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Pump Up The Volume:

An Assessment of Voice-Enabled Web Search on the iPhone

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Mobile Voice Search: Application or Interface?

A foreword by Bill Meisel
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Mobile phones are no longer just portable phones—they are becoming indispensible personal assistants with multiple functions, including the ability to access resources, information, and the Internet much like PCs. But there is one critical application area where mobile phones are potentially one giant step ahead of desktop computers. With the smaller form factor and the universality of a microphone—allowing users to say what they want to achieve an objective rather than use the keypad or touch—mobile phones represent a natural and practical evolution of the user interface.

When the functionality is Web search—saying what one wants rather than typing it into a search text box—it follows that we call the capability *Voice Search*. It also follows that since innovative user interface designs have driven the growth of huge businesses on PCs and Web browsers (the most notable being the Graphical User Interface in Microsoft Windows and Apple Macintosh operating systems), the market must brace itself for vigorous competition for leadership in applying speech recognition technology to the mobile space. In particular, while there may be a clear leader in Web search on PCs, there is no clear leader in search on mobile phones. The race is on, and companies that provide the voice user interface technology are clearly jockeying for position. However, the mobile market—unlike the PC market—is much more fragmented, and so the winners have yet to be determined.

Speech recognition built into mobile phones is ubiquitous, enabling users to press a button and say the name of a contact to dial them. Indeed, speech recognition software from Nuance Communications, a provider of speech recognition solutions, alone is available on more than 300 million phones worldwide.

Two major technical distinctions between simpler speech recognition applications such as voice dialing and voice search applications are (1) the location of the speech recognition processing on the device for voice dialing and in the network for voice search; and (2) voice search is a much more difficult speech recognition problem than selecting from a list of contacts (voice dialing) and thus needs the power of server processing in the network.

Another advantage of using the network is that speech recognition capabilities on the device can in some cases be backed up with so-called "hidden agents" should the result of the speech processing be ambiguous. In this scenario, the mobile phone's data channel is used to send the digitized speech data to services within the network, and the results are sent back to the phone as text or graphics. In the case of voice search, the results are typically displayed on the phone as if they were typed into a Web search text box. The software required on the phone when network processing is used is minimal.

But voice search isn't theory.

- **Yahoo!** announced its oneSearch with voice in a keynote talk at the CTIA Wireless show in April 2008, using a solution from startup **Vlingo**, which in turn used speech recognition technology from IBM.
- **Google** launched its voice search solution initially as a feature of its free Google Mobile App download for Apple's iPhone. The application uses some internally developed speech recognition. Google has since introduced a voice search service tailored to Android-based mobile phones.
- **Microsoft** also moved ahead when Verizon announced a five-year deal to use Microsoft voice-enabled Web search, with Microsoft using internally developed speech technology. The Microsoft Research website states the objective plainly: "In the Voice Search project, we envision a future where you can ask your cell phone for any kind of information and get it."
- **Nuance Communications** has a subscription-based voice search service, Nuance Voice Control, which is available through Sprint Nextel, Rogers Wireless, and TELUS. Nuance recently announced an integrated solution, Nuance Voice Control 2.0, which uses both on-device and in-network technology that includes voice search, but goes well beyond it, even allowing a user to dictate a text message.
- **Vlingo Corporation** introduced its own voice search service, also based on the speech recognition technology it obtained from IBM, when it launched Vlingo for BlackBerry in June 2008. This was followed by Vlingo for iPhone, which launched in December 2008. The company plans to introduce Vlingo for Symbian and Windows Mobile devices in the second quarter of 2009.
- **ChaCha**, in what one could consider a human interface approach, lets users send a text message or call a toll-free number to ask a question "as if you were talking to a smart friend." A user's spoken questions are interpreted and transcribed by ChaCha "guides," individuals trained by ChaCha to conduct the Internet search on the user's behalf, and the answers delivered to the customer's device via SMS. For this reason, ChaCha describes itself as a mobile "answers" service. It introduced its services to the U.S. mobile phone market in 2008.

A less general version of voice search is free directory assistance services that use speech recognition and operate from any phone, using a voice call rather than the data channel. Options include Microsoft's 1-800-CALL411, Google's 1-800-GOOG411, AT&T's 1-800-YellowPages, and Jingle Networks' 1-800-FREE411. Instead of a list of search results, these voice-only applications speak the business name for confirmation and provide the number or complete the call. Nuance Communications provides much of the core technology behind these services, although vendors like Microsoft, Google, and AT&T are also working to incorporate their own technology.

The current technology behind the directory assistance services also allows users to use speech to access functions and features on their mobile phones, and so offset the challenges of cumbersome keypads and complex menus. Nuance Voice Control (NVC), for example, enables the use of speech to access and utilize mobile handset-based or network-dependent features, applications, services, and content. In practice, users can access music stored on their devices by naming the track, or use voice to launch applications on the phone such as calendar and contacts. Start-up Vlingo allows voice-access for dialing names in a handset's address book and even submitting status updates to Facebook and Twitter. Such functionality generalizes voice search into a more wide-ranging model—just say what you want.

Meanwhile, with a much more limited objective for the speech processing, Microsoft recently introduced Recite, a voice notes system that works entirely within the phone. With it, users can record an arbitrary note to themselves, and retrieve it by saying a word or phrase within the voice note, such as "Paul Smith" to bring up a recorded note detailing a lunch meeting with Paul Smith and important details such as time and place of the meeting.

