in the social segment.

The quotes presented in Shirin's persona are directly from interview participants who we had placed in the social group and focus on social aspects of her life. As with Parxat, Shirin's goals for the MoSoSo directory are inferred from the interviews.

### Shirin's context scenario

For Shirin's context scenario we focused on two user requirements: (1) create and join private shared group directories (to support social networks) via SMS/text; and (2) broadcast (push) or post (pull) information within their private shared group directories via SMS/text. See Table 4.

**Table 4: Shirin's primary context scenario**

1	As a cofounder of an unregistered student organization, Shirin is always trying to find ways to recruit new members on campus and let existing members know about upcoming events and meetings.
2	After hearing about the MoSoSo directory she decides to set up a group for her student organization.
3	She also wants to set up the group so that users can get notices in several different ways. They can (1) call in for new information, (2) ask for a text alert that there is new information and then call in, or (3) sign up for text broadcasts.
4	A few days later, once the group has been set up, she sends out a message about an upcoming meeting for group members.

### Replacement Roza

Roza's biographical background was derived primarily from an interview with suburban family members (KG\_RF1). The father's brother lived in a village where there was only one landline housed in a community building that closed at 5PM. See Figures 10 and 11. Since Roza's persona segment only represents 13% of survey respondents, we identified her as a secondary persona whose goals and needs are less of a driving force in the design of the MoSoSo directory compared to the other two personas.

We identified three key characteristics for Roza: (1) she is the least likely to use her phone for work; (2) she lives in a rural area, which is based on survey results that 82% of the replacement group lived in a rural area; and (3) she is not tech savvy, which reflects our finding that the replacement group was the least tech savvy. Roza's remaining personal data was based on survey findings for her segment.

As with the previous two participants, Roza's technical information and mobile phone use were based on survey findings. Since none of our interview participants fit in the replacement group, Roza's quotes are from an interview participant (KG\_UF1\_F1), who emphasized the importance of social networks (rather than technologies) when finding services.

## Roza's context scenario

Roza's context scenario came from the urban father participant, KG\_UF1\_F1, who described recent difficulty finding a mechanic. Roza's scenario focuses on one specific user requirement: allow users to retrieve information from the service without using SMS/text.

**Table 5:Roza's primary context scenario**

1	When Roza's husband, Ermek, left for work this morning he discovered that their car would not start. He called a co-worker who luckily was able to pick up Ermek on his way to the local farm where they both work. Ermek asked Roza to find a mechanic to fix the car as soon as possible.
2	Trusting her social network for answers, Roza began to call friends and family to see if anyone knew of a good mechanic with expertise fixing their make and model of car.
3	Her sister-in-law suggested Roza call the general information line. This suggestion frustrated Roza because it can take several hours to get through the information line and then she will have no idea if the mechanic will be good.
4	Rather than calling the information line right away, Roza calls a neighbor who tells her about the MoSoSo directory and gives Roza a password for the neighborhood group.
5	Since Roza does not use text messaging, Roza is pleased to find she can interact using only her keypad by answering questions that guide her to a list of locally recommended mechanics.
6	After navigating her way through the phone tree, Roza finds a mechanic that the neighborhood group recommended.

Each of these context scenarios illustrates particular user requirements of the MoSoSo directory based real stories about pain-points encountered in everyday life, the importance of social networks, and how the MoSoSo service might support those existing networks and help solve a problem. The personas amalgamate multiple sources of data to provide an idea of who the users are , and the scenarios describe a particular interaction with the proposed service. Together, the personas and scenarios roll-up complex data from multiple sources into communication conduits that design teams can use to understand end-users.



## Parxat Practical

### Primary Motivation to acquire phone:

I got my mobile phone to make calls when I am away from work or home

### Associated motivations:

I got a good price on my phone and mobile phones are cheaper than landlines

### Personal Profile

*"Mobile phones are part of your communications its like eyes and ears"*

For Parxat, mobile phones have provided a key way to stay in contact with work, family and friends.

He owns and manages a small computer game club with eight computers. His club does not yet have internet or a landline; however, he would like to add the internet and more computers when he can afford them.

