

## The App-Maker Model: An Embodied Expansion of Mobile Cyberinfrastructure

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### Abstract

With the Maker Movement promoting a refreshing DIY ethic in regard to creation and epistemology, the time might be ripe for scholars to adopt such techniques into their own research, particularly in the subfield of mobile communication studies. One can now relatively easily participate in the building and implementation of a variety of digital products, such as mobile apps, that can then be used to study user experiences through interactions with rhetorical forms, including a variety of types of informatics. Our experiences in several projects that use both large- and small-scale mobile apps offer a critique and lessons learned directly from engaging in this type of field experimentation, including reflections on observations, survey responses, and other types of data collection made possible through this model. Four larger issues are addressed here, about conducting research through making apps, providing potential research paths, opportunities and challenges to consider. Perhaps most importantly, this research approach offers the ability to tailor an instrument specific to research needs and then test that instrument in a natural setting, affording a true sense of how people interact with their environments in real situations and real settings.

Just as a scholar studying music might benefit in various ways from having composed and played at least a few tunes, digital humanists might gain broader and deeper knowledge about mobile media through the process of building and testing more mobile apps. These integrated processes could lead to richer understandings of the technical backend of the media ecosystem as well as heightened awareness of practical communication issues related to real-world performance and audiences. Imagine a photography class taught by a person who has never taken a picture. Or think about a painting class led by a person who has never mixed and applied different types of pigments to canvas. Or, even more poignantly, ponder a writing teacher who might read a lot but has never written.

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Illustrated in those examples, a certain level of expertise clearly seems gained through direct performative experiences with media communication technologies, whether those are expressing audio, visual, or textual messages. If such experiences also are valued in scholarly work, mobile media researchers are poised right now to transform knowledge about this field. These digital humanists could create new research methods through the integration of their everyday practical experiences with smartphones, tablet computers, smart watches, etc., and the development of new mobile apps that reflect their research interests (not necessarily a third-party company's profit orientation), guided by their robust training in methodologies and theoretics as well as their academic ethics.

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Normative rhetoric, observations, surveys, counting users, dollars, interactions, etc., has helped to build the field to where it is today. But what's the next step in developing our understandings about mobile media? Could direct participation in the development processes open up the scope of what we know as scholars? If we hypothesize that digital humanists could benefit from participating more in the mobile medium in various ways, through alternative research approaches, several critical questions come trailing close behind, such as: What are those ways? What are the appropriate participatory roles for scholars? And, what systematic methodological standards could be employed in this pursuit? The following piece – part critique, part reflections on lessons learned, part argument for more active research approaches – intends to prompt such discussions and delve into related issues.

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To complicate these associated matters even more, such active research approaches are not easy. Digital humanists who single-handedly can write code, mark up data, construct databases, design interfaces, write grants, manage projects, and provide expert content as well as teach, publish, and serve on numerous university committees are rare [Reed 2014]. Consequently, much of the core content and future of computing will be multidisciplinary, collaborative, and understood through mixed methods [Rosenbloom 2012]. In such a complex and fluid research environment, Porsdam [Porsdam 2013] argued, the “read-only” ethos of traditional humanities needs to be replaced with a “read/write/rewrite” approach, rooted in making and integrating processes of design, which could be framed by a broad Action Research ethic.

Action Research, as a process, typically features a researcher (or research team) who works with a group to define a problem, to collect data to determine whether or not this is indeed the problem, and then to experiment with potential solutions to the problem, creating new knowledge [Hughes and Hayhoe 2008]. This insider positionality blends “the experiential, the social, and the communal,” as described by Burdick, Drucker, Lunefeld, Presner, and Schnapp [Burdick et al. 2012, 83]. In turn, they contended, we are leaving the era of scholarship based upon the individual author’s generation of the “great book” and entering the era of collaborative authoring of the “great project.” These projects today often either involve mobile technologies in some way or are conceptualized and created through the mobile medium, giving this piece its particular arena, as a way to focus our exploration in an area. But we also hope this work transcends any particular fields or subfields and speaks broadly to the concept of limitations on a researcher’s mindset. As part of the increasingly mobile-oriented environment – again, as an example – digital humanities scholars can choose to build the cyberinfrastructure they want or be inherently constrained by the ideas, policies, tools, and services bequeathed to them by non-humanist domains. That is the foundation of the social constructivist perspective of this article. That is the position from which we launch. That is the ground we all stand upon and share.

## Participating allows for more control of the research environment

This piece argues that by creating our own instrument designs, for our own purposes, and building our research tools specifically for the research we want to do, we can control our scholarly inquiries more efficiently and therefore create more effective studies than otherwise possible through outsider, uninvolved viewpoints. By plunging deeply inside these processes that we are studying (and that inherently shape our studies), we, as researchers, can gain deeper understandings of the phenomena we are investigating. We also can discover new questions that need to be asked in similarly engaged ways. Without an Action Research approach, many of the facets of a situation would be cloaked and inaccessible, in a practical manner, to the outsider, who wouldn’t be able to see them or even perceive they are present. The advantages of outsider research, from our perspective, are many, but they also create distinct constraints and limits on our knowledge. Sometimes, some people need to go past those boundaries and explore new territory in unconventional ways. We can miss a lot of the richness of our processes by not directly participating in them. So we tried Action Research approaches, and we benefitted as researchers. We argue that you, too, could benefit from such research strategies and tactics, if you incorporate those into your studies of the digital humanities in pursuit of methodologically appropriate questions.

For example, with new technological affordances emerging regularly throughout our modern lives and interactions with various technologies continually increasing, prototyping as a form of inquiry has gained traction in many scholarly contexts. That point especially gains importance when the dizzying speed of information communication technology development rapidly outpaces the academic publishing system. Such hands-on efforts include reexamining the past, such as through Jentery Sayers’ [Sayers 2015] remaking of communication technologies that no longer exist. They include exploring the possibilities of the future, such as through Bolter, Engberg, and MacIntyre’s [Bolter, Engberg, and MacIntyre 2013] experimentations with augmented reality. And they include epistemological examinations and critiques of research methodologies, such as Henze, Pielot, Poppinga, Schinke, and Boll’s [Henze et al. 2011] argument that the creation of their mobile app *is* the experiment. Along those lines, this article aims to synthesize the fully engaged ethic of those types of studies and bring them together through a holistic paradigm that values the acts and artistry of “making something.” We anticipate this approach will become an integral part of the future of research in the digital humanities. From this perspective, we contend, if digital humanists more fully appreciate and value the process of this kind of research approach sooner rather than later, we in turn will more fully understand the products of our research and the

ramifications of our scholarship, creating better academic work as well as a platform from which we can explain that value to people with more external resonance.

## Acknowledging obstacles, then moving onward

Lynch [Lynch 2014] identified a variety of the reasons why such work needs to be done and why essential framework-building efforts, like this, have been uncommon in mobile-based digital humanities, including a paucity of readily available resources, expertise, and rewards. For such projects, digital humanists typically need to collaborate across disciplines and with industry practitioners. They also usually need to raise significant external funds. Recognition within current academic systems for collaboration and community engagement can be diffused or even disregarded, particularly when related to tenure and promotion [Bartanen 2014] [Cavanagh 2013] [Cheverie, Boettcher, and Buschman 2009] [Harley et al. 2007]. Most schools grant tenure based in some combination of the “Big Three,” consisting of research, teaching, and service. Time spent building and maintaining websites, mobile apps, social media channels, databases, and similar artifacts generally does not fit within those goals.

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Takats [Takats 2013], for example, described the amorphous and shifting opinions of his digital humanities work by senior faculty and administrators throughout his tenure process. The college-level committee decreed that the project management, prototype development, design and coding he conducted for such major public projects as the research tool Zotero, and for activities funded by The National Endowment for the Humanities, Institute of Museum and Library Services, and The Andrew W. Mellon Foundation should be classified as the typically least-valuable of the Big Three, service (a notion later overridden by his dean). In such cases, Lynch [Lynch 2014] argued, digital humanists must persevere, overcome the policy and political issues, and lead this type of cyberinfrastructure development, because they alone can judge the usefulness of technologies in the field and guide their related scholarly innovations.

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Scholars with such a mindset might ponder how so many outside of the academy have realized and reaped rewards in recent years because of the mass societal integration of ubiquitous mobile technologies. That list includes: Corporations, doctors, spy agencies, artists, teenagers, media companies, personal trainers, criminals, lawyers, farmers, game makers, and many others. These rewards range from capitalizing on the novel mobilities that the devices enable to the intimate analytics that they track. Scholars also might question why they aren’t allowed (practically speaking) to join this Maker crowd to experiment with these tools and see what they can do for public good, by creating and implementing new mobile ideas into authentic settings, without lumping that exploration in with other traditional research practices and getting academic credit for only a portion of the work, if any.

