Web Usability Considerations for People in Developing Nations

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Abstract

People in developing nations face many specific challenges for accessing the web. The methods they use to access web content, and the ways in which they accomplish tasks online are often very different from people in more developed areas of the world. These differences are often overlooked or ignored by people who develop and design web services and products. Findings show that there are clear solutions to these challenges, and through them we can access huge untapped markets and greatly improve the lives of people in developing areas using the web.

Keywords: web usability, developing nations, human-computer interaction

Web Usability Considerations for People in Developing Nations

The internet is widely available and reliable for those of us in developed countries like the United States and most of the European Union. We have fast, highly accessible networks, ever more powerful technology to access these networks, and relatively good education systems to help us use them. But people in less developed areas of the world can have a significantly different, and often more challenging experience accessing the web. What are the problems people in these developing countries face in regards to web accessibility and usability? How can a better interaction with the web help improve the lives of these people? As designers, developers, and analysts, what can we do to improve this interaction, and why do we even care in the first place?

Problems with web usability in developing areas

A good way to start digging into this topic is to look at the general factors that affect web interaction for everyone. Human short-term memory is a major factor in web usability due to the high volume and availability of information. There are several important aspects and constraints of short-term memory. The occipital lobe stores short term memory in about 100ms, or ten-second, increments, filtering out older information. The ten-second time frame stages the information long enough to be filtered and processed into working memory. This means that if a web page takes longer than ten seconds to display new information, it's likely that the visitor will have already forgotten what they clicked on, or what they were looking for. There are other issues caused by slow web pages, like increased stress and anxiety, as shown by a study from Glasgow Caledonian University (Everts, 2012).

What are some factors that might push a web page past this ten-second threshold? According to measurements from 2013, the average web site uses 90 requests for assets that total over 1MB in size for transfer, coming from 15 different sources. It also important to factor in network latency, which includes many steps like DNS lookup and TCP handshake (Grigorik, 2013). There is a significant challenge in transferring and rendering all of this data within the crucial ten-second timeframe.

It's important to remember that the vast majority of human history was very different compared to the past 40 years of technology advancement. Our work and tasks throughout history have mostly been hunting, gathering, and agriculture. These kinds of tasks generally involved working through short, logical steps that transition smoothly from one to another, to make up a clear goal. Our brains and cognition are not wired for the multi-tasking and stutter inherent to our technology (Everts, 2012). Economies in developing areas of the world are generally more reliant on agricultural work, so people in these areas may be even more susceptible to the challenges of using web technology.

There are many additional challenges to web usability that people in developing nations face specifically. These areas usually have much higher levels of cultural, linguistic, and ethnic diversity. In India alone, there are 122 documented languages actively used as a primary form of communication, including 22 official languages. This is not to mention the thousands of minute differences in regional slang. Developing areas also have lower levels of literacy. The combination of these factors means that reaching out to these areas through the web is incredibly difficult if text is used as the primary form of communication (Jain, 2006).

In addition to the cultural challenges, there are also many technical obstacles to effectively using the web in developing areas. While network connectivity and server centers are rapidly growing in many developing nations, the growth is outpaced by the increasing size and capability of modern web sites. Even in well-connected developing nations like Ghana, the lack of server centers means that every web request ends up getting routed through centers in the US and Europe, adding significant latency to the DNS and TCP steps (Zaki, 2014). These factors have a major impact on web usability, and also contribute to download times averaging about twice as long outside of the US (Lohr, 2012).

One technical factor that is particularly relevant to web usability in developing nations is the latency specific to DNS resolution and TCP handshakes. These two steps in the web request contribute the most significant delays to page rendering (Zaki, 2014), and they are amplified by internet access methods in developing areas. The primary way people in developing nations access the web is through mobile networks (3G, SMS, etc.). Half of African and Asian internet users access the web exclusively through mobile devices, compared to about a quarter of people in the US and UK. Of these internet users in Africa, 85% are not using smartphones, but less capable and slower feature phones (Hill, 2010). The mobile networks these devices operate over add more steps to the DNS and TCP process. According to Alistair Hill (2010):

> Before a mobile device can transmit or receive data, it has to establish a radio
>
> channel with the network. This can take several seconds over a 3G connection [or
>
> the slower SMS connections more common in feature phones] … The
>
> combination of these steps can easily add tens to thousands of milliseconds of
>
> extra latency. Further, if there is no data transmitted or received on the radio

channel, a timeout causes the channel to become idle. This requires a new channel

to be established and the entire process to restart, potentially wreaking havoc on

web page load times.

Another tangential challenge with this method of web access is the inherent information

security issues related to SMS networks (Jain, 2006).

Motivations for better web usability in developing areas

With so many significant challenges facing web usability in developing nations, why

should web-based products and services spend so much time and resources targeting people in

these areas? It would be much easier and simpler to just ignore the needs of these people, and

focus only on the fast reliable networks, more cultural uniformity, and highly capable devices

widely available in developed nations.

It's easy to see how much the web has done for commerce, communication, and quality

of life already in developed countries. As compassionate beings, there is natural motivation to

use this tool to help people who might be in less fortunate circumstances. But are there any

objective measures that show specific benefits to making the web more usable for developing

areas? What might motivate a business to invest in this endeavor?

