# Increasingly mobile: How new technologies can enhance qualitative research

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## Abstract

Advances in technology, such as the growth of smart phones, tablet computing, and improved access to the internet have resulted in many new tools and applications designed to increase efficiency and improve workflow. Some of these tools will assist scholars using qualitative methods with their research processes. We describe emerging technologies for use in data collection, analysis, and dissemination that each offer enhancements to existing research processes. Suggestions for keeping pace with the ever-evolving technological landscape are also offered.

## Keywords

## Introduction

Many technological advances in recent decades were quickly adopted by qualitative researchers. For example, most researchers now use digital audio recorders to document interviews because digital technology is more convenient than cassette tapes. Other technological advances have generated discussion and debate. Some researchers initially worried that the epistemological assumptions of computer software developers could subtly shape their own analytic process in ways that blurred methodological clarity (Davidson and Di Gregorio, 2011). Early software programs were associated with a grounded theory approach and some worried that using the software would lead to a troubling homogenization of qualitative research methods (Coffey et al., 1996). As researchers became more familiar with computer-assisted data analysis packages, these concerns largely dissipated and the use of computers in qualitative analysis has grown considerably (Gilbert

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et al., 2013). New applications available on the internet, and more recently through smartphones, tablet computers, and cloud-based computing, are again changing the way we carry out our work as scholars (Van Doorn, 2013).

In this manuscript, we describe technologies that can be used by qualitative researchers to enhance and improve the experience of conducting qualitative research. Our objective is to help researchers envision how such tools can increase our efficiency, enhance our interpretations, and further the reach of our scholarship. By illustrating how these tools fit within existing qualitative practices of data collection, analysis, and dissemination, we encourage scholars to experiment with these new technologies.

It would be a daunting task to review all the technologies that could be adopted by qualitative researchers, and such a review would certainly be outdated almost immediately. Instead, this paper provides examples of types of tools that can enhance the process of qualitative inquiry to stimulate further thinking among researchers about when and how to incorporate new technologies (see Table 1 for a summary and details on how to access each tool we describe). We have chosen to name products that we are familiar with as a starting place for readers who are interested in exploring technological options, but with the rapidity of change in technology we cannot guarantee the ongoing availability or utility of any specific tool. Often numerous programs offer similar functionality, so we encourage readers to spend some time researching programs before incorporating them into qualitative routines., To the best of our knowledge, all information about programs in this paper is accurate.

Before we begin, it is important to note that technologies have ramifications in terms of epistemology, methodology, and ethics. For example, ethical questions about data privacy, epistemological "fit" of technology tools, and access to technology are just a few of the questions that qualitative researchers must examine when considering new technologies. We do not have the space in this review of technological tools to wrestle deeply with these questions. Others have begun to discuss the implications of technological innovation, and we point readers to these resources for more extensive discussion of the issues (see Nind et al., 2012; Phillips and Shaw, 2011; Travers, 2009).

### Data collection

Improved access to the internet and the increasingly "wireless" nature of many parts of the world has led to new options for gathering qualitative data. In this section, we highlight tools for data collection that function with new devices such as tablets and smart phones, and support a higher level of mobility in research. These tools can be useful not only for conducting interviews but also for collecting data through online focus groups, social media and online communities, and in the field. Despite the growing availability of access to the internet and mobile technology, some research participants may not have the financial resources or access to the equipment and services necessary for some of these tools. On the other hand, mobile technologies and internet-based data collection methods may facilitate access for communities that otherwise may have been geographically or socially inaccessible. As always, researchers should assess whether these data collection suggestions are appropriate for the research questions and populations being studied.

Programs such as Poll Everywhere make use of wireless technology to gather "live" data through internet-enabled devices. Poll Everywhere allows the researcher to ask questions, either multiple choice or open-ended, and get live responses from the participants via text or website interaction. The results can be viewed in real-time online or as an embedded image in a PowerPoint or Keynote presentation. This kind of technology can be useful in gauging a group's experiences or opinions. It could be especially useful in focus groups when there may be a sensitive topic where anonymity of responses would be beneficial to the participants. It could also be helpful in getting conversations started in focus groups by polling participants about the topic and using the results to prompt discussion.