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“Authentic,” as a term, has been chosen and will be used in the descriptions in this piece due to its extensive development in the social sciences as a label used to classify perceptions of human experiences. Wang [Wang 1999] traced that term back to verification procedures in museum usage, via Trilling [Trilling 1972], and MacCannell [MacCannell 1973] began integrating the label into sociological work in tourist settings. Many other scholars have followed that path, including Cohen [Cohen 1988], Bruner [Bruner 1989], Hughes [Hughes 1995], Wang [Wang 1999], and Gilmore and Pine [Gilmore and Pine 2007]. From the social constructivist strain of this perspective, an authentic setting is one within which the participants align their self-reflection with the experience they are having, and consider if it matches their expectations of a sense of realness. They meanwhile feel that they have a self-determined freedom to do what they want, as they would do it, in the situation, while the researcher has been allowed to observe such “authentic” conduct and record data about it.

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In seeking the “real,” and conducting research in authentic situations, we wanted to open this approach up for deeper discussion. This article, reflecting upon such sentiments and contexts, therefore describes a sample of our recent project-based experiences in mobile app development for the digital humanities, infusing ideas from the Maker Movement, and driven by an Action Research ethic. Such reflection, as a core cycle of Action Research, intends to illuminate, from an insider’s perspective, some of the key issues that arise during these kinds of participatory scholarly projects. This piece also identifies affordances and constraints, in terms of related opportunities and obstacles, of the app-maker approach, in an effort to move these ideas past the inertia phase and to propel them into a problem-solving phase beneficial to other researchers encountering the same, or similar, difficulties.

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In this vein, a critique of the situation, through our perspective, is intended to initiate these important conversations. The lessons-learned portion of this piece, though, also is intended to connect the criticism to real-world examples and help to carry scholarship over the pervasive gap separating practice and research, a daunting leap but one that is seemingly surmountable. Therefore, after exploring the potential of Action Research as well as the possibilities of research in the wild, we will share some of the experiences we have had in conducting a systematic program of inquiry that involved building several mobile apps for research purposes. Four important concerns and challenges merited consideration here: 1) App building requires broad expertise and extensive resources, infrastructure needs not to be taken lightly, 2) Audience authenticity creates some issues but solves others, 3) Action Research is not a scholarly magic bullet, and entails a certain amount of risk, from a variety of fronts, and 4) New ways of data collection could help to evolve the type of data researchers can collect, as part of an expansive approach to research fusing technological advances and the ideals of the Maker Movement.

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## Making as a research approach

The larger Maker Movement encompasses the cultural and technological factors that have aligned to entice people into active participation and manipulation of the objects of the world, both physical and digital. A smattering of researchers have adopted this do-it-yourself ethic in mobile contexts, too, as some of these scholars have experimented extensively with what could be considered Maker methodologies, such as Action Research, demonstrating promising and novel results that deserve more documentation and further consideration.

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With the introduction of *Make* magazine in 2005, the Maker Faire concept in 2006, and the opening of the Apple App Store in 2008, the Maker Movement not only broadly made connections – from John Dewey’s progressivism to Seymour Papert’s constructionism, as Resnick and Rosenbaum [Resnick and Rosenbaum 2013] noted – but also brought together all of the learning-by-doing advocates in-between. The Maker Movement spread deep into the computing industry’s cultural foundations, reminiscent of when old-school hackers experimented with the possibilities of new media forms through the process of building them and playing around with them, just to see what was possible. Through the creation and improvement of those formative methodologies over multiple iterations, makers showed the development of new knowledge through the created objects, shared via public demonstrations. They also created knowledge through the discussions about their exploratory activities, as acts of both learning and teaching in a world yearning for new ways to account for – and adapt to – the perpetual uncertainty and rapid change happening across industries, cultures, and societies [Hayes 2011] [Dougherty 2012] [Resnick and Rosenbaum 2013].

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In mobile media and communication research, from the late 1970s through the 1980s, many early ideas were born out of abstractions, through theorizing in environment-independent settings. Those initial studies included a mass of normative writings about conceptual frameworks. Mobile telephony in the early 1990s, when cell phones became more accessible and widespread, then generated another wave of interest and methodologies. That period included the rise of the highly controlled laboratory experiments, which tested specific stimuli and behaviors in artificial settings. Many still employ this laboratory approach (e.g., [Kjeldskov and Paay 2012] and [Jones, Karnowski, Ling, and von Pape 2013]).

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Yet as mobile research grew and expanded, particularly in the smartphone era, it began to raise other kinds of questions. New paths of inquiry have appeared, diverging, and spreading fast, with many of those related to the wide social implications of mobilities and ubiquitous computing (e.g., [de Souza e Silva 2013] [Frith 2015] [Jones, Karnowski, Ling, and von Pape 2013]). As different questions have emerged, scholars have begun to also examine the possibilities that mobile technologies might afford for distinct, efficient, and efficacious digital humanities methodologies ([Büscher, Urry, and Witchger 2011] [D’Andrea, Ciolfi, and Gray 2011] [Fincham, McGuinness, and Murray 2010] [Merriman 2014] [Sheller 2015] [Svensson and Goldberg 2015]).

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Of particular interest has been the potential for mobile technologies to connect to the holy grail of methodological pursuits, to develop a reliable measure of the events occurring in the stream of consciousness over time [Csikszentmihalyi 1978] [Csikszentmihalyi and Csikszentmihalyi 1988] [Hektner, Schmidt, and Csikszentmihalyi 2007, 6] [Karnowski 2013]. Much research still relies on survey measures, rather than direct, in-situ observation and accounting of a rich spectrum of related activities. In the realm of user-experience studies, for example, research so far heavily

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relies upon survey questionnaires. Yet with the sensors and relatively unobtrusive data collection abilities of smartphones and other types of high-tech trackers, users now also can be observed – in a triangulated manner – having their behaviors documented in great detail across time and space, and even be surveyed while in the moment, as experiences shift, rather than in summary, at the end of a multifaceted activity [Bouwman, de Reuver, Heerschap, and Verkasalo 2013]. In turn, sampling data from mobile experiences, within the “earthy” environment in which they happen, allows researchers to avoid the inherent limitations of methodologies that rely solely on memory performance or reconstructions of respondent behavior, through reflective thoughts and attempts at recollection [Karnowski 2013]. So why aren’t more researchers instinctively jumping into this Maker fray to find out what they can do in it?

## Into “the wild”

As a quick historical summary of the issues involved, Kjeldskov and Graham [Kjeldskov and Graham 2003] decided – well before the iPhone, and the mass rise of smartphones in society – that mobile human-computer interaction needed to have a methodological snapshot taken of it. This would help identify shortcomings and to propose opportunities for future research. Inspired by similar work in Information Systems, they analyzed more than 100 human-computer interaction (HCI) publications. Among the methodological trends noted were infrequent study in natural settings, including Action Research, case studies, and field studies, which was perceived at the time as a lack of attention to both the design and the use of the mobile systems.

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Mobile interaction design in the early 2000s, in turn, was dominated by trial-and-error evaluations in laboratories. These studies usually segregated into two distinct camps: those who studied people, and those who studied systems. In retrospect, Kjeldskov and Graham warned of three prevalent assumptions of the field at that time: 1) We already know what to build, 2) Context is not important, and 3) Methodology matters very little. Having assumptions, such as already knowing the problem to solve, made it difficult to put those ideas aside and identify more fundamental challenges at play. A lack of a focus on methodology influenced the results subsequently produced [Kjeldskov and Paay 2012]. That issue led to a diffusive research agenda shared in some streams by relatively small factions but generally without broad consensus on approaches to addressing the major issues of the field [Büscher, Urry, and Witchger 2011] [D'Andrea, Ciolfi, and Gray 2011] [Fincham, McGuiness, and Murray 2010] [Merriman 2014] [Sheller 2015] [Svensson and Goldberg 2015].

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The evolution of HCI methodologies then was compared longitudinally – over a seven-year span – by Kjeldskov and Paay [Kjeldskov and Paay 2012], who found much more collaboration existing between the original group of researchers, primarily in engineering and computer science, and the next wave, which included the social sciences, the humanities, and the arts. The first group, in general, had created the technological possibilities with mobile. The next wave brought with it new ideas about the problem space, the importance and role of context, and the impact and critical nature of methodology. The nearly complete absence of Action Research in the field in the early 2000s, they argued, pointed to both the lack of an established body of knowledge within the discipline and the wariness of failure, in an era when experimentation was expensive and time consuming.