Currently, Parxat maintains all of the computers but knows he may need help with some computer problems in the future. Other club owners that he has known have had to shut down after two to three years because the equipment has broken down and the owners cannot get the old equipment fixed or afford new. Right now he is not sure who he would ask for help if one of his computers needed maintenance that he could not perform himself.

Parxat has always relied heavily on a system of personal recommendations when looking for professional services. He feels that one should *"trust the advice of friends because they are to be trusted."*

### Parxat's Goals for MoSoSo Directory

- Would seek recommendations for professional help such as plumbers and computer maintenance
- Would like to create a public recommendation for his computer club
- Groups he would join or create
  - Family
  - Clients from his computer club
  - Friends through work

### Key Significant Differences

**Uses the phone for work calls**

**Bought his mobile phone (not a gift)**

**Tech savvy compared to other groups**

### Personal Information

**Age:** 43 years

**Profession:** Owns and manages computer game club with eight computers

**Lives:** In the capital city of Bishkek

**Home Life:** Lives with his wife and two sons

**Russian:** Can speak and read fluently

**Primary Home Language:** Kyrgyz

**Primary Work Language:** Russian

**Schooling:** He has a degree in economics focused on finance and credit from Kyrgyzstan Slavonic University

**Income:** 5200 soms a month (approx \$140.00)

### Technical Information

**Internet Use:** Yes, at least occasionally

**Length of use:** 36 months

**Use how often:** 1-2 days a week

**Where use:** Most often at a friend's internet cafe

**Computer User:** Yes

**How often:** Several times a day at work

**Cable or Satellite TV:** Yes

**Home Landline:** Yes

### Mobile Phone Use

**Length of use:** 28 months

**How acquired:** Bought his phone new

**Use how often:** Usually a few times a day

**For:** 60% personal calls, 40% work calls

**SMS:** Yes: 70% voice, 30% text

**Feelings and concerns:**

Concerned that mobile phone activity is monitored

Would miss his phone very much if he did not have it (rated 4 on a scale of 1-4)