Speech recognition is used in ways that make using mobile phones easier without directly affecting the user interface on the phone. For example, companies such as SpinVox, PhoneTag, Yap, and Nuance provide services that convert voice mail to text for delivery to mobile phones, making it possible to scan voicemail as text and address it in any order.

The advance of voice search is evidence that speech recognition has indeed become a critical component of the user interface on mobile phones. But is "just say what you want" the limit of what this technology can achieve? It may appear that this is all users really need, but it does have limitations.

It's not just about voice commands and queries; it's also about *dialog.* Consider a spoken request to an individual. In most cases, to be perfectly clear, the request is often clarified by posing and answering questions about the request. Narrowing a request by reducing its scope is an important part of conversation in real-life, and will likely become even more important on mobile phones with limited screen space. Imagine a request for "Doors." A system capable of turning a query into a dialog might ask the individual if they want the music group The Doors (thus reducing query

ambiguity and avoiding results that include hardware stores), and, if this is the case, activate the mobile phone Web browser to search the Internet for songs by The Doors.

One might call a dialog-based system Voice Access to distinguish it from Voice Search. But the functionality goes beyond a collection of specific applications. The ultimate result may be a multimodal user interface where voice interaction is the primary driver. Since we can't talk in some environments, there will always be non-speech options to access mobile phone features, as well as surf the mobile Web. But, as speech recognition and voice search services become more commonplace, they will likely become our new collective default.

1. Introduction

The guiding principle of voice search on mobile devices is to give consumers a way to avoid complex and confusing navigation and to provide a shortcut to information (in the network) and services (on the device) the user wants.

As Bill Meisel succinctly explains in the foreword to this paper, speech recognition functionality is commonplace in mobile phones, and voice search, one of the newest tools to exploit the capability, has made its way out of the theoretical realm to become a commercially available feature on mobile phones. In fact, the mobile phone's ability to harness speech recognition tools has leapfrogged that of the personal computer, and he suggests that in time voice search is, in fact, likely to become a default means of accessing search services on mobile phones.

The prospect that voice-enabled search could become a ubiquitous service on mobile phones is exciting to contemplate, not only because it will serve the mass-market's desire for access to digital content anytime, anywhere, but because it will also help build customer loyalty and generate new revenue streams for operators, publishers, advertisers and others throughout the mobile and Internet industry value chains. As these mobile voice search technologies and the markets they create evolve, stakeholders from all sides of the industry will have a strategic need to understand and track the various technologies' capabilities and performance characteristics.

So how are these technologies performing today? How do end-users experience the voice search alternatives available to them? Recent tests of several mobile voice search solutions on one of the most popular devices used for mobile search in the U.S. today—the iPhone—identified some of the most compelling attributes of these services on this particular device as well as features needing improvement. The results highlight the value that voice recognition accuracy has on overall search effectiveness, the contributions that a new paradigm—human-assisted search—can have on accuracy and relevancy of results, and the tradeoffs that can occur between service speed and accuracy and quality of search results.

This paper presents findings from those tests. It also demonstrates the use of a new research model that can be used to evaluate, document, and track the performance of mobile voice search solutions as the technology progresses.

2. Methodology

To evaluate the effectiveness of voice-enabled mobile search services, we conducted a series of tests using commercially available mobile search solutions on a single device, the iPhone 3G. The iPhone was selected because U.S. mobile subscribers used it more than any other device for mobile Internet access and search activities during the time this study was conducted. [1]

Services tested included the following:

- ChaCha: A service that delivers "answers" to voice queries via a text message to the device. The user calls an 800 number and submits their query as a spoken question via the voice channel. Individuals trained by ChaCha, known as "guides," transcribe the queries, conduct the searches, and craft the responses.

- Google Mobile App: The voice search feature of the iPhone's Google Mobile App allows users to speak their query into the device. The query is converted to text and submitted to the Google Web search engine as if it were a typical typed search. The results are formatted to fit the device.

- Vlingo for iPhone: A voice-enabled application that allows users to input their query by speaking into the iPhone. The query is submitted to one of two search engines, Google or Yahoo!, and the results are formatted for the device. The user can specify which search engine they want the system to use.

Three mobile voice search solutions that are available on the market were not included in this study, for various reasons. These included:

- Microsoft's Tellme: The Tellme mobile voice search downloadable application was not available for the iPhone at the time this study was conducted. The Tellme toll-free telephone-based service, which any mobile phone user can access by dialing an 800 number, was available but not included in this study because it limits queries to those that fall within a menu of predetermined categories such as sports, directions, maps, and movies.
- Nuance Voice Control: Nuance is a leading provider of mobile speech applications and mobile voice search solutions. All of the solutions it has introduced commercially are embedded into targeted mobile devices. In mid-2008, Nuance did develop and demonstrate a prototype voice search solution for the iPhone based on its Open Voice Search technology, but it has not made the capability available to iPhone users at this time nor has it announced any plans to launch a downloadable iPhone application. The Open Voice Search technology that Nuance used for the iPhone prototype is included in its NVC 2.0, which is slated to appear in devices that come to market this year. [2]

- When this study was conducted, Yahoo! oneSearch with voice was available on 60 devices, but it did not support the iPhone. Yahoo! is expanding availability of the technology rapidly. By March 4 2009, it offered oneSearch with voice on more than 80 devices and had recently added Windows Mobile devices to its portfolio of products it supports. As of this date, it still did not offer Yahoo! oneSearch with voice for the iPhone. [3]

Testing Period: All tests (108 in total) were conducted during the week of January 7-15 2009.