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As Kuutti and Bannon [Kuutti and Bannon 2014] described, HCI has expanded its scope and eclecticism in recent years. As part of that growth, it has developed a “practice” paradigm to accompany its more traditional “interaction” paradigm. When focused on interaction, researchers tend to study the human-machine dyadic relationship in ahistorical situations, often within a highly controlled lab setting and involving predetermined experimental tasks. The practice paradigm has a more long-term perspective, examining both historical processes and performances, and studying actions over the full length of their temporal trajectory. These studies are situated in specific time and space, and they are dependent on their surroundings and cultural context.

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In short, the practice paradigm considers practices as the origin of the social (rather than in the mind, in discourses, or in interactions). Those practices consist of routines that interweave any number of interconnected and inseparable elements, both physical and mental, affected by the material environment, artifacts and their uses, contexts, human capabilities, affinities and motivations. From the practice paradigm, practices are the minimal units of analysis, at the nexus of essential and interesting social issues, accessible for study in natural and authentic ways. So while the

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interaction paradigm has been helpful in numerous cases, for many years, it also has created blind spots in the field that the practice paradigm – as developed through approaches like the app-maker model – could help to reveal in new and valuable ways.

Because so many of our technologies have been embedded in our everyday lives, Crabtree, Chamberlain, et al. [Crabtree et al. 2013] contended that researchers should seek to understand and shape new interventions “in the wild.” Those include the novel technologies developed to augment people, places, and settings without designing them for specific user needs but also new technological possibilities that could change or even disrupt behaviors. As the costs of mobile app experimentations, though, have diminished in recent years, and while the body of knowledge in the field and interest about in-situ experimentation appears to have grown, the amount of mobile-related Action Research projects has not suddenly increased. As Crabtree, Chamberlain, et al. [Crabtree et al. 2013] document, scholarly literature has emerged that shows in-situ user experiences reporting different findings than what was predicted for them in laboratory settings. In other words, what participants tend to do in controlled settings, under instruction and regiment, can be dramatically different from what they might do, under their own volition, in an authentic situation. A growing realization of such disconnect suggests that researchers need to develop more paths that are reflexive and focused upon experiences as well as creative – and often serendipitous – inquiries [Adams, Fitzgerald, and Priestnall 2013]. Action Research, in its various forms, has been developing as an approach for decades and provides opportunities to study practices in authentic settings, which could guide researchers to venture into “the wild.”

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## Action Research as a base

Unlike in the early days of mobile research, scholars in the field today no longer have to lock themselves into the stereotype of wearing white lab coats, carrying around clipboards and staring at people through one-way glass. They do not necessarily have to remain pure spectators, completely detached from their surroundings, and seeking “Truth,” as an isolated Baconesque figure. Instead, through Action Research methodologies, they can bridge the gap between scholars/science and industry/practice in more directly involved ways [Herr and Anderson 2005]. Action Research can be known by many other labels, including participatory action research, practitioner research, action science, collaborative action research, cooperative inquiry, educative research, appreciative inquiry, emancipatory praxis, teacher research, design science, design research, design experiments, design studies, development research, developmental research, and formative research [Design-Based Research Collective 2003] [Herr and Anderson 2005]. But the basic idea is the same: get inside the system, and study it from that viewpoint.

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According to Archer [Archer 1995, 11], such an inquiry simply for “the purposes of,” and having underpinned a particular practitioner activity, should not necessarily earn the label “research.” He stated that the cases that legitimately warrant the “research” designation generally come from research activity carried out through the “medium of practitioner,” in which the best way to shed light on “a proposition, a principle, a material, a process, or a function is to attempt to construct something, or to enact something, calculated to explore, embody or test it” and generate communicable knowledge. These tests tend to generate spirals of action, starting with planning and implementation, followed by observations of the effects and then a reflection as a basis for more planning, action, observation and so on, in a succession of cycles [Kemmis 1982]. This article, as an illustration of the approach, is part of a reflection stage of our recent Action Research efforts, which will then lead us to further planning, action, and more observation. As part of the Action Research methodological framework, these techniques for inquiry are practical, cyclical, and problem-solving by nature, meant to generate change and improvement at the local level [Taylor, Wilkie, and Baser 2006].

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Also embedded within this type of research is the idea that the builders of a system gain knowledge in ways that an observer cannot, as our earlier examples of musicians, painters, and writers illustrated. The relationship between knowledge and practice is complex and nonlinear, and the knowledge needed to clarify practice relates to context and situation [Campbell and Groundwater-Smith 2007]. The app-maker approach, posited here – often generating interrelated qualitative and quantitative data – provides a depth-seeking philosophy to gaining understanding about complicated issues that otherwise could be inaccessible to system outsiders. From this perspective, romanticized non-participatory “objectivity” and personal subjectivity are not polarities but rhetorical constructs, and participation in the research process inherently integrates the researcher [Daston and Galison 2007] [Douglas 2004] [Kusch 2011].

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A key question that emerges in this epistemological process, then, is how openly the researcher's values are described and debated [Douglas 2004]. An alternative scale of consideration with this type of methodology could be conceptualized as the positionality of the researcher, either as an insider or an outsider. The interpretive perspective, from which Action Research generates, transparently acknowledges the researcher as an insider, as a part of the fabric of the inquiry, and an indivisible element of the environment, within which people, including the researcher, are interacting [McNiff and Whitehead 2006].

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Research objectives, of course, should dictate the methodology of a study, and not all research questions warrant the use of Action Research. Various practical challenges also exist with the methodology, and those comprise substantial barriers to even attempting the approach. Action Research, for example, can be relatively more time consuming than some other approaches, and the objectivity of the research perspective can be difficult to maintain when immersed in the environment as a participant and engaged in the project as a stakeholder [Kjeldskov and Graham 2003]. Yet interest in Action Research continues to develop in HCI as well as in other fields that could be of interest to digital humanists, as scholars seek to conduct democratic, collaborative, and Maker-oriented research within – not just about – their communities [Hayes 2011] [Hayes 2012] [Hayes 2014]. This piece attempts to transform principles of the Maker Movement, and similar exploratory scientific practices, into a coherent research paradigm, based on the founding idea that first-hand prototyping serves a critical role in the research process in the field of mobile media and should be valued as a legitimate method of scholarly inquiry on its own, without having to employ a Trojan horse of a more traditional methodology, just to gain entry into academic castles.

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## A longitudinal look at mobile methodologies

When Kjeldskov and Paay [Kjeldskov and Paay 2012] examined a snapshot of mobile methodologies again, the second literature review – in the same 10 outlets – showed a more than quadrupling of the number of publications on the topic. While lab experiments still dominated at 49 percent, field studies grew dramatically, to 35 percent. The purpose of both approaches, most often, was for evaluation. Field studies meanwhile developed into three distinct subcategories of *field ethnography*, *field experiment*, and *field survey*. Normative writings, in turn, nearly disappeared from the field (2 percent). Case studies (6 percent) and Action Research (less than 1 percent) gained little traction. While the expansion of field studies encouraged Kjeldskov and Paay, the often-incomplete images that they created could be misleading without the triangulation of the more comprehensive accounts that case studies and Action Research could provide.

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Around 2010, mobile researchers began to explore the app stores as potential delivery systems for the distribution of research instruments, in the guise of mobile apps, which could be used to conduct large-scale and relatively unobtrusive human subjects studies [Henze 2012]. Just as in traditional studies, researchers develop an apparatus for their study. However, the apparatus in these cases gets embedded into an app, which then is published to the public mobile application market [Henze and Pielot 2013]. In “the wild,” researchers can gain insights about how people might fit new systems into their existing practices and contexts of use as well as how people might change their contexts and practices to accommodate or take advantage of new systems [McMillan et al. 2010]. As part of a user's real-life context, such studies ensure a high external validity and allow for findings otherwise impossible to obtain [Henze 2012].

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Projects by Henze, Pielot, Poppinga, Schinke, and Boll [Henze et al. 2011] are examples of such an app-building approach, in which scholars can relatively easily create and distribute research instruments to the masses through Apple's App Store and Google's Android Play market. In their case, the research team produced and distributed five differing mobile apps with various research objectives to observe what would happen. These apps were downloaded more than 30,000 times. Some of the apps were successful in gathering many participants and unobtrusively compiling research data quickly and in large quantities. The app Tap It, for example, a simple game of touching rectangles – devised as a way to assess touch performance of users in relation to screen locations and target sizes – gathered 7,000 users, contributing 7 million data points, in just two months. Some of these efforts also definitely did not reach their goals, including one app – called SINLA, an augmented reality viewer of nearby points of interest – that only collected eight samples over the course of a year, a sample the researchers deemed worthless. Therefore, merely creating a research app – even if the same talented people work on it, with the same amount of resources, with the same objectives – does not guarantee the return of a large data set.

