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Bodystorming with Hawkins's block: Toward a new methodology for mobile media design

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Abstract
Inspired by the intuitive prototyping method employed by Palm Pilot founder Jeff Hawkins, this formative field study recreates and reimagines his generative techniques as a new methodology that could be useful for mobile media designers. Viewed theoretically through an activity theory lens, this approach also integrates bodystorming ideals as a way to externalize and embody user perspectives about the potential of place-based media, *in situ*, using a proposed National Park Service app, funded by the National Endowment for the Humanities, as an example. Such data gathering, especially early in the design process, could help user-centered projects gather otherwise inaccessible feedback, leading to better designs, through tailored content and interfaces, particularly at the dynamic intersections of digital and physical space.

Keywords
Activity theory, bodystorming, design, low-fidelity prototyping, mobile app, mobile media, national historic site, prototyping, user-centered design, user experience

Introduction

Jeff Hawkins, inventor of the Palm Pilot, launched his ground-breaking, mobile computing product in the mid-1990s with just a small block of wood as his guide. By using that block to focus on his mobile needs, activities, and actions—in context—he was not

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wittingly trying to create a new research methodology. He was trying to solve business problems threatening the livelihood of his company. He could have chosen to invest in a high-end, system-centered usability laboratory. Instead, he went into his home shop, cut and shaped a piece of wood roughly the size of the hand-held device he envisioned, with a whittled-down chopstick for a stylus, and started imagining how the device might work in real-life scenarios. In a matter of hours, he designed the shape and "look of the machine that would change the world" (Butter & Pogue, 2002, p. 76).

Hawkins, in hindsight, had pioneered an approach and research instrument that allowed him to create critical distance from his cultural-historical context, serving as an extending mechanism to perceive beyond the moment and to envision what Bell and Dourish (2007) describe as the proximate future, or the future "just around the corner" (Dourish & Bell, 2011, p. 23). Mobile media designers need such periscopic methodologies and instruments to gain vision and awareness about the constraints of current technologies and contexts, using momentary increases of perceptiveness to better imagine future uses and needs. Hawkins's wood block has established its place in industry lore, with the original instrument now housed in the Computer History Museum in Mountain View, CA. Yet scant academic attention has been paid to that instrument, or Hawkins's method of inquiry into ideas of mobility. The wood-block approach therefore deserves deeper examination as a possible new research methodology, to be applied in other contexts, with other users, to determine its potential viability. So this study develops a theoretical framework for such an examination as well as presents the foundations of that new methodology for applying Hawkins's block to any situations in which place-based media might be warranted and wanted.

Ubiquitous computing, as originally envisioned by computer scientist Mark Weiser, integrates both technological advances, such as mobile devices, and the imagination to envision new applications of those technologies in various contexts. Such innovative amalgamations inherently are, as Dourish and Bell (2011) describe, messy. They write that the "world is never quite as simple, straightforward, or idealized as it is imagined to be" (p. 4), and "the best way to understand the future is to do your best to create a local approximation and try to use it day to day" (p. 12). If the proximate future mostly remains veiled, even when viewed via an instrument like the wood block, the process of reaching and peering ahead still maintains methodological value in its abilities to reveal contemporary cultural assumptions, constraints, and failings. That essential process of actively being in a mode of discovery, metaphysically, suggests Heidegger's (1977) conceptualization of "bringing forth," or of humanity's constant pursuit of the proximate future, the continual push to be among the first to see and recognize as the blossom of a technology metaphorically bursts into bloom. Heidegger argues that every instrumental act of bringing forth is an act of revealing truth, and, technology therefore is a way of revealing our essential truths (p. 12). In a practical sense, then, Dourish and Bell contend that people always will be assembling heterogeneous technologies, in an effort to achieve individual and collective goals, as a sort of bricolage, but those efforts also always will be in a state of bringing forth, as iterative improvements continually appear throughout an interconnected system, causing every other point to readjust, and inherently keeping the system in a state of flux, rather than providing a fixed target. The people who generate these new technologies, meanwhile, are products of