As discussed previously, desktop internet access is much less pervasive in developing

areas throughout Africa and Asia than the growing access of mobile internet. This sets up an

interesting opportunity for application development companies and web-based products and

services to capitalize on a fresh market of consumers. In India specifically, 57% of mobile-only

internet users have direct billing through their providers, but otherwise have no access to

electronic banking or spending. In Africa, the highest mobile browsing rate is for games and

music downloads, potentially paid content. There is a lot of opportunity for people in developing

nations, who have not previously had access to online banking or ecommerce, to use their mobile

billing to make electronic purchases directly on their devices (Hill, 2010).

To coincide with these new electronic payment capabilities in developing areas, there are

significant increases in the number of people accessing the internet across the developing world.

The majority of mobile-only internet users in India are students, a group that is rapidly growing

there, and are projected to be a big consumer influx within the coming decade (Hill, 2010).

Ghana, one of the most well-connected developing nations, saw exponential increases in internet

users from 2009 to 2011, from 5.4% to 14.1%, the largest increase in the history of the country.

There are similar trends in other developing countries (Zaki, 2014).

Solutions for better web usability in developing areas

There are clear business benefits to engaging people of developing nations as consumers,

despite the many technical and cultural obstacles. And there are several clear solutions to

overcoming the web usability problems faced by these people.

The look-and-feel and design of a web page can have a strong effect on its usability for

people in developing areas. Because of the previously discussed network latency, and dramatic

increases in web page weight, it's especially important to limit and prioritize the assets that are

delivered to requests from these areas. The more assets delivered for a page, the longer it will

take to render, and the more monetary burden it will put on the visitor (people in developing

countries spend a greater proportion of their income on internet access than those in

industrialized countries) (Jain, 2006). Two basic elements to consider in a site's aesthetics are

colors and fonts. Previous research has shown that four to five different colors is a strong

benchmark for solid information structure and hierarchy in a web page, without looking

unprofessional or overwhelming (Tezza, 2011). Using a more restricted color scheme also

benefits people with poor connectivity because color asset requests will be smaller, and the fewer

colors will render faster. For similar reasons, another good heuristic for page design is to limit

the number of fonts to three (Tezza, 2011).

A 2011 study by Tezza, Bornia, and Adrade used item response theory to mathematically

create scales of usability features and elements. This point of view can give some valuable

perspective on what helps a website be more useful and what we can prioritize for rendering. In

regards specifically to ecommerce sites, two usability features that stood out as particularly

important in this study were site navigation elements and product search capability. In relation to

people in developing areas, it's interesting to note that language options ranked among the

highest navigation features for importance to usability (Tezza, 2011). Prioritizing these high

ranking features for page rendering can go a long way to alleviate the previously discussed

ten-second time window for web page usability.

There are also several development and performance guidelines that can drastically

improve the time to page render. According to Jain (2006):

current web applications are ill-suited for the low bandwidth environment found

in [Cambodia and Ghana] ... well-known solutions such as caching, compression

and proxying can lead to a significant improvement in performance and user

experience.

While prioritizing elements for page rendering is important, and can help a site get closer

to the 10-second benchmark, it won't help cut down on the actual monetary costs for a person

requesting assets over a network. It's critical to cut down on overall page weight for people that pay for their data in developing areas (Hogan, 2015).

In addition to these clear steps, there are a few new advancements that are predicted to land in the next decade that will also help towards making the web more usable for people in developing areas of the world. New innovations in routing algorithms, as well as better server distribution around the world are simple things that are continually improving connectivity for developing countries (Lohr, 2012). New HTTP2 protocols are becoming more widespread, lessening the need for performance workarounds (Hogan, 2015). Another interesting idea that is gaining more traction is prebrowsing. Modern web browsers are able to predict where a visitor may go to next in a web site, and start requesting that information before they even click, if given some basic direction. Common features that might be good for prebrowsing include login screens and questionnaires, where there is some certainty of where a visitor might go next. There are also more advanced pattern analysis algorithms that can predict user flow through websites in more complex situations, but there are currently significant risks for bandwidth usage through these techniques (Valdarrama, 2014).

Web usability in developing areas of the world is an important subject, and one thing that most developers, designers, and researchers agree on is that there is currently too little research into it. "Very little effort has been expended on understanding and solving the Internet problems in developing regions relative to the number of people these issues affect", according to a 2014 study by Zaki, Chen, Pötsch, Ahmad, and Subramanian. One suggestion is for the W3C to take charge in automating data collection about web usability through server centers, and provide these general data points to analysts and researchers (Jain, 2006). Despite the limited amount of

information, there are many clear problems about the usability of the web in developing areas.

Fortunately there are also clear solutions that can help alleviate these specific problems. Many

times, it ends up being a matter of how motivated web companies are to implement these

solutions, and helping them see the benefits of working towards a more usable, accessible web.

Not only can better web usability help developing countries spread their trade and commerce, it

will also modernize and improve the quality of life for people in developing areas.

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