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In another public app project, using the App-Maker Model, Henze [Henze 2012] created a simple screen-touching game that allowed him to not only collect basic device details – such as handset type, time zone, and screen resolution – but also to log each touch event, in relation to the position and size of the targets, as a way to determine error rates. In the process, which garnered more than 400,000 downloads, the data also documented a systematic skew to the touch position that could be corrected with additional device calibration. So many factors dictate the app adoption and use, including the marketing of the project, the perceived production value of the app, and the realistic nature of the related activities.

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On the negative side of this approach, Lew, Nguyen, Messing, and Westwood [Lew, Nguyen, Messing, and Westwood 2011] contended that the authenticity of the experience significantly affects internal and external validity. If a mobile experiment, for example, lacks ecological realism in any of four dimensions – appearance, content, task, and setting – the study can be compromised, and test subjects could be inadvertently responding to the treatment rather than the controlled research condition. Other significant issues with data collection included the difficulty of complementary observations, in an ethnographic sense, because the use of the devices is tough to monitor, as the movement of the users, and the intimate relationship of the device to the user, makes viewing the screens and interactivity generally impractical [McMillan et al. 2010]. Apps also get used in unpredictable ways, such as getting turned on and inadvertently left on, when the user leaves the device behind (giving the false appearance of long use), creating the potential for noise in the data that needs to be filtered [Henze et al. 2011]. With an insider's positionality, and systematic and thorough accounting of the procedures and data collected, the researchers can have access to more material, in more direct ways, often allowing them to make more informed interpretations of the data generated in the study. The App-Maker Approach might not be a perfect one, and it does include disadvantages. But, it also has advantages as well that should not be discounted.

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## Our experiences in the field

After conducting several traditional user studies, through observations and surveys, and building a few functional app prototypes in 2010 at the Fort Vancouver National Historic Site, a National Park Service hub near Portland, OR, we started to build and release to the public early versions of a location-based history-learning smartphone app in the spring of 2011. Eventually, after dozens of iterations, the beta version of the app was released in June 2012 [Oppegaard and Adeopse 2013]. As of this writing, significant work continues on the project, with development of the app planned for as long as resources for it can be gathered and maintained, as well as for an offshoot tablet app. In the meantime, we also created and used in studies several separate mobile apps designed specifically to answer particular research questions. These were mobile apps built for one-time use, at public events, and designed to gather precise data from users, in-situ, about their responses to mobile media within the authentic environment of intended use. For the larger projects, we gathered data from the devices of the users, through the app, but for the one-time apps, to save time, we brought our own devices. The users then simply used the research instrument apps as is, with a consistent experience.

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The first prototype of this one-time model tested social facilitation and user engagement at a community festival in 2012 by providing unique historical background on the festival. This app enabled the delivery of video and audio files as well as easy sharing of that information to users not present at the time of use. The second prototype, in 2013, expanded upon the idea even further by gathering data about user satisfaction. Both prototypes encased all of the research procedures within the app, including the consent letter, the survey, and the acknowledgements, along with the various shared media forms. Later prototypes, employed in 2014 and beyond, generally were modeled after the second version.

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Our hope was that this iterative process would create ever-improving models of mobile apps that could be quickly tailored and deployed to address any research question we had about mobile app use, in context, including investigating issues related to interface design, physical-digital interaction and media-form choice, within the mobile medium. The mobile apps generated a highly detailed log of user behaviors during the tests. Users were given various media forms in randomized scenarios, with randomized ordering of questions. They interacted with the device within the situation, and all of this logged information was stored locally on the device, avoiding complications related to Internet connections and data transfers, or third-party interference (something we learned after the first round of data collection, as we discuss later). Exporting the logs into a data analysis system not only was streamlined and easy, because we

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designed the app with that transfer in mind, but the information was rich, precise, and responded directly to our predetermined research questions.

The following remarks therefore primarily relate to the formative experiences we have had during these processes, either in summative composite, or to specific incidents that are identified as such. These reflective comments – as part of a Maker cycle intended to prompt further Action Research – are intended to corroborate, strengthen, and add detailed particulars to the theoretical assertions being made. They also provide an insider's perspective and could prompt discussions about some of the most significant methodological issues encountered during these Action Research efforts:

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## Lessons Learned

### Issue 1: App building requires broad expertise and extensive resources

#### Opportunities:

Unlike the apocryphal tales of teenagers developing million-dollar apps in an evening hack-a-thon, the thought of building your first mobile app research tool should seem like a daunting task, because it is. Such a project can overwhelm you and your team, as it has ours at times, especially if not managed within the scope of your expertise and resources. The larger projects we mentioned earlier involved multi-year endeavors with dozens of professionals, more than 100 volunteers, and more than \$100,000 in grant monies to produce. That said, we also did not need to build such enormous programs to test many of the ideas that we eventually started focusing upon, including most of our recent studies. The bigger projects had numerous and varied goals, including civic engagement, service learning, and even some exploratory meandering.

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For the most recent studies, though, we simply built spare formulaic apps that had the functions we wanted, without any aesthetic flourishes. We then installed those apps onto a set of identical tablet computers dedicated to this research. That refined approach avoided the complications we have had with the development and installations of the other apps, and various problems with compatibilities to the many different handsets that could be using the apps. The smaller and more-focused apps took roughly a day for a professional coder to complete, and even less in cases in which existing code could be reused in similar ways. So the hack-a-thon approach can be fruitful, as such, if focused.

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Yet that does not mean these more-limited efforts were cost-free. A full day of paid mid-level programming typically costs about \$1,000, and that does not include the pre-planning, post-analysis, or fixing the errors that become apparent during the design process. If the app design is simple enough, and if the scholar has some programming experience, an app of this nature probably could be made in a week or so by hobbyists familiar and comfortable with basic HTML5, CSS 3, and JavaScript. The initial design work of the throw-away app – including how it would function, and precisely what media would be delivered when – was roughly the same amount of work as any other equivalent research design. Instead of printing and handing out surveys, for example, that same data was gathered and delivered digitally through the app. In the past 15 years, collecting survey data online has become the norm, and this merely represents, from our perspective, the next iteration of taking digital data collection into the field.

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Publishing apps to the App Store or Google Play market requires another level of expertise and more time, but Android APK files (the program installed on the devices) can bypass the markets altogether and be shared directly via email. As an open system, making, testing and distributing via Android can be relatively easy (although it creates different sets of issues related to the multitude of devices that operate on Android OS). Apple has some work-arounds at this point, too, such as HockeyApp, which allows non-store distribution. If the goal is to conduct research on specific devices that you can reach via email, rather than a mass market reached through the app markets, then a lot of the hassle of publishing and sharing apps can be avoided simply by focusing on Android development or working through services such as HockeyApp.

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#### Challenges:

As digital-media delivery systems become more and more accessible and open to the general public, mobile app development is an example of an activity within a ubiquitous system that many scholars could navigate within and directly participate. While reachable, the bar still remains. Scholars without adequate coding skills and/or resources to hire a programmer could tailor the content of readily available third-party software and test through that system, but then the researcher would have limited access to the data collected and to the controls of the overall app environment, which we consider significant trade-offs. Large-scale public projects, such as Fort Vancouver Mobile ([www.fortvancouvermobile.net](http://www.fortvancouvermobile.net)), create several research paths, but they also have significant drawbacks as well, including the exertion of enormous amounts of energy, often without the equivalent academic credit in many institutions, and with continual maintenance concerns. Starting small, with a focused research tool, and taking that mobile app all of the way through the implementation process, before raising ambitions and the stakes in sustainable increments, is the path we recommend as a lesson learned. Building a mobile app also means becoming aware of the many possibilities that mobile technologies offer. Scope creep and feature creep are ever-present. Focus is difficult to maintain, with so many available options, and easily reachable enticements, along the lines of, “We can do that, too,” which easily can derail original intent or distract from the research purpose and drain resources, of which the needs already are many.

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This broader challenge was one we could have anticipated, of course. Trial and error remains a common element of research and development procedures, as well as of collecting data in new ways through emerging protocols. But the details of these difficulties were revealed in the discovery process, not in the abstract conversations about what could go wrong. For example, we initially used both mobile phones and tablet computers for our field tests. After finding no significant differences between them in regards to how people reacted to our research app (data from our first collection confirmed this), we used tablet computers exclusively in ensuing field work. The bigger devices were easier for us to track in the field, provided a larger interface for the participants, were not as likely to be pocketed and stolen, and also importantly, were easily accessible to us in terms of equipment with which we had access and were familiar. We encountered a few minor issues regarding the alteration of survey items as we planned the study; rather than having the ability to directly change the items, for example, working through a developer bogged the process a bit. Working with trusted development partners, though, cannot be overstated. We hired and worked with a few different developers before and during this project. The ones who did not deliver sapped our resources – including time, money, and enthusiasm – but the highly valuable people who did seemed to be able to nearly perfectly translate our ideas to the technologies and in the process generate new forms of research instruments.