social shaping, performing social actions, operating within social contexts, at particular historical moments, all of which guides the imagination of what needs technology might meet, and in what settings (Dourish & Bell, 2011). The wood-block approach, for a low-level objective, could at least free the user's mind from the form factor of, say, the physical constraints of a powered-down iPhone, even if traces of cultural assumptions about contemporary technologies, mobilities, and place, are not as easily shed. Researchers inherently operate within such social and historical contexts as well, but they also can mindfully try to escape those, at least momentarily, to peer into the distance, and attempt to picture what is coming next. Whether the wood block melds into a manifestation of the mind of the user, or, as object-oriented ontologists might suggest, the block relates on its own, or something else altogether is happening, from other perspectives, the philosophical foundations of this methodology can be projected from its practical results. Within this methodological context, Hawkins carried his wooden "mobile device" around with him and interacted with it, as a way to reveal the next frontier of humanity, like the object was an obscured view, but a view nonetheless, of the powerful and pervasively connected communicator/computer it eventually would become. This wood block did not bear the burdens of what was technologically possible at the time, or pet ideas of any designer, or even the constraints and baggage of what previously had been conceptualized as the hand-held's domain. Hawkins merely followed his normal routine and pretended to use the block as he would like to use a mobile device, with his visualization of such a device melding the functions of other technological tools he regularly used at the time, such as the telephone, calendar, pager, notepad, and Internet-connected computer. This particular idea-generation process, for Hawkins, brought forth and shaped the design of the Palm Pilot (Butter & Pogue, 2002). He later reflected upon that wood-block method, through retrospective recall, as providing otherwise inaccessible insights into mobile development opportunities, which helped him and his company to beat the major business competition, including Apple (J. Hawkins, personal communication, May 18, 2012).

As mobile technologies continue to emerge, and the mobile platform defines itself as a distinct medium, McLuhan and Fiore's (1967) contention that each new medium creates unique potential for communication—and that the medium, inherently, "is the message"—deserves revisiting, particularly when considering developments during the past two decades in the applications of activity theory to human–computer interaction (HCI) and other technology-focused fields (Kaptelinin & Nardi, 2006, 2012; Nardi, 1996). Mobility introduces new dynamics to our media ecologies, by connecting users to each other and to locations, possibly both at the same time, while these users are physically in motion and/or engaged in everyday life activities. Such flows of information and communication can be seamlessly woven into the rhythms of everyday life, with important social ramifications (Campbell, 2013). The mobile medium, in turn, can be considered the ubiquitous interface for contemporary society, through which we see *and experience* the world (Farman, 2012). So people do not just interact with their computers, from the corresponding activity theory perspective, they interact with the world *through* computers (Bodker, 1991; Kaptelinin & Nardi, 2012, p. 6). Mobile devices thereby epitomize the manifestation of the activity theory perspective. Gordon and de Souza e Silva (2011, p. 2) argued that mobile devices are generating a pervasive "net

locality," or networked locality, in which something different begins happening to "individuals and societies when virtually everything is located or locatable." People are changing the ways in which they live, because of mobile devices, but also changing their internal projections of the proximate future, what they want to be able to do and how they want to be able to do it, to deepen users' interactions with the places they inhabit (Humphreys & Liao, 2011). Researchers, in turn, need to work fast, developing methods to make those projections external, as a process of converting such ideas into design guidelines that can be immediately implemented and tested. From those circumstances and perspectives, this formative field study attempts to transform Hawkins's intuitive information-seeking response, through an activity theory framework, into a new bodystorming methodology for mobile app development, as an embodied style of brainstorming, to question if this wood block instrument can perhaps help designers better see the proximate future.

Activity theory as the theoretical lens

On the most fundamental level, research is a creative activity and also a form of interaction with the world, or another extension of Heidegger's "bringing forth" idea. After considering an array of theoretical perspectives with familial relations, including situated action, phenomenology, and distributed cognition, activity theory became the lens of this research design primarily because of its holistic scope, its emphasis on the empowering nature of artifacts to serve as "functional organs" mediating human experience, and the underlying premise of the theory, which suggests that design begets technology, and design is under the aegis of human intentionality and imagination (Kaptelinin & Nardi, 2012). An overriding principle of activity theory is the unity and inseparability of consciousness and activity (Rubinstein, 1946). At the theory core, therefore, is the "activity," which is generally defined as a purposeful, mediated, and transformative interaction. As the fundamental concept of activity theory, a unit of activity is understood in greater depth as a relationship between a subject (an actor, or group of actors) and the object (an objectified motive), which can be tangible or intangible, motivated by the subject's needs and viewed as dynamic and constantly under development. Yet the relationship, from an activity theory perspective, also hierarchically favors the object, rather than the subject, because the object provides the motive for the interaction, or the ultimate cause for human activities: needs. Needs—biological or psychological—that are not "objectified," or associated with a specific object (or objective), create the stimulus that causes searching for the object. When a need meets its object, an activity emerges (Kaptelinin & Nardi, 2012). The wood block, through bodystorming, could help a latent need become objectified and transformed into an activity. An activity always contains various artifacts, from instruments and machines, to procedures and laws, to signs, forms of organization, and even just raw shared ideas. These artifacts play a mediating role, and relations between elements of an activity do not happen directly, but through mediation, consolidating concerns about an activity back to the artifact in focus (Kuutti, 1996). Artifacts, such as a mobile device or a wood block pretender, in turn, can profoundly extend and transform the human experience, assisting with the "bringing forth" (Nardi, 1996). When Hawkins used his wood block, for example, he recalled becoming so intimately aware of

the feel, look, and navigation of the device he wanted to create that when engineers brought him the first plastic prototype, he instantly knew it was a half millimeter too thick. More important, though, Hawkins said he knew, from the experience with the wood block, his new device would be engaging, throughout various types and levels of activity, and people would buy it.