Feels mobile phone access is too expensive

Primary persona: represents 55% of survey respondents who own mobile phones

1

Figure 6: Parxat Persona

# Parxat Persona Data Detail

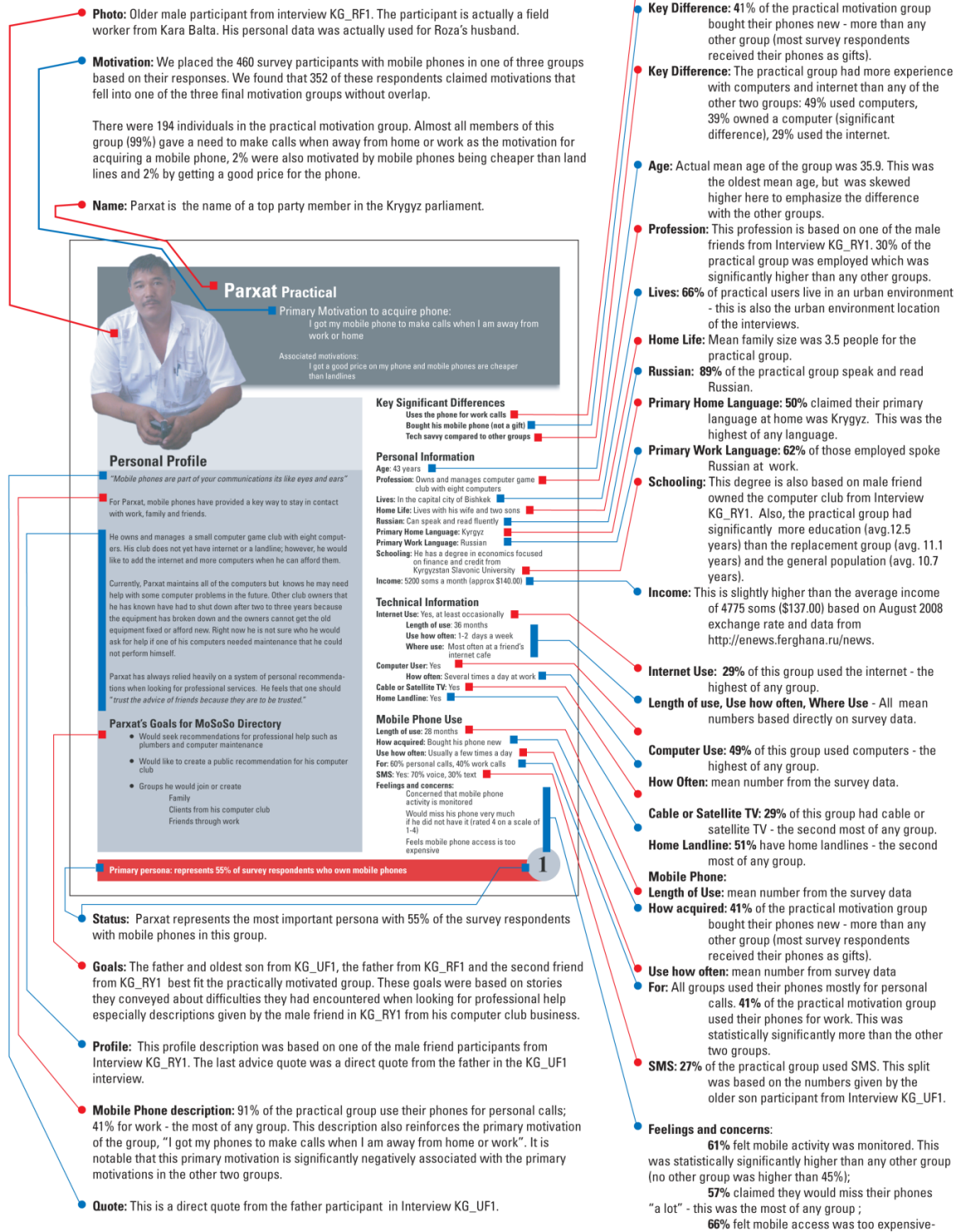
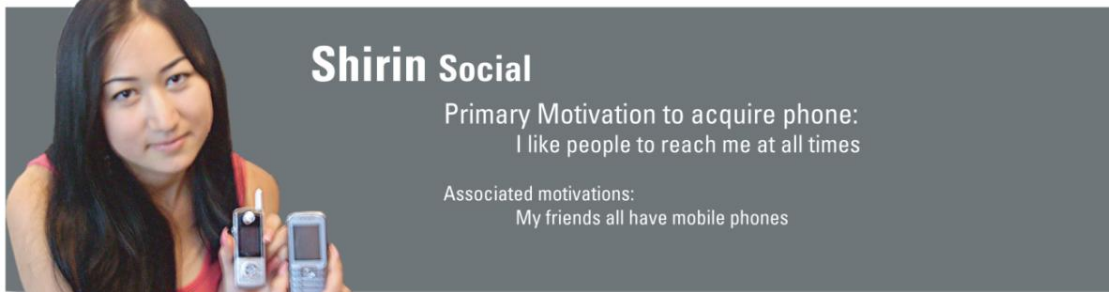


Figure 7: Parxat persona data detail





## Shirin Social

Primary Motivation to acquire phone:  
I like people to reach me at all times

Associated motivations:  
My friends all have mobile phones

### Personal Profile

*"We just talk to our friends....things like did you hear that this or that happened - in our communication rumors are the official news, and gossip works"*

For Shirin, keeping in contact with friends is the most important thing about mobile phones.

She is a full time student (junior) at American University of Central Asia (AUCA), studying business administration. She also works part time as a bartender in a cafe .

Shirin is part of an unregistered student association at school that organizes cultural and historical meetings at a local cafe. She also enjoys arranging parties for her friends.