Test Conditions: To avoid common voice recognition (VR) issues such as foreign accents and background noise, all tests were conducted by a single user (female, English speaker) in a quiet setting. We used a new, previously unused iPhone to ensure there was no influence from previous searches or knowledge of previous user context on the device. To ensure minimal network latency and superior 3G coverage, we conducted all tests in a location offering the best possible 3G signal. All tests were performed from the same location in Santa Rosa, California, a city approximately 55 miles north of San Francisco. The tests were conducted on the AT&T network (the only network offering the device in the U.S.).

We had no prior experience with any of the voice-enabled search services studied in this project. We approached each service as if we were everyday consumers, using publicly available information such as vendor Web sites, online news articles, and in the cases of the Google Mobile App and Vlingo for iPhone, instructions contained within the application to learn how to use each service. We did not contact any of the vendors for tips or instructions on how to use their services. While ChaCha sponsored the study, it was fully removed from the planning, testing, analysis, and reporting of this work.

2.1 Query Formulation

To assess overall performance of the voice-enabled search services in a typical range of use cases and scenarios, we created 18 queries representative of mobile search usage and trends.

The queries covered search categories considered common in the mobile environment, such as navigation (to a specific Web site), directions, local information, general information on timely topics, and specialized or unusual long-tail topics (sometimes referred to as "dinner table" questions). We included specific queries that represent the most popular mobile search terms in 2008, based on mobile search data publicly reported by AOL and Yahoo! [4], as well

as social queries (a new and emerging category for queries that are subjective in nature and in some cases can include interpretations from other Web users in the results). We did not include transactional queries. These types of queries are associated with downloading music and applications (which ChaCha, Google Mobile App, and Vlingo for iPhone do not facilitate for the iPhone) and purchasing goods and services via a device (which would involve much more interaction with the device and targeted Web sites than this study was designed to evaluate).

Within these general search categories, the queries were crafted to reflect popular mobile search topics such as social networking, weather, movies, restaurants, entertainment, and politics. The long-tail queries were drawn from a list of 616 random trivia questions, generated by Trivia Database, covering categories such as popular culture, history, sports, science, and general information. Each question used was selected randomly from its category. Because the mobile voice search solutions evaluated in this study represented various technology approaches, such as an emphasis on natural language queries or a heritage in keyword search, we developed two sets of queries to accommodate both strengths. These included:

- Natural language queries: queries submitted as questions using normal conversational syntax, and

- Keyword queries: queries seeking the same results as the natural language queries but reduced to the least number of keywords we believed necessary to convey the same request. Note that we did not limit keyword queries to a pre-designated number of terms; while mobile search studies have observed that end users tend to limit mobile queries to 2-2.5 terms due to keypad limitations, voice search does not have that constraint.

The natural language queries, keyword queries and intended results are presented in Table 1.

Table 1:
Natural language queries, keyword queries and intended results

Query Category	Natural Language Query	Keyword Query	Intended Result1
Navigational	Send me a link to MySpace	MySpace	www.myspace.com
	Send me a link to Hotmail	Hotmail	www.hotmail.com
Directions	What is the most direct driving route from the Ferry Building in San Francisco to Harrah's Lake Tahoe?	Driving directions from Ferry Building San Francisco to Harrah's Lake Tahoe	Correct Directions
Information Local	What's the weather right now in Atlanta, GA?	Weather Atlanta, GA	Current weather
	What's the nearest theater playing Slumdog Millionaire?	Nearest theater Slumdog Millionaire	Rialto Cinemas
	Where is the nearest Italian Restaurant?	Nearest Italian restaurant	Lococo's Cucina Rustica
Social	What are some cool alternative British bands?	Cool alternative British bands	subjective2
	What is the best way to cook short ribs?	Best recipe short ribs	subjective3
General Information on Timely Topics	Who is the most famous person seeking Hillary Clinton's Senate seat?	Most famous person seeking Hillary Clinton's Senate seat	Caroline Kennedy
	When are Jennifer Lopez and Marc Anthony planning to announce their divorce?	Jennifer Lopez and Marc Anthony announcing divorce	Valentine's Day
	What was the top box office movie last weekend?	Top box office movie last weekend	Gran Torino
	When is the first game of the 2009 major league baseball season?	2009 major league baseball season first game schedule	April 5, 2009
	What is the name of Bruce Springsteen's forthcoming album?	Name Bruce Springsteen's forthcoming album	Working on a Dream
Long-Tail Queries	What is the name of comedian Eddie Murphy's 1980s hit song?	Name comedian Eddie Murphy's 1980s hit song	Party All The Time
	What land was called Caledonia by the Romans?	Land called Caledonia by Romans	Scotland
	Which NBA team used to have the nickname "The Bullets"?	NBA team nicknamed "The Bullets"	Washington Wizards
	What electronic device only allows current to flow in one direction?	Electronic device allows current in only one direction	Diode
	Where in the U.S. is area code 201?	Where is area code 201	New Jersey

Notes

1. For ChaCha, the intended results are answers. For Google Mobile App and Vlingo for iPhone, the intended results are Web links, which could include information snippets.