Another online tool for gathering textual data is Voice over Internet Protocol applications such as Skype (Hanna, 2012). Most people are aware of Skype for video and phone calls, virtual meetings or instant messaging, but it can also be used for data collection. For example, you can conduct interviews or focus groups in real time via the instant messaging feature, which allows multiple users to participate simultaneously by typing their comments in a common "room." All conversations are saved in Skype and can then be searched for keywords or concepts. The conversation can also be exported in plain text format into programs such as Microsoft products (Word or Excel) or a specialized qualitative data analysis program. Programs such as Kudos Chat Search also allow the user to do more powerful and complex searches, backup data, and manage multiple Skype accounts and chats across multiple computers. Skype can also be useful for collecting audio and visual data. The researcher can conduct interviews or focus groups via the audio-only phone feature or the video chat feature that includes a live video stream of each participant. Programs such as Evaer video recorder for Skype allow you to record both audio and video content and convert it to MP4/AVI files that can be used in data analysis.

New applications for collecting audio data are readily available for the iPhone/ iPad and Android-based devices. Typical digital recorders allow the user to record audio and sync it to a computer where it can be listened to and/or transcribed. In addition, applications such as Circus Ponies or AudioNote allow you to record audio and take notes within the same interface, with the audio and notes synced. Users can either navigate through the audio file via automatically generated time stamps or by clicking on a note that then links directly to the audio that was recorded when the note was written. Notes can also be added after the initial recording is made, so researchers can sync added notes to the audio file while working on data analysis or during the writing process. Syncing notes and audio data enhances the utility of field notes and creates a seamless integration of normally unlinked sources of data.

Photographs are powerful ways of capturing qualitative data and there are many digital tools that offer opportunities to store and use visual data. For instance, photo-sharing programs such as Picasa and Flickr allow users to create closed groups of invited users to upload and share photographs from participatory visual methods projects. These photo-sharing sites can house data and also function as an online forum for reacting to and discussing the images. Other programs, such ass Ning, support more of a community-building process by allowing the researcher to create an interactive online community that includes customized forums, photos, videos, and blogs, all of which can be contributed to by invited users.

Lastly, there are several data collection tools that capture daily activities in a way that may be useful for a variety of research projects. Several applications will depict a person's daily routine and track specific behaviors of interest, such as health behaviors or social contacts. Daily Routine, for example, allows the user to customize the activities of interest and then track them via interacting with the application when they perform the specified behaviors. Summaries of behavioral data can be emailed as a PDF. This information could be used to prompt recall in interviews designed to understand the context or phenomenological experience of performing the tracked behaviors. Other programs, such as Path, include geo-tagging as part of the data collection process. Geo-tagging refers to the process of attaching geographical coordinates to other types of data. These programs create a digital history of place by using smartphones to track location as standalone data or to attach spatial information by "tagging" photos, videos, or written material. This function could be especially useful for ethnographies or other projects in which place is conceptually important.

## Data analysis

Data analysis procedures vary widely based on the type of data, the research methods used, philosophical approaches, and numerous other factors. Here, we will explore common steps in preparing and analyzing qualitative data and technological tools that can enhance these processes.

Even though several computer-assisted qualitative data analysis software packages (CAQDAS) allow a researcher to directly upload audio files for analysis, most social science researchers transform audio data into a more usable format through transcription, the form of which is an analytical and epistemological choice (Hammersley, 2010). As a pragmatic matter, transcription is a time-consuming process. Software (such as Transcriber AG) facilitates transcription by slowing down the audio and allowing pausing and rewinding of the audio using the keyboard, similar to the older foot pedal operated transcription machines. Advances in the accuracy of voice recognition software may further improve the experience of transcribing. Dragon™ is perhaps the most well-known of these products. Earlier versions of voice recognition software were riddled with transcription errors, taking significant effort on the part of the user to fix errors and "train" the software to recognize their voice (Johnson, 2011). Newer versions are more accurate. A transcriber using Dragon might listen to the recording and repeat the audio back into a microphone linked to the transcription software (Matheson, 2007). The researcher will still need to check the transcript for errors, but the bulk of the transcribing can be done with little to no typing using speech-to-text software.