She is interested in social networking applications on the internet, but has found it boring, stating *"the first time is interesting then you get bored because you already know everybody."*

### Shirin's Goals for MoSoSo Directory

- Would use the service most to create groups of friends
- Would like to broadcast messages to particular groups or to tell people where there will be social gatherings
- Would like to retrieve messages from other members of a group
- Groups she would join or create
  - Family
  - Friends from work and school
  - Associations through her unregistered student organization

### Key Significant Differences

Uses the phone to primarily to call friends  
Least likely to feel mobile access is too expensive  
Somewhat tech savvy

### Personal Information

**Age:** 20 years  
**Profession:** Student and works part time as a bartender in a local cafe  
**Lives:** In the capital city of Bishkek  
**Home Life:** Lives with her dad and an older brother. She also has around 30 cousins in towns.  
**Russian:** Can speak and read fluently  
**Primary Home Language:** Kyrgyz  
**Primary Work Language:** Kyrgyz  
**Schooling:** She is a full time student (junior) at the American University of Central Asia studying business administration  
**Income:** 2000 soms a month (approx \$55.00)

### Technical Information

**Internet Use:** Yes, at least occasionally  
**Length of use:** 33 months  
**Use how often:** About once a week  
**Where use:** Most often at an internet cafe  
**Computer User :** Yes  
**How often:** A few times a week at school  
**Cable or Satellite TV:** Yes  
**Home Landline:** Yes

### Mobile Phone Use

**Length of use:** 25 months  
**How acquired:** Was given the phone by a cousin  
**Use how often:** Several times a day  
**For:** 80% personal calls, 20% work calls  
**SMS:** Yes: 65% voice, 35% text  
**Feelings and concerns:**  
 The least likely of any group to feel that mobile phones are too expensive  
 Feels that mobile phones are important to her future career