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## **Issue 2: Audience authenticity exacerbates control issues**

### **Opportunities:**

Mobile technologies can gather deep data about a person, doing real tasks, in real situations, in real settings, but that data – even if it is considered “authentic” – is not complete, and it is not highly controlled. Mobile apps can acquire extremely detailed data from people unobtrusively, in the flow of life, and in situ. With our apps, for example, we have tracked from the exact moment a user opens a program until the user closes it, and everything in-between. These acts included the precise time and location of the person when any sensor, such as a touch of the screen, is triggered. That geospatial context – directly connected to specific interactions and users, in particular places at exact times – offers unprecedented potential for the granularity of data collection and data-point triangulation.

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That insight is arguably the most meaningful addition to our understandings of the research topic, but problems arise when researchers, including us, begin to parse that data, or combinations of that data, into usable units, in terms of determining exactly what variables are affecting what behaviors. In short, one cannot possibly control for all of the variables in “the wild.” Action Research with mobile devices, though, can create fascinating forms of self-contained triangulation. The devices gather detailed analytics of use, and then they also can push users into traditional research instruments, with more methodological certainty, such as Likert-like scale surveys, which are geolocated and taken in the context of the other data points. If a researcher observes the test subject performing the tasks with the app and taking the survey, another perspective dynamically is added to the rich mix of app-collected data.

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We also have found that people generally enjoy participating in research that does not feel like research. We typically

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have kept our hypermediate interventions, such as pushing a survey to the user, to a minimal time (ideally 5 to 7 minutes). As such, we tend to ask just a few questions at a time, which has reduced the traditional data collection results, in exchange for the instrumental transparency of in-flow data of ordinary use. The trade-off comes in the form of a high-quality sample composed not of a homogeneous group (e.g., students, members of an organization), but of a wide-swath of the surrounding community. Too often, in our opinion, validity gets sacrificed for statistical “purity.” This App-Maker Model approach allows for both, though the breadth of some statistics is lost in the pursuit of a more-representative sample.

## Challenges:

An authentic real-world data sample is one drawn from the complexities of humanity in action in authentic settings. Laboratory scientists, reductionists, and those who favor highly controlled experiments, of course, might be troubled by the inherent messiness of this style of data gathering (and have told us so in various formal and informal settings). The App-Maker Model approach means looser levels of control compared to traditional laboratory experiments. In a lab, we can put people into evenly divided groups, in the same environment, and examine their behaviors within a consistent experience. In the field, conditions are harder to manipulate (though our randomized app conditions, more or less, address this), environmental factors such as sunlight, noise, and temperature can impact the results, and the wider swath of humanity studied requires more adept communication skills and responsiveness to the situation than, for example, interactions with homogeneous crowds of college students in a lecture hall.

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In addition, the mass of data collected by mobile devices could be misleading, or could be misinterpreted, without other methodologies to triangulate and fully comprehend the results. People might not naturally cooperate in pursuing the goals of the research agenda. They might not stay on task. They might act in ways unaccountable to the device, and irrational, such as leaving an app turned on and running, so it appears to be in use, while instead the person has placed the smartphone into a pocket and forgotten about the app. “Constant use” could be mistaken for neglect.

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We can anticipate some of these issues, but they also often come in forms we do not expect and don’t discover until in the midst of the situation. To us, those experiences just deepen our understandings of mobile media. For the most part, as an example, we have had pleasant weather during our tests, and everything has proceeded according to plan. On days we didn’t (during a couple of early prototype testing periods), rainy days turned highly organized and resource-intensive testing environments into wastelands of resources. From those failures, we learned to constantly check the weather reports. We also learned how environmental conditions (such as nearly unavoidable screen glare caused by the sun at high noon) significantly could affect use. In another testing situation, we had a train park next to a collection site less than an hour into the event. It proceeded to backfire at irregular intervals for the duration of the data collection. Many people had trouble hearing the multimedia portions of the app (and rated their experiences accordingly). The noise held constant across conditions, and although the raw numbers experienced some differences, the distinctions between groups we investigated likely did not. During another collection, the cold weather impacted people’s abilities to effectively utilize the touch screen (apparently cold fingers do not register on a touch screen well), a problem that potentially could have been mitigated with a stylus, if we had thought to bring one. Ultimately, these observances constitute a real view of the environmental factors that people face in the wild and help remind us to take these things into account in the design process.

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The last and perhaps most important issue we faced involved connectivity, as most outdoor spaces do not have accessible Wi-Fi. Our field experiments at Yellowstone National Park, for example, have been severely constrained by connectivity issues. During our initial data collection with the one-time-use app, for example, we relied on a cell phone data plan, which became erratic. For ensuing studies, everything was stored on the device, allowing the media to load quickly, and data remained on the local device until we downloaded it to a common file. In studies such as ours (working in a park with less connectivity), this higher level of control allowed for a consistent and expedient experience. Apple has improved its ability to host local apps with the HockeyApp application, but we found the Android APK to have more robust features and less glitches. So we would recommend staying in an Android development environment for initial pilot explorations, at least at this point in history.

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### Issue 3: Action Research through mobile technologies is not a scholarly magic bullet and entails significant risks

#### Opportunities:

Conducting Action Research within mobile environments offers solid methodological choices for many situations. The App-Maker Model can uncover and build knowledge that other approaches simply cannot reach. It has been potent, in particular, for our studies of the medium, media forms, interaction design, remediation, and mobile learning. We have used mobile technologies to track behaviors in traditional HCI contexts, such as measuring time on task, in design contexts, such as A/B comparisons of interface features, in learning contexts, such as with error rates, and in broader medium and media studies, such as comparing knowledge transfer from a brochure versus a mobile app, and response to information in video form versus audio-only. Further, we have made new media forms, such as location-oriented videos, and studied how audiences reacted to them. We have explored prompts and triggers for audience interaction, particularly those in which users might be compelled to make and share media. All of those different approaches have been enabled by the opportunities afforded when researchers build their own mobile app instruments, which, in turn, creates some forms of experimental controls.

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By pioneering in this realm of mobile technologies, and actively participating in its construction, through building in it and seeking out new areas to explore, a researcher can break ground and set the foundation for a field or subfield. Such unexplored territory has significant value, and the findings can feel thrillingly fresh. When we have built mobile apps, and have seen what they can do, we often have small moments in which we truly think we might be the first people on the planet to have encountered a particular scholarly research situation. New mobile affordances and applications emerge continually.

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Digital humanists have to ask digital-humanist questions in these cases, because no one else is going to do that for us. Generating an original thought about that sort of situation can be an exciting moment, and it happens relatively frequently through this kind of formative research. Those moments, in turn, can open new research paths of all shapes and sizes. As a research engine, this approach can reveal many otherwise obscured issues. Ideas for next steps appear everywhere. Those recurring moments empower and energize, and research feels less like incremental boulder rolling and more like an adventure.

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#### Challenges:

Action Research through mobile technologies also can be ineffective and inefficient for some research pursuits. This App-Maker Model approach, by nature, is time consuming and involves laborious cycles of planning, action, reflection, and so on. Combine that pace of research with the tedious nature of app development (and publishing), and some researchers simply might not have the patience or perseverance, or the interest, to see what eventually might come from such long-term efforts.

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Many other kinds of research methodologies have been developed over decades and proven themselves in specific niches for answering certain kinds of questions about particular kinds of things. They also have developed a methodological certainty that comforts many researchers, administrators, and publishers. Frankly, they are less trouble to use. Action Research, by nature, might be more exploratory and also more unpredictable than other types of methodologies. The App-Maker Model approach also integrates the researcher directly into the research, rather than keeping operations at arm's length and safe from direct influence by stakeholders' desires, even subconscious ones. Sometimes, such observational distance helps provide clarity. Likewise, such detachment reveals flaws that otherwise could be missed, especially by researchers invested in the production process.

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Risks also can lead to failures, sometimes in grand fashion. The research community generally wants new ideas and research paths to emerge. Contradictorily, it often has a difficult time dealing with new paradigms and findings that challenge the status quo, or scholarly traditions, in terms of fitting those into pre-existing conventions and forms. Action Research, for example, has been a widely discussed and supported scholarly approach for decades, yet its messiness and methodological uncertainties keep it on the fringe of the academic publishing world. Work with this approach can be

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widely unappreciated, or underappreciated, and confusion about its standards and techniques contribute to its outlier status. When people in power do not understand this approach, or dismiss it as unscientific, there are ramifications beyond just social capital. By not following the specific leads of others, down well-trodden methodological paths, action researchers can be ostracized or even punished, especially when issues of promotion and tenure are raised, especially by non-digital-humanists.