Qualitative data analysis techniques range from using paper, highlighters, and index cards, to word processing (LaPelle, 2004) or spreadsheet tools (Meyer and Avery, 2009), and for the past decade, CAQDAS packages such as Atlas.ti and Nvivo. Advances in web-based technology are creating new opportunities for analyzing qualitative data, particularly in team-based projects.

Many qualitative researchers utilize some form of coding as their primary analytic technique. Various tools for visualizing data have been developed that can assist in the

process of coding and discovering themes and patterns in the data. Word clouds, for example, use frequency counts to develop visual maps of the most commonly used words in a specified body of text. These diagrams can be helpful as an initial overview of common words and concepts in the data. However, the utility of these visualizations is limited because it is not possible to discern useful details like which respondents used the words and the contexts in which they were used. Other automated tools are somewhat better at providing context; for example, word trees search for a specified word or phrase in a body of text and display all of the words following the index phrase. Some of these tools are available in CAQDAS programs such as NVivo, while similar web-based tools often require the user to upload data into a public database, so they are more useful for analysis of texts, documents, public blogs, or other data that is not confidential.

While these visualizations are helpful, researchers will likely still need to use some system for coding and retrieving their data. Many researchers are familiar with a CAQDAS package, such as Atlas.ti, NVivo, or HyperRESEARCH (see Lewins and Silver, 2007 for a helpful guide). While these software packages offer many benefits to researchers, they were developed before cloud computing became readily available, and so have some limitations. For example, the software must be housed on a local machine or server, be updated often, and can be quite expensive to purchase especially for those who are not sure they will use the software repeatedly. Newer Web 2.0 (i.e. cloud-based) software, such as Dedoose, allow users to access their data and analysis from any computer with internet access. Dedoose also allows for multiple users to work on an analysis project simultaneously from distant locations, facilitating the increasingly common practice of team-based coding and analysis in qualitative research. Because the analysis software is housed on a remote server, it is updated continuously and without effort on the part of users allowing the developers to add new features without interrupting the user experience.

New technologies also help researchers to visually represent linkages between concepts and data. For instance, Atlas.ti has a well-developed "network" interface that allows the researcher to drag and drop codes, quotations, or other concepts in order to organize their connections and relationships. Similarly, mind mapping software is accessible and easy to use, allowing researchers to organize patterns and themes that emerge from data analysis into a conceptual framework. Advances in touch screen functionality on tablet computers make these applications particularly intuitive and flexible (MindNode is one example). Nodes, ideas, or concepts can be organized and moved much like the classic qualitative practice of using notecards to sort and arrange ideas, only with the ability to save a copy of the arranged ideas for later use or manipulation.

### Dissemination

One of the essential elements of the research endeavor is the process of disseminating the results of that research, whether in journals, books, or conference presentations. In this section, we explore technological advances that can facilitate the dissemination of research in written and audio/visual formats, as well as exploring emerging dissemination media such as blogs and infographics.