Primary persona: represents 32% of survey respondents who own mobile phones

2

Figure 8: Shirin persona

# Shirin Persona Data Detail

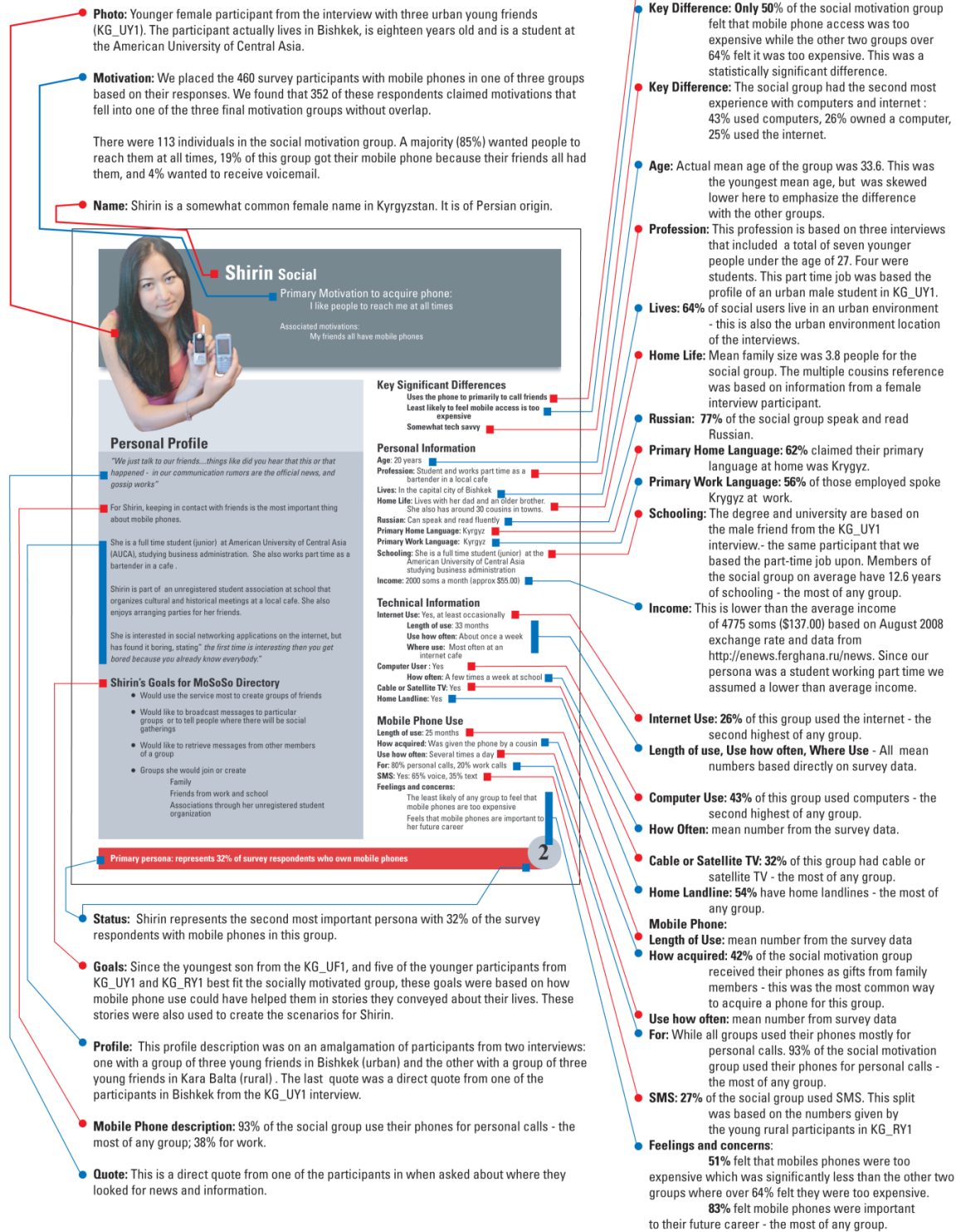


Figure 9: Shirin persona data detail





## Roza Replacement

Primary Motivation to acquire phone:  
I have no home phone

Associated motivations:  
It takes too long to get a home phone

### Personal Profile

*"There are only so many services provided, but not enough for middle class people... it would be nice if there was the one server that gave the information about everything that was needed for marshukas (buses) and other things."*

For Roza, who does not have a landline at home, a mobile phone is a very important device that allows her to stay in contact with her friends and family; however, she would like to see more affordable mobile phone services for "middle class" people like her.

There is only one landline in a community building in her village that closes at 5 PM every day.

While Roza herself is not tech savvy; she does not use the internet or computers. However, she recognizes the importance of technology for her daughters, and would like to have a computer at home while they are in school.

Roza and her husband rely on their friends and family to find specialist to complete services they need. Recently, she needed to find a mechanic and used her social network, stating *"...it's better to find someone through your friends."*

### Roza's Goals for MoSoSo Directory

- Would be more likely to seek a recommendation for services than to make one
- Would want to access the service without using text
- Would like to find recommendations for professional services from other members of a group
- Groups she would join
  - Family
  - Neighbors
  - May look in the public area for professional services

### Key Significant Differences

Least likely to use the phone for work  
Lives in a rural area  
Not tech savvy

### Personal Information

**Age:** 35 years  
**Profession:** Housewife - her husband is a driver for an agricultural corporation (for 23 years)  
**Lives:** In Ceragulak, a rural village  
**Home Life:** Lives with her husband, son and two daughters  
**Russian:** Can speak and read Russian  
**Primary Home Language:** Kyrgyz  
**Primary (Husband's) Work Language:** Kyrgyz  
**Schooling:** Completed secondary school  
**Income:** (Husband's income) 4200 soms a month (approx \$110.00)

### Technical Information

**Internet Use?:** No  
**Computer User?:** No, but she would like to get a computer for her two daughters who are still in school  
**Cable or Satellite TV:** No  
**Home Landline:** No

### Mobile Phone Use

**Length of use:** 17 months  
**How acquired:** Was given the phone by her brother  
**Use how often:** Three to five days a week  
**For:** Primarily for personal calls  
**SMS:** No, but has considered it  
**Feelings and concerns:**  
 She feels it is difficult to use a mobile phone when you do not know English  
 She is concerned that mobile phones represent a threat to local culture and ways  
 She feels strongly that mobile phones allow her access to important and relevant information