> What I did, by using it like that, was that I convinced myself that it would work. I convinced myself that the user experience would not be weird. It was going to be good, actually, and that people would like it. It was fun. And I think I didn't know that until I actually did it. Until you actually sit and try it, you don't really know. (J. Hawkins, personal communication, May 18, 2012).

As a measurable, an activity theory unit can be conceptualized initially as the simple relationship between a subject and an object, or an objectified motive. While dividing the subject from the object and vice versa, can be complicated, and, again, messy, as the understanding of the relationship expands and integrates the mediating object, or instrument, an even more complex relationship emerges; the artifact mediates and transforms the relationship between the subject and the object as well as the subject and the artifact. Engeström (1987, 1999) expanded upon this foundation to demonstrate how networks of activity systems overlap, and interactions form with rules, community, and division of labor. Sharples, Taylor, and Vavoula (2007) were inspired by Engeström's model to craft their own framework for examining the holistic system of learning as an interaction between people and technology, again, the bringing forth, which then could be used by software developers and engineers to propose requirements for the design and evaluation of new mobile learning systems (see Figure 1). Researchers meanwhile have begun to look toward theory to underwrite certain intellectual and ethical commitments, as prototyping has evolved. Activity theory's development as a theoretical lens, in turn, has become progressively more focused on design, and for use with ongoing projects, particularly as part of those exploring novel ways of supporting people with interactive technologies, creating an intriguing avenue of inquiry for navigating the messiness of the bricolage (Kaptelinin & Nardi, 2012). With a focus on such technological mediation, m-learning researchers, in particular, have been drawn to activity theory's potential for the creation of new educational models (J. Taylor, Sharples, O'Malley, & Vavoula, 2006), for designing mobile learning environments (Uden, 2007), and for knowledge management (Liaw, Hatala, & Huang, 2010). The framework developed by Sharples et al. (2007) for analyzing mobile learning extended the traditional activity theory dynamic of subject–object–mediating artifact as a way to look deeper at the technological and semiotic layers of mobile learning contexts. Those additional layers were focused on issues of control (defined by HCI and social rules), context (defined by the physical environment and the community), and communication (defined by the channels of information, protocols, conversations, and division of labor). Those three categorizations shaped the understanding in this study of user responses to the wood-block type of bodystorming, as a way to see through the messiness of digital development, described by Dourish and Bell (2011).