2. We were looking for bands such as Snow Patrol, Radiohead and Coldplay. However, we were willing to consider other suggestions that we could, with simple follow-up research, confirm as alternative and attracting

3. We were looking for advice, opinions, recipes, references or links.

Source: Albright Communications/MSearchGroove

2.2 Performance Characteristics Measured

For each query tested, we evaluated nine performance characteristics. These included 1) key taps required, 2) response time (in seconds) to achieve a result, 3) the number of results received, 4) voice recognition accuracy, 5) accuracy of the result, 6) relevancy of the result, 7) location awareness, 8) use of advertising, and 9) availability of other value-added content or features. We also noted any problems we observed.

We considered the first five characteristics to be essential to the study of mobile voice search performance, and used these as the basis of our evaluations. Our definitions of characteristics, including explanations of how we assessed the performance of each type, are defined in Table 2.

A note about determining the accuracy of a result: We predefined the specific result we were seeking for each query and we defined an accurate result as one that delivered the intended result. Therefore a yes/no determination of accuracy could be given in each case, unless noted as follows: For the two social queries, which were subjective in nature, we specified the types of information we were looking for and judged the ability of the result to deliver that type of information based on our own knowledge of the topic or substantiation of the findings through simple follow-

up research. We used similar logic in judging the results of the query for driving directions.

Note that we assessed the sixth characteristic, relevancy, for each test, considering a result to be relevant if it addressed the most important aspects of the query. We did not factor this characteristic into the performance metrics, though we did make note of relevant results in our observations on a case-by-case basis if these results contributed to an understanding of a service's capabilities.

For characteristics 7, 8, and 9, respectively, we documented the availability and use of location awareness (if the service understood and used the user's location to deliver results to local information queries); the placement of mobile advertising; and value-added features that we observed, such as requests for feedback, recommendations, or graphics. We did not incorporate our observations of these last three in our final calculations; however we did note these observations, where relevant, because these features, in many cases core to a company's competitive advantage, represent new business models likely to deliver superior user experiences in the future.

Table 2:
Key Performance Characteristics

Characteristic	Defined as
Key taps	Total number of key taps required to input and receive a response to a search query.
Response time (in seconds)	The number of seconds recorded to receive a response; timing began with speaking the question.
Number of results received	Number of results immediately visible on the screen of the device without scrolling or following links. Note that ChaCha delivers a single result as an SMS message. Google Mobile App and Vlingo for iPhone results appear in the browser; neither service displays a numeric value to indicate the total number of results retrieved.
Voice recognition accuracy	Correct understanding of all words in a query. Minor variations, such as interpretation of a noun as plural vs. singular, were ignored.
Result accuracy	Delivery of the result intended for a specific query (intended result) documented in Table 1. Note the intended result for a ChaCha query is the actual "answer" to the query. The intended result for a Google Mobile App or Vlingo for iPhone query is a link (with meta description or snippet of information) to a site that will obviously, or is judged likely to, contain the desired result.

Source: Albright Communications/MSearchGroove

3. Key Facts and Findings from Natural Language Tests

In this section, we introduce each search service and present the key results and findings from the performance tests that used natural language queries. We also measured each service's ability to perform according to the specific query categories summarized in Section 2.1 (Query Formulation). Summary data for these and the keyword tests are presented in Table 6.

3.1 ChaCha

ChaCha launched its Mobile Answers Text Service in January 2008, an SMS text-based mobile search capability that allows users to get answers on the go. Mobile Answers Voice Service, a voice-enabled mobile search service that also delivers answers to users via SMS text, launched in April 2008. Customers access the voice-based service by calling 1-800-224-2242 from their mobile phone. The user is asked to speak their question following the prompt, "What is your question?" A ChaCha "guide" (an individual trained by ChaCha to find and provide answers to search queries)

then transcribes the question and within seconds sends a text, "ChaCha heard ur Q as…," to the user's mobile device to confirm the query. The guide then searches for the answer to the query and sends the answer to the customer in the form of an SMS text message (see Figure 1). Unlike the voice-enabled Web search engines considered in this study, Google Mobile App and Vlingo for iPhone, which use speech recognition technology to interpret queries, and conventional Web search algorithms and other techniques to find and rank search results, ChaCha uses a "people-powered" approach that relies on the knowledge and human judgment of the guides it has trained to provide its service. To date, ChaCha counts some 55,000 guides and is recruiting more at the rate of 10,000 per month. Revenue is generated by targeted text advertising, and clients include Coca-Cola, Palm, McDonald's, H&R Block, and the Obama presidential campaign. [5]

Because ChaCha is accessed by calling its 800 number on the device, it is not necessary to download or install software to use the service. Users seeking to streamline access to the service can eliminate the "dialing" process by storing the 800 number as a favorite on the device or by using redialing or "recently dialed" shortcuts. (The latter approach was used in this study.)