Secondary persona: represents 13% of survey respondents who own mobile phones

3

Figure 10: Roza persona

# Roza Persona Data Detail

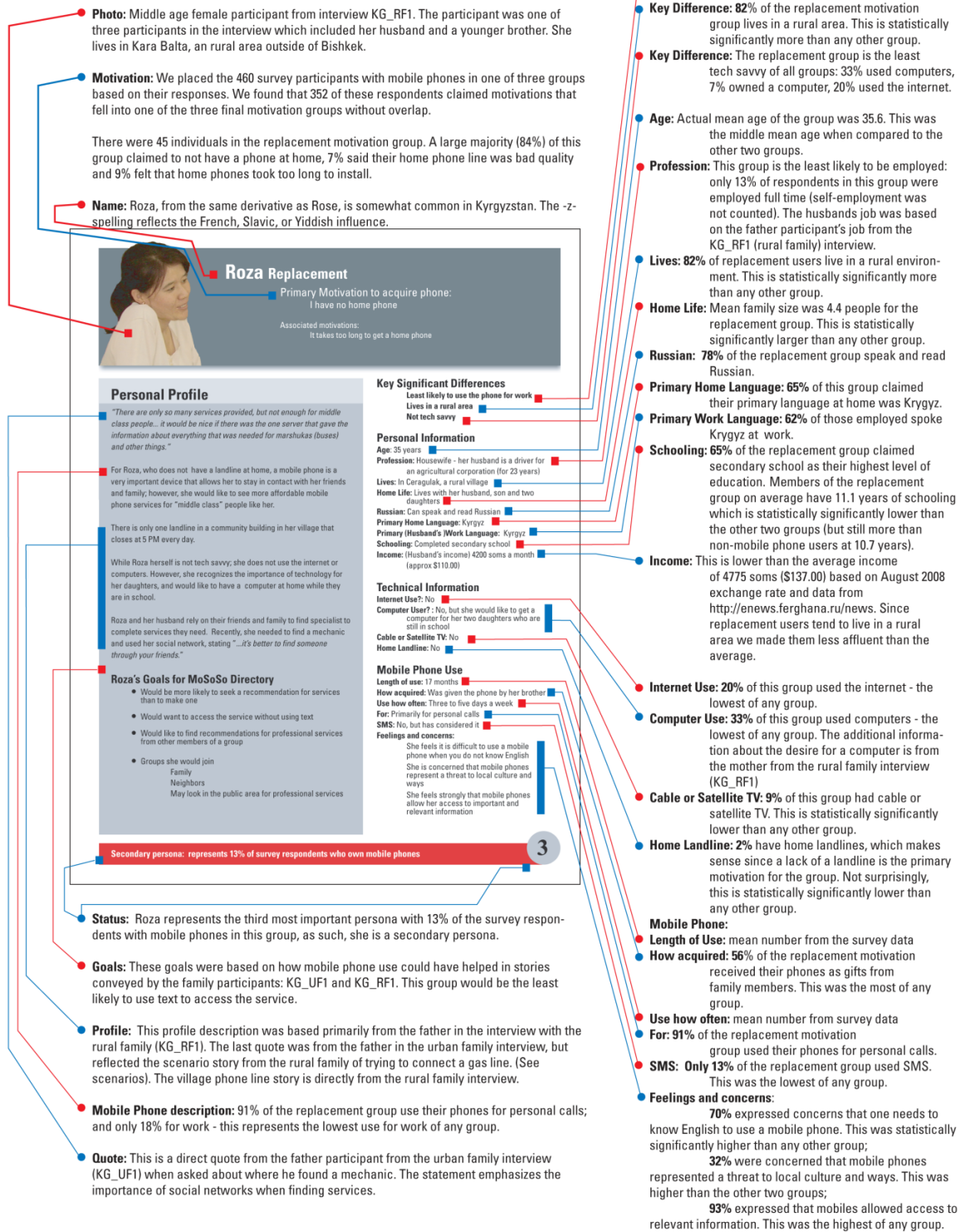


Figure 11: Roza persona data detail

## Discussion

The case study presented here discusses how we used existing qualitative and quantitative data to create personas and scenarios that identify user requirements and communicate user needs. . The data was not collected in relation to a specific product or service. We began by segmenting the audience through statistical analysis of survey questions and identified three groups that were differentiated by their motivation to acquire a mobile phone: practical, social and replacement. We then analyzed the survey data for additional differences among the three groups. The differences reflected in the final personas were based on three constructs; (1) demographics; (2) attitudes about mobile phones and mobile phone usage; and (3) other experience with technology. While quantitative datasets was useful for user segmentation, the richer qualitative data was needed for personal profiles and scenarios.