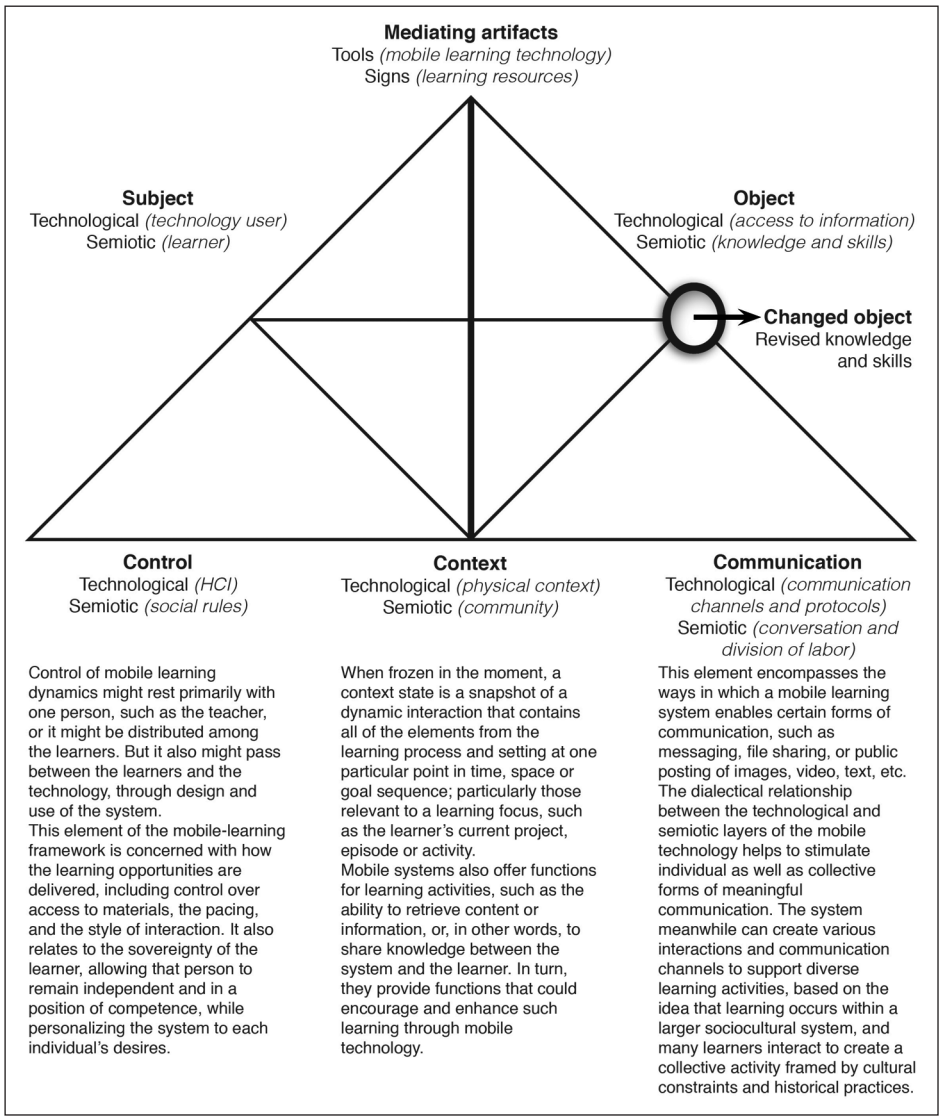

Figure 1. A framework for analyzing mobile learning, from Liaw et al. (2010); Lonsdale, Baber, Sharples, and Arvanitis (2004); and Sharples et al. (2007).

Bodystorming as an approach

Guided by that mobile learning framework, and based on activity theory principles, this formative effort to establish a new bodystorming methodology for mobile designers focused upon the interaction between the test subject and the objectified motive of exploring and learning about a historic site, through the functional organ of a wood

block, as an artifact. Functional organs support and complement natural human abilities in building up a more efficient system—of internal and external resources—that can lead to the accomplishment of goals that could not be attained otherwise, like a scissor elevating the human hand to a precise cutting instrument, or a notebook enhancing a person's memory, or a mobile app tailoring data to inform about the particular situation of the user. Of central concern to HCI and related fields, such as mobile media communication, is the integration of computerized tools into the structure of human activity. What are the needs that necessitate the development of a new functional organ, such as a mobile app? What is the range of goals that a new tool, such as an app, might be intended to satisfy? What is the structure of the human activity before the assimilation of that tool, and how does the tool transform that experience? (Nardi, 1996). Those questions helped to shape this research design as it developed. But the perspective of this research also kept returning to the primary focus of activity theory, which is to identify needs of users; in this case, the users of mobile devices at a national historic site. When users walk around the historic site, what do they want to do? What needs do they have? Because of the limited literature in this field, and lack of models, even the users seem to have little idea. Could they see more clearly, and "bring forth," in the moment of "being there," with a wood block to help them focus? Could any mobile user play Hawkins's designer role in such a scenario, if given a wood block and a large question to explore, such as "What would you want your app to do here?" With that question as the core prompt of the study, bodystorming became the mode of "being there," as a way to enter the location-specific substrata of intertwined physical, social, interactional, and psychological contextual factors that swirl underneath each ubiquitous computing environment (Oulasvirta, Kurvinen, & Kankainen, 2003). Dynamic, experiential, and generative, bodystorming immerses designers into user situations through loosely configured contexts, allowing users and designers to explore space and situations in tandem, while also increasing empathy about decision-making processes, interactive experiences, and emotional responses of users (Hanington & Martin, 2012). In short, bodystorming can turn abstract ideas into physical experiences, and observational data, as a form of role playing (Holmquist, 2008).

Bodystorming as an embodied idea-generation technique was created in the 1950s, as an offshoot of Osborn's (1953) brainstorming concept. Computer system designers similarly have incorporated role playing with low-fidelity prototypes into idea-generation exercises since at least the early 1980s, with the UTOPIA project bringing together the Nordic Graphic Workers Union and researchers from Denmark and Sweden, to design together through work organization games and mock-ups (Ehn, 1993). Bodystorming's initial application in computer system design reportedly did not take place until the 1990s, when Interval Research began exploring its potential. The company classified bodystorming as an "experience prototyping" tool, and, like Hawkins, considered such prototyping a key activity in understanding and developing interactive systems as well as a primary element of innovation (Buchenau & Suri, 2000).