How ChaCha Performed: Overall

ChaCha proved to be a reliable service. Its "guides" interpreted the natural language spoken query accurately in 94.4% of tests and delivered the intended search result in 88.9% of tests. Results are delivered in the form of actual answers, not links (although links can be delivered if requested or needed). It can take several minutes to receive a result (median response time was 227.5 seconds, just under four minutes), and some answers were compromised by the 160-word character limit of SMS technology. The service provided advertising, in the form of keyword promotions, in eight tests.

Figure 1 presents a screen shot of a ChaCha voice search result. Table 3 presents a summary of ChaCha's overall performance in the natural language tests.

Figure 1:
ChaCha's result for the query, When are Jennifer Lopez and Marc Anthony planning to announce their divorce?

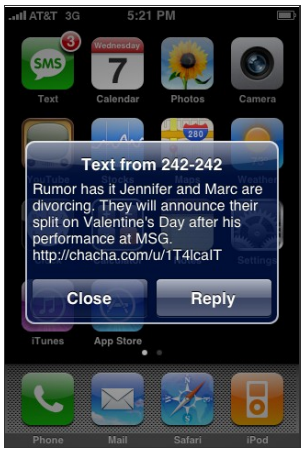

Table 3:
ChaCha Results At-A-Glance

Performance Characteristic	Observations
Key taps required	Minimal. With dialing shortcuts, most answers were accessible in just 1-2 key taps. Additional taps were needed occasionally to input zip codes or to respond to requests for feedback.
Response time (in seconds)	Comparatively slow. Median response time was 227.5 seconds.
Number of results received	One answer delivered to each query.
Voice recognition accuracy	Excellent. Accurate in 94.4% of tests.
Results accuracy	Very high. Delivered intended result in 88.9% of tests.

Source: Albright Communications/MSearchGroove

How ChaCha Performed: By Category

The following paragraphs provide quantifiable results illustrating ChaCha's performance in each query category along with our key observations from each category of tests.

Query Category: Navigational
Number of Queries: 2

Number of Queries Producing Accurate VR: 2
Number of Queries Producing Intended Result: 2
Success Rate (Percent of Queries Yielding Intended Result): 100%

ChaCha had no difficulty with this query category, whose purpose is to generate links to desired Web sites. It delivered the desired link in each test, allowing one-click to the destination website.

Query Category: Directions
Number of Queries: 1
Number of Queries Producing Accurate VR: 1
Number of Queries Producing Intended Result: 1
Success Rate (Percent of Queries Yielding Intended Result): 100%

Delivered accurate response to query but it was truncated due to the 160-character limitation of SMS text display. The user could request the remaining content by replying "more" or following a link to source information.

Query Category: Information Local
Number of Queries: 3
Number of Queries Producing Accurate VR: 3
Number of Queries Producing Intended Result: 2
Success Rate (Percent of Queries Yielding Intended Result): 66.6%

Delivered the intended answers in two of three tests. It needed zip code feedback, which required additional key taps, however the extra data entry was only needed once because the service used that information in subsequent queries. Additional "value-added" features included query-related keyword promotions.

Query Category: Social
Number of Queries: 2
Number of Queries Producing Accurate VR: 2
Number of Queries Producing Intended Result: 2
Success Rate (Percent of Queries Yielding Intended Result): 100%

Delivered the intended answers. The recipe for short ribs was in the form of brief advice (due to SMS text limitations), however a source URL given with the answer provided a link to www.itswhatsfordinner.com offering additional information.

Query Category: General information on Timely Topics
Number of Queries: 4
Number of Queries Producing Accurate VR: 4
Number of Queries Producing Intended Result: 4
Success Rate (Percent of Queries Yielding Intended Result): 100%

Delivered intended results in all cases. "Value-add" was additional and contextual information with most results. In the case of the query, When are Jennifer Lopez and Marc Anthony planning to announce their divorce?, the answer noted that the divorce is a rumor and indicated when and where the announcement was expected to be made. In one case, however, the "value added" information was erroneous: In response to the query, When is the first game of the 2009 major baseball season?, ChaCha provided the correct date, but it provided information about the teams and game time (the "value-add") that was incorrect.

Query Category: Long Tail
Number of Queries: 5
Number of Queries Producing Accurate VR: 4
Number of Queries Producing Intended Result: 4
Success Rate (Percent of Queries Yielding Intended Result): 80%

Delivered the intended result in a majority (4 out of 5) of cases. In the one case that produced an error (the service misunderstood the query, What land was called Caledonia by the Romans?), the service admitted the voice recognition problem and asked for more information in order to deliver a result. A notable "value-add" was the inclusion of keyword promotions with all results. In one instance, the value-added information was misleading: In response to the query, Which NBA team used to have the nickname "The Bullets"?, ChaCha provided the correct answer (The Washington Wizards), however it added some specific details on the history of the team's name that were not all accurate.

3.2 Google Mobile App

The Google Mobile App has a voice search feature that uses speech technology to transform spoken words into text, which is then submitted to the Google search engine as if it were any other typed search query. The company did not provide detail about its voice recognition technology for this paper except to say via a spokesperson that it uses a wide range of technologies to make search recognition work, some developed internally. Nor would the company provide any data to illustrate adoption and use of the service.