In our experiences, for example, we have had research grants from the National Endowment for the Humanities indiscriminately classified as “service” work because they funded these sorts of Action Research initiatives. Besides the various issues related to credit for the work, formative studies in any new field, like this, can get lost in search of landmarks, because of the novelty of the technologies and the inexperience of the test subjects (and researchers) with those technologies. That should not be a surprise or be set up for organizational punishment. This is part of the wayfinding, as getting lost can sometimes lead to interesting, otherwise unknown places. In the meantime, working with technologies that change and rapidly update creates a churning of effort and resources needed just to maintain a place within the research realm. When operating systems are updated, when hardware innovations appear, when societal use patterns dramatically shift as the newness of an idea wears off, action researchers need to remain nimble and ready to adapt. Otherwise, they quickly get left behind, and their work could become irrelevant. Those recurring moments of shifting and reconfiguration can be draining and exhausting.

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## **Issue 4: New ways of data collection help evolve the types of data researchers can collect**

### **Opportunities:**

Mobile technologies allow data to be collected in novel ways. During our recent research, we have combined traditional ideas with new mobile techniques, such as inserting survey questions into an app, so that they are interspersed throughout the experience, rather than solely being collected at the end. While the survey itself is standard (e.g., asking for basic demographic information, using Likert-like scaled questions to better understand responses to the mobile intervention), the process is fundamentally changed by the technology’s affordances. For example, the questions can be automatically randomized. This gives each user the items in a different order, helping to eliminate any fatigue effects that the ordering might cause. The data is entered directly into the app, limiting data entry mistakes to the ones created by users, and the app exports the data into a common database form. The surveys also can keep the user from advancing through the app until all of the questions are answered, eliminating missed questions, and preventing users from skipping parts, keeping the survey data complete. In turn, the data can be collected in ways that simply have not been readily available to researchers in the past. For example, as soon as the research app has been opened, if the privacy permissions have been allowed, the test subject will create a complete record of all interactions with the mobile device when using that app, including a GPS trail of where those interactions took place, and a time and date stamp. The richness of such available deep field data is unprecedented.

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### **Challenges:**

Yet the more data collected from a test subject, the more choices that have to be made about how that data is collected, how that collection process affects the data, and what the data inherently means. In short, the potential of what we can do now dramatically increases the possibilities and therefore exponentially expands the complexity of what can and could be done. We do not know yet, for example, how survey data collected in a mobile fashion, within an app, and as part of a mobile experience, affects the ways in which test subjects answer the questions and approach those surveys. What would the results be if a paper survey was included in the same experience, in place of the mobile survey, and given at the same time? Other data collection techniques are more complicated and need more consideration, whether they are extensions of traditional methods or some sort of new methodology emerging from the primordial technological ooze. In turn, this data resembles discovering a new species of information. We think we know something about it, but we do not know enough to make many assumptions without carefully measuring and tempering our leaps. In the process, we also encounter the risk of becoming too reliant on the data and the machinery and losing mindfulness about what we study and what the data reveals.

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This freshness of perspective was the most predictable benefit, in our experience. The different types of data allow for new ways to triangulate findings, and provide ways to validate the data analytically beyond statistical  $p$  values. The biggest drawback here goes back to Issue 3; collecting data in a new way does entail risk and doesn't fit into the prescribed patterns most people are trained to recognize and evaluate in graduate school. Combining a humanistic approach with qualitative and/or quantitative data is historically rare, but scholars are beginning to integrate these approaches more frequently [Kinshuk, Sampson, and Chen 2013] [Lynch 2014] [Spiro 2014]. A journal editor, in turn, could face significant challenges finding appropriate reviewers to which such an article can be sent for feedback, and junior faculty, eager to build publishing credentials, hardly can afford additional obstacles in an often highly challenging and ultra-competitive peer-review environment.

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## Discussion

Cognition “in the wild” has been a significant topic for anthropologists since the late 1980s [Crabtree et al. 2013]. Lave and Wenger [Lave and Wenger 1991] furthermore detailed how new members are brought into knowledge communities, and how those communities both transform and reproduce themselves. That process starts through peripheral participation by the new members, but gradually their involvement usually increases in engagement and complexity the longer they are a part of the community [Adams, Davies, Collins, and Rogers 2010]. The Maker Movement shares such heritage, as a call for people, including scholars, to return to learning by doing.

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Calls for action at various academic conferences we have attended in recent years regularly have challenged researchers to actively pursue innovative methodologies that reflect the distinct affordances of the mobile systems studied, along with an integrated view of the users of those systems [Lew, Nguyen, Messing, and Westwood 2011] [Kjeldskov et al. 2012] [Kjeldskov and Paay 2012]. Action Research approaches, in turn, could be worth more exploration, as long as the opportunities are weighed with the inherent challenges. Instead of waiting for someone else to invent research tools, the way to get started, in summary, is to get started, to try and fail and try again.

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One area not addressed in much depth in the academic literature of this topic, and a primary motivational factor for us to develop our own programs, is the stark reality that digital humanist researchers, whether studying mobile or not, are constrained and contorted by third-party data and third-party systems, created for other purposes (e.g., making profits). Invariably, that subservient dynamic leads to projects getting restricted by the whims, agendas, and benevolence/malfeasance of the developers. Instead of having independent agency and basic control of the core systematic procedures, like through other applications of the scientific method, many digital humanist researchers today have to settle for what they can get in terms of mobile data and trying to make something useful out of it. Sometimes, even under such heavy constraints, significant insights emerge.

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We think there are clear benefits for researchers in the digital humanities to have broader procedural control of their projects, especially in terms of direct involvement in the design, delivery, and data-output decisions. The only way to assure such oversight and jurisdiction in the future, though, is for digital humanists to build these data collection systems and sets of data, under the designs of academic researchers. Instead of data created by for-profit ventures, or even non-profit organizations with alternative goals, the information accumulated in these cases can be exactly what the researchers planned for and needed, governed by established research protocols, and exported into easy-to-process forms, for analysis and interpretation.

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Natural settings, typified by field studies, also have been shown to offer significant potential, but mobile researchers have tended to not do as much work “in the wild.” Concerns about control issues and methodological certainty hold some people back. The App-Maker Model approach offers an acknowledgment of insider's positionality and full transparency about the techniques incorporated, including the option to share the specific mobile-app code used to allow for easy replication of studies in different settings. Mobile technologies offer researchers many other new possibilities, too, for better research procedures. Many other professions already are embracing such potential, within their respective fields. In our experience, using mobile devices for research provides a substantial level of control, without the artificiality of a lab experiment. Whether the App-Maker Model approach becomes a primary strategy for the field, or remains as a secondary or tertiary option, some mobile researchers will continue to benefit while others remain

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on the sidelines, missing their chance to play and explore in this field as it forms.

From our Action Research paradigm, participating through this App-Maker Model approach was an extremely helpful way for us to transform our understandings of mobile technologies and mobile media from an outsider’s perspective to an insider’s perspective, where we began to understand more completely why people acted in particular ways with their smartphones and tablet computers, often for practical reasons. We did not take this approach as a step toward becoming app developers or to transition into industry profiteers. We did not take this approach as a way to circumvent scholarly traditions and work outside the boundaries of rigorously established and highly valued conventions. We did not take this approach as a way to reap academic rewards. Instead, we thought that we understood mobile technologies and mobile media to a certain extent from observing it but that we might be able to learn more about it by participating in it. We just had no idea how much existed below the surface, until we were under there.

If such a perspective seems like a common-sense approach – like the sculptor, who works with the clay rather than only looking at the creations of others – then we circle back to the fundamental and underlying question, related to mobile technologies or not: Why aren’t more scholars, especially in the digital humanities, experimenting with these kinds of action-research approaches? Academics working in the digital humanities will never be able to – and shouldn’t aim to – replicate the approaches and perspectives taken by natural scientists studying non-human behavior. Action Research, such as through the App-Maker Model approach, offers legitimate alternatives. But we will only know how valuable and effective these approaches can be (and become) through applying them to a variety of situations and environments and writing about those experiences and responding to the discourse circulating about those efforts. Mobile media and communication research, as illustrated here, might be an ideal field for such innovative approaches, as long as researchers can adequately address and overcome biases and control systems and various other pragmatic obstacles limiting this type of approach and experimentation. Also, they have to be willing to take chances and give it a try.