The wood-block methodology

Traditionally, bodystorming sessions follow a few common steps: (a) Interesting phenomena are selected and edited into easily readable design questions, representing the phenomenon as a problem in the events, experiences and/or practices of

Figure 2. The Village at the Fort Vancouver National Historic Site in 2012.

users; (b) Participants go to the representative environment; (c) One design question at a time is given to users; (d) The attempt to solve the problem occurs in the place where the phenomena are directly observable, in which users are asked to act out the activities, with ideas recorded on site and later discussed and elaborated upon (Oulasvirta et al., 2003).

To choose an environment representative of a place-based attraction, several different sites near Portland, OR, were considered. Those included the Oregon Zoo, the Fort Vancouver Barracks Cemetery, Multnomah Falls, the Cathlapotle Plankhouse, and the Fort Vancouver National Historic Site, which serves as a regional hub of the National Park Service. Because of the audience size and scope of the National Park Service site, as well as its many amenities and opportunities for mobile media, that place was chosen as the research site. Rather than focus this research upon the primary audience magnet of the site—the reconstructed Fort Vancouver stockade, which is like a smaller version of Colonial Williamsburg, with costumed interpreters, regular demonstrations of period arts and crafts, and other interpretive activities—the Fort Vancouver staff suggested a remote location of the site for the mobile media project, with many more technical challenges but with less distractions as well. Because that place, dubbed The Village, had vast untapped potential in terms of media delivery and also presented more control over the research variables, it was agreed upon, and the partnership with the National Park Service began, with Digital Start-Up funding for the development of the project later provided by the National Endowment for the Humanities. When the research started, The Village had few physical amenities: A couple of walking paths, several grassy fields, a couple of interpretive signs, and a couple of small reconstructed houses, which mostly were kept closed and locked (see Figures 2–3). However, it had a rich hidden history and location near the relatively new Vancouver Land Bridge, designed by renowned artist Maya Lin, as part of the Confluence Project commemorating the changes to the Northwest since Lewis and Clark passed through the region.

Figure 3. A wayside sign and reconstructed house at Fort Vancouver National Historic Site.

Representative users were identified as those within the National Park Service's Fort Vancouver communication channels, including social media feeds, and a short message was sent seeking volunteers to participate. The choice of a site and participants for such research therefore was made under the auspices of an established qualitative method called a "purposeful" sample (Koerber & McMichael, 2008). Additional screening confirmed that the first five volunteers to respond were between the ages of 18 and 65, with an interest in history and a general openness to new technologies, traits considered the essence of the target audience. These five people (three female, two male), as an initial sample pool, were considered a large enough of a group to, at the least, generate an improved iteration and to identify "show-stopping" problems during discovery phases of research (Macefield, 2009).

Because the wood block would be given to users, rather than used as a tool for motivated introspection, as Hawkins used it, the test instrument in this case was crafted slightly larger, bulkier, and heavier than a typical mobile device, meant to serve as a constant tactile reminder to the user of its presence and as a way to keep the responses focused on content that could be delivered through the device, rather than just to generate general observations about the site. Field testing involving users could have been employed at a later date, when a more refined prototype was available. Also, any actual mobile device, with its interface disabled, could have been used instead of the wood block. However, user-centered design principles suggest the importance of engaging user involvement in the design process as soon as possible, especially in the actual environment of use, and to do so in such a way that as few of the design requirements as possible, including the interface and form factors, are present to influence the user's cognitive engagement.

Such an approach, of generating a low-fidelity prototype—or what is sometimes called a paper prototype—has value for a couple of key reasons, which warrant its inclusion, especially at the beginning of the user-centered design process. First, as Grady (2000) points out, users are more apt to offer up critical feedback, even "suggest significant flaws when the [application] design is obviously very rough" (p. 39). A rougher, or low-fidelity prototype, encourages users, according to Still and Morris (2010) "to fully express their conceptualizations and, thus, reveal their mental models of a proposed design" (p. 144). Second, a low-fidelity prototype is a means of communication, and the lower the fidelity, as long as it is understandable to the user, the better because the designer and user can communicate openly from the beginning of the process, before even the designer has had the chance to make assumptions about the size of the device, the size of the screen, or other interface features. There must be some fidelity, but if, as Zdralek (2000) argues, the interface is how the designer and user talk to each other, lower fidelity prototypes allow for those "first attempts at a dialog" to happen sooner, and with less encumbrance.