Once each interview participant was placed in the appropriate segment, the interview information was used to fill in biographical stories. The resulting persona information was amalgamated into a single sheet for each persona to provide a memorable image of end-users. The scenarios presented here were based on real life stories in response to interview questions about difficulties the participants had encountered. For each context scenario, we inferred how the MoSoSo directory could help the participants navigate those difficulties and we focused on specific user requirements.

Because design research in for diverse populations, including developing regions, is expensive and demands significant resources and expertise, we argue that using existing data sources can reduce costs while still representing the user needs of these populations. Designing for diverse populations is crucial for both development and economic reasons. While on the ground studies are irreplaceable as data sources, other approaches are needed if design is to

address increasingly diverse users. User researchers and designers can make significant headway in creating appropriate designs by extracting user requirements from existing data sources. Additionally, we demonstrate that personas and scenarios make compellingly communicate user research and define user requirements. Because there is very little information about how to create personas and scenarios using existing data, the methods presented here will help researchers (1) create effective conduits of user research (personas and scenarios) that capture and communicate user requirements to design teams; and (2) allow a broader range of designers – including those in workplaces that lack financial resources and/or cultural expertise – make use of such approaches to develop creative and appropriate technologies for diverse users.

## **Future Work**

We plan on using the work presented here in two very different studies. The first study is part of an investigation that hopes to identify variables that affect how useful, actionable and usable personas and scenarios are from the perspective of design team members. As part of the study, several professional designers and developers will be asked to interact with the personas and scenarios presented here in an experimental lab setting. Additionally, they will be asked to reflect on previous use (if possible) of personas and scenario and whether or not interacting with personas/scenarios that represent a diverse audience has an effect on their utility. We hope to identify which claims made of personas and scenarios in the literature are met, and what circumstances affect their usefulness.

We are also in the process of developing a second version of the MoSoSo prototype for usability testing. In late March 2009, we conducted eight usability tests in Bishkek, Kyrgyzstan, using a rough prototype created in Adobe Flash. The prototype did not have any voice functionality; all interaction was through text a simulated phone displayed on a computer. Our

initial results presented rich data with respect to the functionality as well as the user interface; however, the basic concept was enthusiastically received by six of our eight participants. Our future work will continue testing of the MoSoSo directory to see if our development process that relied significantly on existing data did indeed generate a usable and useful product.

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## **References**

*Note: 2 references deleted to remove identifying information*

- Barlow-Busch, B. (2006). Marketing versus design personas *The Persona Lifecycle* (pp. 602-641). San Fransisco, CA: Elsevier.
- Carroll, J. M. (2000). Five reasons for scenario-based design. *Interacting with Computers*, 13, 43-60.
- Carroll, J. M. (2000). *Making Use: Scenario-based design of human computer interactions*. Cambridge, MA: Mit Press.
- Chapman, C. N., Love, E., & Alford, J. L. (2008, 7-10 Jan). *Quantitative Early-Phase User Research Methods: Hard Data for Initial Product Design*. Paper presented at the Proceedings of the 41st Hawaii International Conference on System Sciences, Hawaii, USA.
- Chapman, C. N., & Milham, R. P. (2006). *The persona's new clothes: methodological and practical arguments against a popular method*. Paper presented at the Proceedings of the Human Factors and Ergonomics Society 50th Annual Meeting, Santa Monica, CA.
- CIA World Factbook (2008). Retrieved September 22, 2008, from <https://www.cia.gov/library/publications/the-world-factbook/>
- Cooper, A., Reimann, R., & Cronin, D. (2007). *About Face 3: The Essentials of Interaction Design*. Indianapolis, IN: Wiley Publishing.
- Go, K., & Carroll, J. M. (2004). The Blind Men and the Elephant: Views of Scenario-Based System Design. *Interactions*, 11(6), 45-53.