Google introduced its first voice search service on the iPhone in November 2008 as a new feature of the iPhone Google Mobile App, which users can download from the iPhone App Store. Google introduced voice search to the Google Mobile App for BlackBerry in late March 2009. It also launched a separate voice search capability, specifically developed for Android devices, which it has integrated into the Android platform to allow access via its browser or home screen widget; it made this feature available via firmware update for the T-Mobile G1 in February 2009. [6]

One of the innovative features of the Google Mobile App is its use of the iPhone accelerometer (a motion sensor) to recognize when the user raises the device to their ear and automatically activate the voice search service, a feature designed to eliminate the need to press any keys to conduct a voice search. Alternatively, the user can tap on the microphone icon from within the application to launch a voice search.

Because Google Mobile App uses voice recognition for access to Google Web search, search results appear on the device in conventional format, as links, meta descriptions, and/or snippets, though optimized for the iPhone. The application is location aware and takes advantage of the iPhone's location capabilities for location-relevant searches. Users must opt-in to employ this feature.

To obtain the Google Mobile App, iPhone users will need to search for, find, and download the application from the Apple App Store. The process is intuitive and easy and the application is free. Downloading is completed in a matter of seconds. No installation is necessary. The opt-in function to enable location awareness is easy and intuitive (we enabled this feature).

How the Google Mobile App Voice Search Feature Performed: Overall

The Google Mobile App accessed via its voice search feature is fast, providing results in a median response time of 12 seconds. However, it did not perform well in response to natural language voice queries. Its voice recognition technology was accurate in only 16.7% of queries. The service delivered the intended result in only 22.2% of tests. As value-adds, Google Mobile App provided advertising, in the form of sponsored links, in two cases. The use of the iPhone accelerometer to automatically activate the vocal search service did not work routinely, however the service was still activated in a matter of one or two key taps. Nor did the service's use of the iPhone location capabilities effectively yield the desired location-based results.

Figure 2 presents a screen shot of a Google Mobile App search result. Table 4 presents a summary of the service's overall performance in the natural language tests.

Figure 2:
Google Mobile App's result for the query, Where in the U.S. is area code 201?

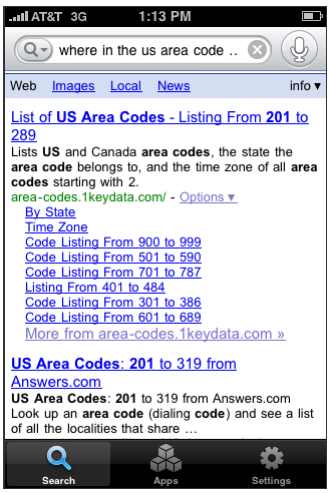

Table 4:
Google Mobile App Results At-A-Glance

Performance Characteristic	Observations
Key taps required	Minimal. Results were generally achieved with 1-2 key taps. Although the motion sensor makes it possible to launch a voice search with zero taps after opening the application, this feature did not always work.
Response time (in seconds)	Excellent. Median response time was 12 seconds.
Number of results received	3 or 4 results per screen.
Voice recognition accuracy	Low. Accurate in 16.7% of tests.
Results accuracy	Low. Delivered intended result in 22.2% of tests.

Source: Albright Communications/MSearchGroove

How the Google Mobile App Voice Search Feature Performed: By Category

The following breakdown provides quantifiable results illustrating Google Mobile App's voice search performance in each query category, along with our key observations from each category of tests.

Query Category: Navigational
Number of Queries: 2
Number of Queries Producing Accurate VR: 0
Number of Queries Producing Intended Result: 0
Success Rate (Percent of Queries Yielding Intended Result): 0%

Poor VR yielded inaccurate results in response to both queries. For example, the request "send me a link to Hotmail" was mistaken for "tin can make to hotmail."

Query Category: Directions
Number of Queries: 1
Number of Queries Producing Accurate VR: 0
Number of Queries Producing Intended Result: 0
Success Rate (Percent of Queries Yielding Intended Result): 0%

Poor VR mistook the query, What is the most direct driving route from the Ferry Building in San Francisco to Harrah's Lake Tahoe?, for the route to "Paris Tahoe." It delivered results related to travel in San Francisco and/or Lake Tahoe, but not the driving route between the two locations specified.

Query Category: Local Information
Number of Queries: 3
Number of Queries Producing Accurate VR: 1
Number of Queries Producing Intended Result: 0
Success Rate (Percent of Queries Yielding Intended Result): 0%
Poor VR compromised the quality of results. In the case of the query, Where is the nearest Italian restaurant?, the service understood the query but the restaurants delivered as links on the screen were inaccurate and out of zip-code range, even though the service understood the user's location and zip code. However, it offered a link to "local results near" and several value-added features, including a sponsored link to Google Maps for restaurants. Voice recognition as well as results were inaccurate in all other cases.

Query Category: Social
Number of Queries: 2
Number of Queries Producing Accurate VR: 1
Number of Queries Producing Intended Result: 1
Success Rate (Percent of Queries Yielding Intended Result): 50%

The result to the query, What is the best way to cook short ribs?, was a link to a short ribs recipe on answers.yahoo.com, a community search service belonging to Yahoo!. Poor VR mistook the query What are some cool alternative British bands?, for What are some cool alternative British pounds, preventing an accurate search.