Certainly, there are drawbacks to a wood-block prototype, too; the most obvious being that it does not, in its construction, resemble the final object that eventually will be used. Yet so much of that resemblance is dependent upon context of the digital bricolage of the moment, so we erred on the side of introducing, at this beginning stage, a prototype with the crudest refinement possible to allow the focus of this study to be specifically on the mobile activity within the actual use environment. Through that approach, users' conceptualizations theoretically could be included in a relatively unhindered way, in terms of reacting to the low-fidelity interface design elements, within that context, as a method to bring forth ideas. Subsequent prototypes, based on additional user and designer communication, could yield higher levels of fidelity per prototype and more specific feedback about design choices. As part of an iterative-design process, though, which eBay's Morgan and Borns call "360 degrees of usability" (p. 795), low-fidelity prototyping, such as the wood block we used, invites user participation, at almost the inception of the idea, and collaboration in the development of the requirements that eventually will be integrated into the elements of the application they, or those they represent, will use at its highest, production-level fidelity.

Our hypothesis is that the wood block, therefore, would be a better generative instrument for bodystorming than a functioning app prototype, because once the prototype—no matter how spare or how well-developed—reveals what it can and can't do, the user would be responding to the immediate design of the prototype instead of imagining the pure potential of the situation.

The procedures of this experiment were relatively simple and straightforward. During this process, each person was invited to visit the site, independently, at a prearranged time. The person then was oriented to the same spot at the Fort Vancouver National Historic site. The person was given the wood block, told it was representative of a smartphone running a new Fort Vancouver app that had no budgetary or technological limitations, and it could deliver any media imaginable—including text, audio, video, graphics, 3D models, animation, maps, etc.—then asked, "What would you want your app to do here?" As the test subject described the user needs emerging from this process, via think-aloud protocol, walking around the site, other gentle prompts—such as "What do you

want the app to be doing now?"—were used, particularly when passing in front of the two small reconstructed houses at the location, wayside signs, and other landmarks. Think-aloud protocol, originating in cognitive psychology, is a common method of eliciting data about cognitive processes through verbalizations by test subjects, typically seeking to know what the subject is thinking about at that specific moment, and at times provoked by prompts from researchers (Ericsson & Simon, 1985; Jaaskelainen, 2010).

To compare the open-ended scenario with a more refined and focused launching point, a second round of research was conducted with the same participants. In this round learners were asked to imagine watching a short video about archaeologists on site finding a piece of Hawaiian coral, which then prompted them to get involved in discovering where the coral came from, and what it meant for the coral to be at the site. This session was also recorded and later transcribed and sifted, to remove side discourse, such as commentary about the weather, background on the research project, inaudible or incomprehensible matter, etcetera. The remaining 35,000 words of discourse then were separated into chunks of distinct design ideas, which then were coded as either related to control, context, or communication (see Figure 1).

Results

Each person spent roughly an hour at the site with the wood block, with times on task ranging from 50 minutes to 70 minutes. In total, 300 distinct and chunked ideas related to mobile development at the research site were generated, or about one per minute of testing. With no specific scenario in place—just a wood block and the question of "What would you want your app to do here?"—this purposeful sample of users focused about the same amount upon control (99 chunked ideas) and context (93), with only three mentions of ideas that involved communication issues. When the Hawaiian coral scenario was added, in the second round, control issues (60) nearly tripled contextual issues (24). Communication issues increased as well (10), but that increase also was connected to a new prompt question, added during this round, which asked specifically about users making connections to others through the mobile device. These responses then were pooled into the nominal groups (Diehl & Stroebe, 1987; Rietzschel, Nijstad, & Stroebe, 2006; D. W. Taylor, Berry, & Block, 1958). Instead of eliminating redundancy, which is a typical way of measuring productivity in bodystorming sessions, the ideas were clustered by a trained rater through affinity characteristics, as a way to look for common needs among the participants.

An example of a control issue that became clustered by affinity was the recurring idea that the site should be providing videos of the interpretation material, instead of large sections of text, like brochures and wayside signs do, with each of the five users making a similar request:

- Participant 1 (50–64 years old, female): "I prefer video. You know, actors, costumes, animals, and anything you could bring in to feel like that time, like recreating that life."
- Participant 2 (25–34 years old, male): "If there was a video of someone, you know, of the reenacters actually around the house doing their thing, whatever that

was, whether there was a farmer, a blacksmith, or whatever. Being able to see that and sort of imagine that and seeing, OK, being able to actually visualize that, instead of just hearing or reading about it would be, would be pretty cool."

- Participant 3 (35–49 years old, female): "A short, little video, and that would probably be one of the best (ways to learn). I think text is great on a larger screen, but we are dealing with a smartphone."
- Participant 4 (25–34 years old, male): "Video would be important, if the production values are good."
- Participant 5 (35–49 years old, female): "I prefer videos, because I am just a video kind of a girl."