- Goodwin, K. (2002). Getting from Research to Personas: Harnessing the Power of Data, Retrieved April 23, 2008, from [http://www.cooper.com/journal/2002/11/getting\\_from\\_research\\_to\\_perso.html](http://www.cooper.com/journal/2002/11/getting_from_research_to_perso.html)
- Goodwin, K. (2006). Taking personas too far, Retrieved April 28, 2008, from [http://www.cooper.com/journal/2006/12/taking\\_personas\\_too\\_far.html](http://www.cooper.com/journal/2006/12/taking_personas_too_far.html)
- Grudin, J. (2006). Why Persona's work: The psychological evidence *The Persona Lifecycle* (pp. 642-663). San Fransisco, CA: Elsevier.
- Jacobson, I. (1995). The use-case construct in object-oriented software engineering. In J. M. Carroll (Ed.), *Scenario-based design: Envisioning work and technology in system development* (pp. 309-306).
- Kahn, H. (1962). *Thinking about the unthinkable*. New York, NY: Horizon Press.
- Kam, M., Bhagwani, S., Kumar, A., Lal, S., Mathur, A., Tewari, A., et al. (2007). *The social complexities of usercentered design in ICTD: Experiences from four schools in India's villages and slums*. Paper presented at the Proceedings of the 2nd IEEE/ACM International Conference on Information and Communication Technologies and Development, Bangalore, India.
- Kish, L. (1949). The procedure for objective respondent selection within the household. *Journal of American Statistical Association*, 44, 380-387.
- Koskimies, K., Systä, T., Tuomi, J., & Männistö, T. (1998). Automated support for modeling OO software. *IEEE Software*, 15(1), 87-94.
- Kuehnast, K., & Dudwick, N. (2004). *Better a Hundred Friends than a Hundred Rubles? Social Networks in Transition - The Kyrgyz Republic* (Illustrated ed.): World Bank.
- Kuniavsky, M. (2003). User Profiles *In Observing the user experience: A Practitioners guide to user research* (pp. 129-159). San Francisco: Morgan Kaufman Publishers.
- Maunder, A., Marsden, G., Gruijters, D., & Blake, E. (2007). *Designing interactive systems for the developing world: Reflections on user-centred design*. Paper presented at the Proceedings of the 2nd IEEE/ACM International Conference on Information and Communication Technologies and Development, Bangalore, India.
- Mulder, S., & Yaar, Z. (2007). *The user is always right : a practical guide to creating and using personas for the Web*. Berkeley, CA: New Riders.
- Nieters, J. E., Ivaturi, S., & Ahmed, I. (2007, April 28- May 3). *Making Personas Memorable*. Paper presented at the Proceedings of CHI '07, San Jose, California, USA.
- Portigal, S. (2008). TRUE TALES: Persona Non Grata. *Interactions*, 15(1), 72-73.
- Potts, C. (1995). *Using Schematic Scenarios to Understand User Needs*. Paper presented at the DIS '95, Ann Arbor, MI.
- Pruitt, J., & Aldin, T. (2006). *The Persona Lifecycle*. San Fransisco, CA: Elsevier.
- Pruitt, J., & Grudin, J. (2003, June 06 - 07). *Personas: practice and theory*. Paper presented at the Proceedings of the 2003 Conference on Designing For User Experiences, DUX '03, San Francisco, California.
- Quesenbery, W. (2006). Storytelling and narrative *The Persona Lifecycle* (pp. 520-555). San Fransisco, CA: Elsevier.
- Rosson, M. B., & Carroll, J. M. (2003). Scenario-Based Design. In J. A. Jacko & A. Sears (Eds.), *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and*

- Emerging Applications* (pp. 1032-1050). Mahwah, New Jersey: Lawrence Erlbaum Associates.
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using Multivariate Statistics* (Fifth ed.). Boston, MA: Pearson Education.
- Wirfs-Brock, R. J. (1993). Designing Scenarios: Making the Case for a Use Case Framework. *The Smalltalk Report*, 3(3).