Query Category: General information on Timely Topics
Number of Queries: 5
Number of Queries Producing Accurate VR: 0
Number of Queries Producing Intended Result: 2
Success Rate (Percent of Queries Yielding Intended Result): 40%

Voice recognition was poor, mistaking all query questions, and the service delivered inaccurate results in 3 out of 5 cases. In the case of the query, Who is the most famous person seeking Hillary Clinton's Senate seat?, all results immediately visible on the screen achieved the intended result. In another correct result, given in response to the query What is the name of Bruce Springsteen's forthcoming album?, the service provided a "value-add" in the form of a link to download the first single of the debut album. An example of an inaccurate result was the response to the query, What is the first game of the 2009 baseball season? In this case the service delivered links related to NFL results.

Query Category: Long Tail
Number of Queries: 5
Number of Queries Producing Accurate VR: 1
Number of Queries Producing Intended Result: 1
Success Rate (Percent of Queries Yielding Intended Result): 20%

The service easily understood the query, Where in the U.S. is area code 201?, producing a variety of accurate links for Area Code listings. It also delivered the correct result to the query, Who is the most famous person seeking Hillary Clinton's Senate seat?, even though the voice recognition did not qualify as accurate. However, poor VR in the remaining cases led to inaccurate results. For example, in response to the query, What land was called Caledonia by the Romans?, the service understood the query as "Wetland west hotel Italia Rome" and delivered a sponsored ad for hotels in Rome as the top result in the list.

3.3 Vlingo

Vlingo's voice-powered interface is based on core technology from IBM. The company differentiates its deployment by its use of internally developed techniques that allow the technology's acoustic, pronunciation, vocabulary, and language models to self-learn and adapt dynamically in response to customers' use of the system.

In April 2008, Vlingo was chosen to provide voice recognition for Yahoo! oneSearch (Vlingo secured a series B financing round, led by Yahoo! Inc.). In June 2008, Vlingo launched Vlingo for BlackBerry and in December 2008 it announced the availability of its Vlingo for iPhone application on the Apple App Store. The company plans to launch Vlingo for Symbian and Windows Mobile in the second quarter of 2009. [7]

The Vlingo for iPhone application lets users choose Google or Yahoo! as the default search engine. For this study, because we were already testing a Google search service, we established Yahoo! as the default. (Note that this service is distinct from Yahoo!'s oneSearch with voice; Yahoo! itself did not support voice-enabled search on the iPhone when this study was conducted.) Vlingo also offers a choice of two procedures for performing a voice search: Users can press and hold a soft key while speaking a query; or they can tap the button, talk, and tap again to

conclude the query. We chose the former. Vlingo also lets users categorize their searches for added context and convenience, such as access to phone dialing, maps, Web search, or social networking applications, as well as an all-purpose "home" tab. The system will default to its search function if it doesn't recognize a particular search category is desired. We used the all-purpose "home" category for all searches.

To obtain the Vlingo for iPhone application, users will need to search for, find, and download the application from the Apple App Store. The process is intuitive and easy and the application is free. Downloading is completed in a matter of seconds. No installation is necessary.

Vlingo told us that "thousands" of users download the Vlingo for iPhone application per day. A typical customer uses the application an average of four times a day on each day they use the device. About 60% of Vlingo traffic is used to take advantage of the application for search functions: 38.6% for Web search and 21.3% for maps. The remaining 40% of traffic is associated with phone dialing (28.5%) and updating social network status (10.4%). [8]

How Vlingo for iPhone Performed: Overall

Vlingo for iPhone is fast, providing results in a median response time of 14.5 seconds. Its voice recognition technology is highly accurate, correctly interpreting the query in 72.2% of tests. However, it delivered the intended result in only 27.8% of tests. The number of results immediately visible on the screen was limited to 2-3 items due to the user interface design. Advertising was not presented.

Figure 3 presents a screen shot of a Vlingo for iPhone search result. Table 5 presents a summary of the service's overall performance in the natural language tests.

Figure 3:
Vlingo for iPhone's result for the query, What's the weather right now in Atlanta, GA?

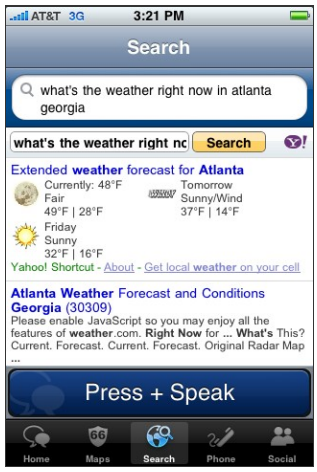

Table 5:
Vlingo for iPhone Results At-A-Glance

Performance Characteristic	Observations
Key taps required	Minimal. Results generally achieved in 1-2 key taps.
Response time (in seconds)	Excellent. Median response time was 14.5 seconds.
Number of results received	2-3 results per screen.
Voice recognition accuracy	High. Accurate in 72.2% of tests.
Results accuracy	Low. Accurate in 27.8% of tests.

Source: Albright Communications/MSearchGroove

How Vlingo for iPhone Performed: By Category

The following breakdown provides quantifiable results illustrating Vlingo for iPhone's performance in each query category, along with our key observations from each category of tests.