A context theme cluster, which appeared as part of all of the user comments as well, was the idea that the test subjects wanted to know specific and rich stories about the people who had lived at this particular site in the past, not just factoids, or generalities about the period:

- Participant 1 (50–64 years old, female): "So I might want to know more about some of the people who inhabited the village at this point. And so look at maybe what was available, I would assume they just have various scenarios available, and it might be about the people or what kind of work they were doing, or where they got their materials."
- Participant 2 (25–34 years old, male): "If this was a farmer's house. You know, if they, if they'd be out in their garden, or whatever, behind the house. Or if this was a hunter, like, even if he was just kinda cleaning his gun or whatever. Just kinda getting a feeling … A real name and a real person would be cool, if available. Just because I think that, when you hear that it tends to make it a little more personal."
- Participant 3 (35–49 years old, female): "I want it to give me more in-depth information than just this sign here. I want to learn about the people, the cultures. I want some insider's scoop.… Stories, you know people love to read stories.… I would love to find out some interesting stories about the people who lived here and how their lives might have been different if they had, if they had different cultural backgrounds."
- Participant 4 (25–34 years old, male): "Controversy.… People being upset or excited is more interesting than people being happy."
- Participant 5 (35–49 years old, female): "Maybe there was a family in this house out here, and you had the mothers from a couple of the different homes helping take care of each other's kids while they are cooking. That's like what was going on in this village. What were the people doing if their husbands were out working or shopping. What had the wives been doing?"

Along with the emergence of such clearly connected clusters, some individual comments were not as easy to categorize or lump together, or were non sequiturs. These ideas represented an array of curiosities, attitudes, and opinions. Participant 1 (50–64 years old, female), for example, mentioned, while walking between landmarks, that: "It would be fun to have music playing in the background here, music representative of the times."

Participant 2 (25–34 years old, male) asked questions about the modern development plans of the site, including the pending bridge design and its traffic impacts, rather than maintaining focus on historical connections. Participant 3 (35–49 years old, female) suggested that not only should she be learning about what people ate at the site, she wanted to see their recipes. Participant 4 (25–34 years old, male) asserted that he wanted to know precisely how long of an adventure he was starting, before he began it. Participant 5 (35–49 years old, female) asked to be quizzed every so often, just to see how much she was learning. All of which indicated that the wood block process revealed needs that might otherwise have never been objectified, from an activity theory perspective.

Raw idea generation is never the ultimate goal of bodystorming, because pure productivity, or the number of ideas generated during a session, only demonstrates a limited view of the effectiveness of the exercise. A process that generates a lot of unfeasible or commonplace ideas is not necessarily valuable. Osborn's (1953) original conceptualization of brainstorming suggests that quantity leads to quality, though, in that with more ideas available, there invariably will be more good ideas within that mix. How to effectively tease out the good ideas from the chaff, and measure those results, has puzzled many researchers and remained an obstacle in this approach (Rietzschel et al., 2006).

Discussion

This formative study was intended to provide results that could serve as guideposts for mobile designers, as a way to "bring forth" the ideas of the future. But in the process, the wood-block method demonstrated the potential to overcome the initial inertia on any mobile app project, giving designers the opportunity to talk to real users, within a specific context, and to learn what mobile technologies might provide in that particular place. Through that effort, designers might consider more clearly what to create and how to create and distribute it. Such a user-centered design approach is positively constructive because it emphasizes, according to Pratt and Nunes (2012), "putting the users in the center of the interaction design process, and taking into account their wants and needs" (p. 15). Faced with the often fuzzy front-end of design where questions like what to do, how to do it, where to begin, and what do the users need, ultimately, to be successful, are better addressed by making users part of the process, from the very beginning. Many types of idea generation models have been introduced to support that critical part of the process, with mixed evidence regarding their effectiveness (Liikkanen, Hämäläinen, Haggman, Bjorklund, & Koskinen, 2011). The wood-block approach follows and extends the traditional path of user-centered design process models, which typically observe user activities, document those observations, and then create a design based on that documentation (Oulasvirta et al., 2003). Creating situations for representative users to engage with the proposed product, even at an early prototype stage, therefore, is crucial because, as Pratt and Nunes (2012) further note, "well-designed devices take into account the factors of the environment in which we use them. Well-designed objects take into account our bodies, offering clues as to how they will be used by their affordance or shape" (p. 16). If users are not significant players in the design of the final product they ultimately will use, then critical knowledge will be lost that informs the construction of the product, and this will mitigate its successful adoption. At the very least, their involvement serves

to deter "feature creep," which has plagued many products, especially mobile applications. Designers, working in the proverbial dark with little user feedback, have often overloaded on features to satisfy every potential need or want when, ironically, "the more features you add," Colborne (2011) argues, "the less chance you have of coming across a new feature that is of real value to someone" (p. 6). User-centered design helps to identify, through user activity, what needs to be there and what does not.