Writing has moved in the past few decades from a pen and paper activity to one involving personal computers as technologies were developed that allowed for greater speed and efficiency. New software offers a means of increasing the ease by which qualitative researchers (and other writers) communicate their ideas. For example, Scrivener was designed to address an essential quandary that many writers have encountered: the process of writing does not lend itself to the linear format of traditional word-processing programs. In reality, the writing of research reports and manuscripts rarely happens in a linear fashion (starting with the abstract and continuing on smoothly through the conclusion). Researchers generally move back and forth between writing and revising sections of the manuscript in an order that makes intuitive sense (rather than in the order they appear in a finished manuscript). In qualitative research reports, in particular, writers often find that developing the best way to convey the findings takes multiple iterations and substantial revisions. Scrivener is designed to allow writers to compose in whatever order naturally makes sense, facilitating the organizing and reorganizing of content, and allowing for seamless interfacing with all related reference sources within the same program as the writing occurs. By utilizing a more flexible structure, Scrivener offers a simple but effective tweak on writing software.

Researchers also disseminate results through presentations, such as at academic conferences or as training for practitioners. Presentation software has become the standard means of providing visual aids at conference and other presentations. Most academics are familiar with at least one presentation software package, such as Microsoft's Powerpoint or Apple's Keynote. Several new software applications have developed that improve the user experience or final product. For example, Prezi eschews the standard linear format of presentation software and instead has users place all their presentation content on a single canvas so that a "camera" can then move around and zoom in and out to view the content. Done well, this feature of Prezi gives presenters an added way of telling the story through the use of visual metaphors (e.g. the phrase "if we dig down deeper into the interview data, we can see something interesting emerge" can be paired with the camera zooming in to show the interesting findings). However, the movement of the camera around the canvas can make audience feel motion sickness. One of the more useful features of new presentation applications is that they are web-based, rather than housed on a local computer. Having cloud-based presentations allows for easy collaborating with coauthors. More importantly, the presentation is housed on a server and can be shared as widely as the user wants. Presentations can also be paired with pre-recorded audio tracks in order to share a verbally annotated version of a presentation.

For many social work researchers, it is just as important to disseminate findings to audiences that do not typically have access to academic journals and do not attend academic conferences. Much of the research done by social workers has direct relevance to practitioners and finding ways to distribute results to those most likely to make use of them is a particular priority for community-engaged scholars. Technological advances open up new possibilities for qualitative researchers to share their findings with nonacademic audiences. For example, Twitter can be used to publicize and share brief updates about research findings with networks of colleagues and practitioners. Blogs offer a venue for engaging in discussion and dialog about issues related to research (Vannini, 2013). Many

free blogging sites are available (e.g. WordPress, EduBlog, and Blogger). Infographics, or visual and graphic depictions of research findings offer engaging and accessible ways for practitioners to quickly understand the gist of the results. Visual.ly has a large gallery of infographics and templates for creating your own graphic. Others have experimented with using cartoons and digital animation to disseminate research results to communities and stakeholders (Bartlett, 2013; Vaughn et al., 2013).

## Conclusion

In this article, we have outlined a variety of ways that qualitative researchers can incorporate new technological tools into their research process. The obvious disadvantage of any publication about technology is that the tools continue to advance while the publication remains static and quickly becomes dated. For this reason, we felt it was important to offer readers some suggestions about how to keep up with emerging trends in technology that are relevant to qualitative researchers. As of the writing of this article, there are several websites that are useful sources of information (see Table 1 for URLs). The ProfHacker blog on the Chronicle of Higher Education website regularly reviews technology of use to academics. While not specific to qualitative research, it is a great source of up-to-date information about tools that other academics, teachers, and researchers have found useful. A wiki-type site called Bamboo DiRT features an extensive collection of links to digital tools of use to researchers (not exclusively qualitative in focus). An additional webpage, Mobile, and Cloud Qualitative Research Apps features a long and useful list of software and applications specific to qualitative research. Finally, the American Historical Association maintains "A Digital Toolbox for Historians" that features descriptions and links to a number of useful tools.

In addition, we urge qualitative researchers to discuss and describe their use of technological tools in their manuscripts and conference presentations so that others can learn about useful resources. This journal accepts short pieces on technical applications relevant to qualitative research that would make an excellent venue for researchers to describe technological aspects of their research. There are also social media spaces for the discussion of qualitative research, most relevant to readers of this journal perhaps are spaces such as the International Qualitative Social Work group on Facebook. Of course, social work and qualitative research conferences also provide formal and informal venues for discussion and resource sharing.