## Appendix

### Screenshots from the mobile apps mentioned in this paper:

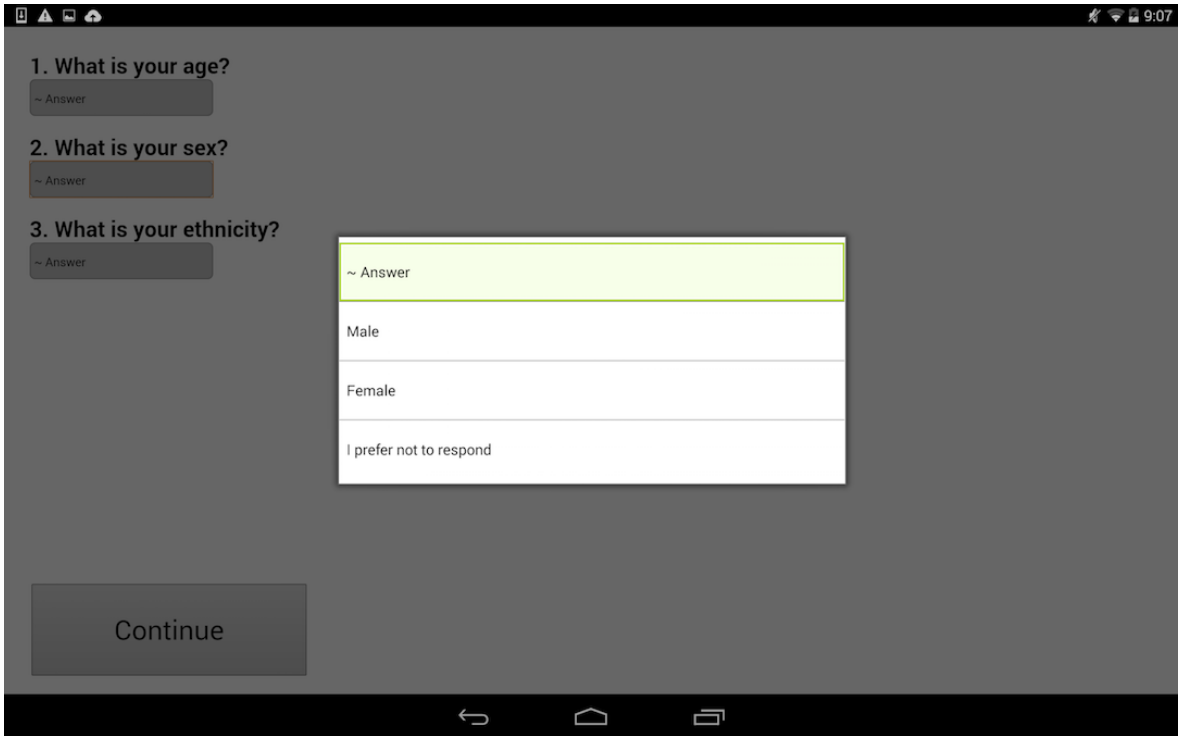


Figure 1. The mobile app on the tablet computer first gathered basic demographics.

Would you like to take a picture with the Old Apple Tree?

Yes

No

Continue



**Figure 2.** After the audio or video file played, users were offered a photo option.



Saving screenshot...

I felt happy after spending time with this app.  
Definitely

I was really drawn into this app.  
Possibly

Using the app gave me pleasure.  
Definitely

I will use things from this app in discussions or arguments with people I know.  
~ Answer

This app  
~ Answer

This app  
~ Answer

I will bring this app to other people.  
~ Answer

I felt interested in this app.  
~ Answer

This app was fun.  
~ Answer

I felt good after using the app.  
~ Answer

Continue

**Figure 3.** After the photo option was offered, users were asked specific survey questions about their experiences.

**Images showing the research context (Photos courtesy of Michael Rabby)**



**Figure 4.** A researcher (in the tan vest) talks with test subjects in front of the Old Apple Tree during the initial test in 2012.



**Figure 5.** The equivalent research context two years later (in 2014), with a research assistant, in khaki shorts and holding one of the tablet computers, standing near a newly erected fence around the tree.

## Works Cited

- Adams, Davies, Collins, and Rogers 2010** Adams, A., Davies, S., Collins, T., and Rogers, Y. (2010). Out there and in here: design for blended scientific inquiry learning. In: *17th Association for Learning Technology Conference ALT-C 2010*, 07–09 Sep 2010, Nottingham, UK.
- Adams, Fitzgerald, and Priestnall 2013** Adams, A., Fitzgerald, E., and Priestnall, G. (2013) Of catwalk technologies and boundary creatures. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 20, (3).
- Archer 1995** Archer, B. (1995). The Nature of Research. *Co-Design Journal*, 2(11), 6-13.
- Bartanen 2014** Bartanen, K. (2014). Digital Scholarship and the Tenure and Promotion Process. *The Academic Commons*. Retrieved from <http://www.academiccommons.org/2014/07/24/digital-scholarship-and-the-tenure-and-promotion-process/>.
- Bolter, Engberg, and MacIntyre 2013** Bolter, J. D., Engberg, M., & MacIntyre, B. (2013). Media studies, mobile augmented reality, and interaction design. *interactions*, 20(1), 36-45.
- Bouwman, de Reuver, Heerschap, and Verkasalo 2013** Bouwman, H., de Reuver, M., Heerschap, N., and Verkasalo, H. (2013). Opportunities and problems with automated data collection via smartphones. *Mobile Media and Communication*, 1(1), 63-68.
- Bruner 1989** Bruner, E. M. (1989). Tourism, Creativity, and Authenticity. *Studies in Symbolic Interaction*, 10, 109–114.
- Burdick et al. 2012** Burdick, A., Drucker, J., Lunefeld, P., Presner, T., and Schnapp, J. (2012) *Digital Humanities*. Cambridge, MA: The MIT Press.
- Büscher, Urry, and Witchger 2011** Büscher, M., Urry, J., & Witchger, K. (2011). Introduction: Mobile methods. In M. Büscher, J. Urry, & K. Witchger (Eds.), *Mobile Methods*. New York, NY: Routledge.
- Campbell and Groundwater-Smith 2007** Campbell, A. and Groundwater-Smith, S. (2007). *An ethical approach to practitioner research: Dealing with issues and dilemmas in action research*. New York: Routledge.



- Cavanagh 2013** Cavanagh, S. (2013). Living in a Digital World: Rethinking Peer Review, Collaboration, and Open Access. *ABO: Interactive Journal for Women in the Arts, 1640-1830*, 2(1), 15.
- Cheverie, Boettcher, and Buschman 2009** Cheverie, J. F., Boettcher, J., & Buschman, J. (2009). Digital Scholarship in the University Tenure and Promotion Process: A Report on the Sixth Scholarly Communication Symposium at Georgetown University Library 1. *Journal of Scholarly Publishing*, 40(3), 219-230.
- Cohen 1988** Cohen, E. (1988). Authenticity and Commoditization in Tourism. *Annals of Tourism Research*, 15: 371–386.
- Crabtree et al. 2013** Crabtree, A., Chamberlain, A., Grinter, R., Jones, M., Rodden, T. and Rogers, Y. (eds.) (2013) Special issue on “The Turn to the Wild” with authored introduction, *ACM Transactions on Computer-Human Interaction - ToCHI* 20(3), 13:1-13:4.
- Csikszentmihalyi 1978** Csikszentmihalyi, M. (1978). Attention and the holistic approach to behavior. In K. S. Pope and J. L. Singer (Eds.), *The stream of consciousness* (pp. 335-358). New York: Plenum.
- Csikszentmihalyi and Csikszentmihalyi 1988** Csikszentmihalyi, M., and Csikszentmihalyi, I. (1988). *Optimal experience: psychological studies of flow in consciousness*. Cambridge, England: Cambridge University Press.
- D'Andrea, Ciolfi, and Gray 2011** D'Andrea, A., Ciolfi, L., & Gray, B. (2011). Methodological challenges and innovations in mobilities research. *Mobilities*, 6(2), 149-160.
- Daston and Galison 2007** Daston, L., & Galison, P. (2007). *Objectivity*. Cambridge, MA: MIT Press.
- Design-Based Research Collective 2003** Design-Based Research Collective (2003). Design-based research: An emerging paradigm for educational inquiry. *Educational Researcher*, 32(1), 5-8.
- Dougherty 2012** Dougherty, D. (2012). The maker movement. *Innovations*, 7(3), 11-14.
- Douglas 2004** Douglas, H. (2004). The irreducible complexity of objectivity. *Synthese*, 138(3), 453 - 473.
- Fincham, McGuiness, and Murray 2010** Fincham, B., McGuiness, M., & Murray, L. (2010). *Mobile methodologies*. Basingstoke, England: Palgrave Macmillan.
- Frith 2015** Frith, J. (2015). *Smartphones as locative media*. Cambridge: Polity Press.
- Gilmore and Pine 2007** Gilmore, J. H., & Pine, B. J. (2007). *Authenticity: What consumers really want*. Boston, MA: Harvard Business Press.
- Harley et al. 2007** Harley, D., Earl-Novell, S., Arter, J., Lawrence, S., & King, C. J. (2007). The Influence of Academic Values on Scholarly Publication and Communication Practices. *Journal of Electronic Publishing*, 10(2).
- Hayes 2011** Hayes, G. R. (2011). The relationship of action research to human-computer interaction. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 18(3), 15.
- Hayes 2012** Hayes, G. R. (2012). Taking action in your research. *interactions*, 19(4), 50-53.
- Hayes 2014** Hayes, G. R. (2014). Knowing by Doing: Action Research as an Approach to HCI. *Ways of Knowing in HCI* (pp. 49-68): Springer.
- Hektner, Schmidt, and Csikszentmihalyi 2007** Hektner, J. M., Schmidt, J. A., and Csikszentmihalyi, M. (2007). *Experience sampling method: Measuring the quality of everyday life*. Thousand Oaks, CA: Sage Publications.
- Henze 2012** Henze, N. (2012, May 5-12). *Hit it!: An apparatus for upscaling mobile HCI studies*. Paper presented at the CHI 2012, Austin, TX.
- Henze and Pielot 2013** Henze, N., and Pielot, M. (2013). App stores: external validity for mobile HCI. *interactions*, 20(2), 33-38.
- Henze et al. 2011** Henze, N., Pielot, M., Poppinga, B., Schinke, T., and Boll, S. (2011). My app is an experiment: Experience from user studies in mobile app stores. *International Journal of Mobile Human Computer Interaction*, 3(4), 71-91.
- Herr and Anderson 2005** Herr, K., and Anderson, G. L. (2005). *The action research dissertation: A guide for students and faculty*. Thousand Oaks, CA: Sage Publications, Inc.
- Hughes 1995** Hughes, G. (1995). Authenticity in Tourism. *Annals of Tourism Research*, 22: 181–803.