On the other hand, the openness and fluidity of this wood-block approach did not answer every question about creating dynamic historical interpretation with mobile devices, not even every question about this specific site. Users did not naturally migrate toward many of the areas considered most technically fascinating or artistically rewarding for skilled media practitioners. Users also typically are not as passionate about a proposed project, nor do they have as much personal investment, as the designers, which potentially could translate into a preponderance of shallow and visceral responses, rather than truly innovative and thoughtful ideas.

The wood-block approach did accomplish, though, what it accomplished for Hawkins; it generated massive amounts of user-centered data that provided intriguing patterns worth exploring. In other words, it created enough information to inform and drive future iterations. The wood-block approach is inexpensive, takes minimal setup and time, and it can be done as early and as often as needed. It adds information and feedback benefits otherwise unattainable for a project with such a limited budget. This type of testing immediately gets the concept out of the creator's mind and into the hands of the users, in the spot they are going to be using it, and gives them a chance to respond in as much detail as desired. The sooner in the process this sort of experimentation with users occurs, the earlier fundamental problems can be identified and addressed. Incorporating the learners into the design process from the beginning, and giving them so much freedom, also serves several important creative purposes. The learners, as temporary members of the team, contribute a wide range of fresh ideas for the group to consider during the ensuing iterations. They bring an outside perspective, focusing on the product, not the process or the personalities. They also are able to reveal the complexities of the relationship that will be developed between the app and the person, amid the messy development sphere, putting that link into perspective, in which the user might have unforeseen agendas, or not be as focused or as concerned with fine details that might obsess designers and create production bottlenecks.

On the negative side, as research questions became more specific and detailed, and closer to actual production, such as in the second phase of this study, the user responses appeared to increasingly depend upon—and likely could have been influenced by—researcher prompts, indicating the probable need for higher fidelity prototypes to reach more precise calibrations and to avoid transferring bias from the researcher to the test subject. In addition, observations at this site confirmed the bodystorming concerns that Oulasvirta et al. (2003) raised about such approaches, including the notion that, even with a wood block, some locations simply are not physically accessible; for example, users cannot enter the locked houses. Some ideas are not cognitively accessible, especially to those not aware of the history, or who have not spent a lot of time in the location. Some actions are not socially accessible, due to the nature of having a researcher in the midst, instead of a typical companion, such as a family member or friend, and some options are not ethically accessible, with privacy concerns restricting access.

This wood-block method also is not intended to take all of the power from the designers and put it into the hands of the users. No one is suggesting that designers are not needed any more, or that all parts of systems-oriented design should be discarded. Rather, this user-centered design approach, as the wood-block project demonstrates, is a new one that reflects an ecological reinterpretation of design. Ecologists study microsystems to reveal information, not just about the organisms within that system, but also how such revelations convey knowledge about surrounding larger systems. In fact, user-centered design is not about just the users. It is an effort, on a small scale, repeated iteratively, and begun as early as possible, to "reveal more knowledge about the behavior and structure of an entire community" (Still, 2010, p. 93). Or, as Heidegger would describe it, a bringing forth. We test with a focus on users because what they bring to the product reflects the world beyond the product, and what we learn from their activity engaged with the product improves knowledge not just of the product interface, but also of how people use any variety of products. We understand the mental models and affordances they carry with them and the ways in which those influences design.

The goal, then, is not to fully convert the user into the designer. The goal is to give this primary stakeholder a place at the table where decisions are made. Inevitably, bigger issues are dealt with earlier, which often translates into cost savings if not the mitigation of use problems later on when they are more difficult to address. Still further, with the recognition that what makes interfaces more complex now is the mercurial nature of who uses them, how they are used, and where they are used, user-centered design offers the means to engage in design that does not necessarily have an end, but does have a proactive solution for variability.

In the current development environment, such an approach is practical as much as it is enlightening to those in the business of creating location-specific apps that fill niches no conglomerated organization would ever stoop to consider. With this mindset, the commitment to try a project out takes almost no discussion. Such formative research can indicate areas of potential as well as "show-stopping" flaws in design ideas. There is nothing to lose, much to gain, and even if the original concept is wrong, the next low-fidelity round can alter and fix the strategy immediately. These ideas and prototypes generated from the wood-block approach are built as much upon user feedback as designer heuristics, meaning they can integrate the strength of both. This kind of app development meanwhile does not take thousands or even hundreds of designers and programmers. It simply takes an idea and some gumption to try. Also, a wood block definitely seems to help.

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