Finally, we encourage qualitative researchers to think about their own research processes and identify ways that their routines could be improved by technology. Many of the tools we described here were developed for purposes unrelated to qualitative research. In the future, we hope qualitative researchers will be able to partner with programmers and others to develop technologies that fit more closely with the needs of researchers.

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**Table 1**

Detailed information about tools listed in the order mentioned in the text.

| Tool | What it does | Where to get it | Platform | Cost (in US$) |
|---|---|---|---|---|
| *Data collection tools* | | | | |
| Poll Everywhere | Live audience polling via text message or internet | www.polleverywhere.com | Web-based | Free, paid accounts for larger audiences |
| Skype | Video, audio, and instant messaging via internet | www.skype.com | Multiple platforms | Free, advanced features require upgraded account |
| Kudos Chat Search | Search and export Skype text conversations | www.kudoschatsearch.com | Windows, Mac | Free, advance features require upgraded account |
| Evaer | Record audio and video calls on Skype | www.evaer.com | Windows | $19.95, free trial available |
| Circus Ponies | Notebook with features, including syncing audio and notes | www.circusponies.com | Mac, iPad | $24.95–29.95 |
| AudioNote | Sync notes and audio | www.luminantsoftware.com/iphone/audionote | Multiple platforms | Free version, $4.99 full mobile version,$19.99 full PC version |
| Picasa | Photo-sharing | picasa.google.com | PC | Free |
| Flickr | Photo-sharing | www.flickr.com | Multiple platforms | Free |
| Ning | Build communities and share photo, video, and other data | www.ning.com | Web-based | Free trial, $25/month |
| Daily Routine | Tracks specified behaviors | dailyroutineapp.com | iPhone/iPad | $2.99 |
| Path | Attaches geographical coordinates to other data | path.com | iPhone, Android | Free |
| *Data analysis tools* | | | | |
| Dragon | Speech-to-text transcription | www.nuance.com | Multiple platforms | $99, upgraded versions available |
| Word cloud, Word tree | Data visualization | www-958.ibm.com/software/analytics/manyeyes | Web-based | Free |
| Mindnode | Node-based mind maps | www.mindnode.com/#!/touch | Mac, iPad/iPhone | $9.99–19.99 |
| Dedoose | Qualitative and mixed methods data analysis | www.dedoose.com | Web-based | Free trial, $12.95 each month account is used |
| *Dissemination tools* | | | | |
| Scrivener | Flexible word processing | www.literatureandlatte.com | Windows, Mac | Free trial, $35-45 |
| Prezi | Presentation creation and sharing | www.prezi.com | Web-based | Free, upgraded accounts with additional features |
| Twitter | Social networking | www.twitter.com | Web-based | Free |
| Wordpress | Blog hosting | www.wordpress.com | Web-based | Free |
| Edublog | Education themed blog hosting | www.edublog.com | Web-based | Free, upgraded accounts with additional features |

| Tool | What it does | Where to get it | Platform | Cost (in US$) |
|------|-------------|----------------|----------|----------------|
| Blogger | Blog hosting | www.blogger.com | Web-based | Free |
| Visual.ly | Infographic creation and sharing | www.visual.ly | Web-based | Free, paid services available |
| *Resources for further information about digital tools* | | | | |
| ProfHacker | Technology blog for academics | www.chronicle.com/blogs/profhacker | | |
| Bamboo DiRT | Registry of digital tools for research | dirt.projectbamboo.org | | |
| Mobile and Cloud Qualitative Research Apps | Links to tools of use to qualitative researchers | www.nova.edu/ssss/QR/apps.html | | |
| A Digital Toolbox for Historians | Links to tools for historians, many of which would also be useful for qualitative researchers | pinterest.com/ahahisto rians/a-digital-tool-box-for-historians | | |