- Hughes and Hayhoe 2008** Hughes, M., and Hayhoe, G. (2008). *A research primer for technical communication: methods, exemplars, and analyses*. New York: Lawrence Erlbaum.
- Jones, Karnowski, Ling, and von Pape 2013** Jones, S., Karnowski, V., Ling, R., and von Pape, T. (2013). Welcome to Mobile Media and Communication. *Mobile Media and Communication*, 1(1), 3-7.
- Karnowski 2013** Karnowski, V. (2013). Befragung in situ: Die Mobile Experience Sampling Method (MESM) *Handbuch standardisierte Erhebungsverfahren in der Kommunikationswissenschaft* (pp. 235-247): Springer.
- Kemmis 1982** Kemmis, S. (Ed.). (1982). *The action research planner*. Geelong, Victoria, Australia: Deakin University Press.
- Kinshuk, Sampson, and Chen 2013** Kinshuk, H.W. H., Sampson, D., & Chen, N.S. (2013). Trends in educational technology through the lens of the highly cited articles published in the Journal of Educational Technology and Society. *Educational Technology & Society*, 16(2), 3-20.
- Kjeldskov and Graham 2003** Kjeldskov, J., and Graham, C. (2003). A review of mobile HCI research methods. *Human-computer interaction with mobile devices and services* (pp. 317-335). Heidelberg: Springer Berlin.
- Kjeldskov and Paay 2012** Kjeldskov, J., and Paay, J. (2012, Sept. 21-24). *A longitudinal review of mobile HCI research methods*. Paper presented at the Mobile HCI 2012, San Francisco, CA.
- Kjeldskov et al. 2012** Kjeldskov, J., Cheverst, K., de Sá, M., Jones, M., and Murray-Smith, R. (2012, Sept. 21-24). Research methods in mobile HCI: Trends and opportunities. Paper presented at the Mobile HCI 2012, San Francisco, CA.
- Kusch 2011** Kusch, M. (2011). Knowledge and Certainties in the Epistemic State of Nature. *Episteme*, 8(1), 6-23.
- Kuutti and Bannon 2014** Kuutti, K., and Bannon, L. J. (2014, April 26 - May 1, 2014). *The turn to practice in HCI: towards a research agenda*. Paper presented at the Proceedings of the 32nd annual ACM conference on Human Factors in Computing Systems, Toronto, Canada.
- Lave and Wenger 1991** Lave, J. and Wenger, E. (1991) *Situated learning. Legitimate peripheral participation*, Cambridge: University of Cambridge Press.
- Lew, Nguyen, Messing, and Westwood 2011** Lew, L., Nguyen, T., Messing, S., and Westwood, S. (2011, May 7-12). *Of course I wouldn't do that in real life: Advancing the arguments for increasing realism in HCI experiments*. Paper presented at the CHI 2011, Vancouver, BC.
- Lynch 2014** Lynch, T. J. (2014). Social Networks and Archival Context Project: A Case Study of Emerging Cyberinfrastructure. *Digital Humanities Quarterly*, 8(3).
- MacCannell 1973** MacCannell, D. (1973). Staged Authenticity: Arrangements of Social Space in Tourist Settings. *American Journal of Sociology* 79, 589–603.
- McMillan et al. 2010** McMillan, D., Morrison, A., Brown, O., Hall, M., and Chalmers, M. (2010). Further into the wild: Running worldwide trials of mobile systems *Pervasive Computing* (pp. 210-227). Heidelberg: Springer Berlin.
- McNiff and Whitehead 2006** McNiff, J., and Whitehead, J. (2006). *All you need to know about action research*. Thousand Oaks, CA: SAGE Publications Ltd.
- Merriman 2014** Merriman, P. (2014). Rethinking mobile methods. *Mobilities*, 9(2), 167-187.
- Oppegaard and Adeopse 2013** Oppegaard, B., & Adeopse, O. (2013). Mobilizing the past for the present and the future: Design-based research of a model for interactive, informal history lessons. *Journal of Teaching and Learning with Technology* 2(2): 90–113.
- Porsdam 2013** Porsdam, H. (2013). Digital Humanities: On Finding the Proper Balance between Qualitative and Quantitative Ways of Doing Research in the Humanities. *Digital Humanities Quarterly*, 7(3).
- Reed 2014** Reed, A. (2014). Managing an Established Digital Humanities Project: Principles and Practices from the Twentieth Year of the William Blake Archive. *Digital Humanities Quarterly*, 8(1).
- Resnick and Rosenbaum 2013** Resnick, M., and Rosenbaum, E. (2013). Designing for tinkability. In Honey, M., and Kanter, D. (eds.), *Design, Make, Play: Growing the Next Generation of STEM Innovators*, pp. 163-181. Routledge: London.
- Rosenbloom 2012** Rosenbloom, P. S. (2012). Towards a conceptual framework for the digital humanities. *Digital*

**Sayers 2015** Sayers, J. (2015). Prototyping the Past. *Visual Language*, 49(3), Retrieved from <http://visiblelanguagejournal.com/issue/172/article/1232>.

**Sheller 2015** Sheller, M. (2015). 8 Vital Methodologies. In P. Vannini (Ed.), *Non-Representational Methodologies: Re-Envisioning Research* (pp. 130). New York, NY: Routledge.

**Spiro 2014** Spiro, L. "Defining Digital Social Sciences" (2014) <http://acrl.ala.org/dh/2014/04/09/defining-digital-social-sciences/>.

**Svensson and Goldberg 2015** Svensson, P., & Goldberg, D. T. (2015). *Between Humanities and the Digital*. Cambridge, MA: MIT Press.

**Takats 2013** Takats, S. (2013). A Digital Humanities Tenure Case, Part 2: Letters and Committees. <http://quintessenceofham.org/2013/02/07/a-digital-humanities-tenure-case-part-2-letters-and-committees/>

**Taylor, Wilkie, and Baser 2006** Taylor, C., Wilkie, M., and Baser, J. (2006). *Doing action research: a guide for school support staff*. Thousand Oaks, CA: Sage Publications Ltd.

**Trilling 1972** Trilling, L. (1972). *Sincerity and Authenticity*. London: Oxford University Press.

**Wang 1999** Wang, N. (1999). Rethinking authenticity in tourism experience. *Annals of tourism research*, 26(2), 349-370.

**de Souza e Silva 2013** de Souza e Silva, A. (2013). Location-aware mobile technologies: Historical, social and spatial approaches. *Mobile Media and Communication*, 1(1), 116-121.



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