Query Category: Navigational

Number of Queries: 2
Number of Queries Producing Accurate VR: 2
Number of Queries Producing Intended Result: 1
Success Rate (Percent of Queries Yielding Intended Result): 50%

Accurate VR, however it delivered an accurate result to the first query (the first result was a link to MySpace) and an inaccurate result in response to the second, resulting in a 50% success rate.

Query Category: Directions
Number of Queries: 1
Number of Queries Producing Accurate VR: 0
Number of Queries Producing Intended Result: 0
Success Rate (Percent of Queries Yielding Intended Result): 0%

Because of poor VR, Vlingo mistook the query What is the most direct driving route from the Ferry Building in San Francisco to Harrah's Lake Tahoe? for the route from the "Terry Building" to "harris Lake Tahoe," and therefore failed to deliver the desired result.

Query Category: Local information
Number of Queries: 3
Number of Queries Producing Accurate VR: 3
Number of Queries Producing Intended Result: 1
Success Rate (Percent of Queries Yielding Intended Result): 33.3%

Accurate VR in all tests. The request for the current weather in Atlanta, GA, produced the desired information, including graphics and data for the current weather and two-day forecast, in the top link. However, the Yahoo! search service failed to harness location information to provide accurate results in the next two queries, despite its value-added location awareness map application. In response to the query What's the nearest theater playing Slumdog Millionaire?, the results identified a nearby real estate office (not a theater) and the nearest theater was 40+ miles away. It produced a similarly inaccurate response when asked for the nearest Italian restaurant.

Category: Social
Number of Queries: 2
Number of Queries Producing Accurate VR: 2
Number of Queries Producing Intended Result: 0
Success Rate (Percent of Queries Yielding Intended Result): 0%

Accurate VR, however the results in both tests were inaccurate. For example, in response to the query What is the best way to cook short ribs?, the results were links to articles about different cuts of meat and recipes for prime rib and various pork cuts.

Category: General information on Timely Topics
Number of Queries: 5
Number of Queries Producing Accurate VR: 4
Number of Queries Producing Intended Result: 1
Success Rate (Percent of Queries Yielding Intended Result): 20%

Accurate VR in the majority of cases. Vlingo delivered the correct result when asked, "Who is the most famous person seeking Hillary Clinton's Senate seat," providing the desired information in a link on the screen. While the results set in many of the other tests included links to relevant sites, these were not sites that could offer a clear answer to the

query. For example, in response to the query When is the first game of the 2009 baseball season?, the results set included links to sites that explained the history of baseball. Likewise, the results set displayed in response to the query What is the name of Bruce Springsteen's forthcoming album? included outdated results from music websites and entertainment information from www.nj.com

Long Tail query performance
Number of Queries: 5
Number of Queries Producing Accurate VR: 2
Number of Queries Producing Intended Result: 2
Success Rate (Percent of Queries Yielding Intended Result): 40%

Poor VR in 3 out of 5 cases negatively impacted the results in this set. However, Vlingo did produce accurate results in two of the tests: What land was called Caledonia by the Romans?, and Where in the U.S. is area code 201?

4. General Findings from Keyword Tests

Recognizing that the search engines used in the Google Mobile App and Vlingo for iPhone services have their foundations in keyword search—matching documents/information on the basis that they contain one or more terms (keywords) specified by the user—we conducted a second set of tests using keyword queries. The queries were crafted to seek the same results as the natural language queries but were reduced to the least number of keywords we believed necessary to convey the same request. Note that we did not limit keyword queries to a pre-designated number of terms; while mobile search studies have observed that end users tend to limit mobile queries to 2-2.5 terms due to keypad limitations, voice search does not have that constraint. The keyword queries, and the results we were seeking with these queries, are presented in Table 1.

FINDINGS

ChaCha: In the previous tests that used natural language queries, ChaCha's SMS "answers" service, which uses trained "guides" to listen to and transcribe queries, conduct searches, and craft responses, demonstrated its excellent voice recognition accuracy and ability to deliver the intended results (answers to the queries). We expected a possible drop in performance during the keyword tests because ChaCha is not promoted as a service to process keyword queries. When tested with keyword queries, ChaCha's voice recognition accuracy remained high (88.9%). Its ability to deliver intended results (desired answers) to queries did decline, from 88.9% in the natural language tests to 61.1% in the keyword tests. In several cases, the people-powered search service recognized that the root issue preventing the service from delivering the desired answer was ambiguity associated with the keyword query and it asked for more information before delivering an answer. For example, in response to the request "Hotmail" (which was seeking a link to the site), the service responded "Oops, I think you were trying to send a keyword, but it didn't quite work." It suggested the user submit more information via reply. As a value-added feature, ChaCha delivered text advertisements in all but two of the keyword tests.

In summary, the ChaCha guide-based service performed voice recognition functions with high accuracy during keyword tests, though its ability to deliver the user's intended result (answers) was compromised.

Google Mobile App: We expected Google Mobile App's voice recognition accuracy and its ability to deliver the intended results would show improvement with abbreviated (keyword) queries, and both did improve. VR was accurate in half (50%) of the keyword tests, a marked increase over its performance in the natural language tests, when VR was accurate in 16.7% of tests. Google Mobile App's voice search delivered the intended results in 38.9% of

the keyword tests, up from 22.2% in the natural language tests. The Google Mobile App voice search exhibited an important value-added feature in response to the navigation queries "MySpace" and "Hotmail." In both cases, the service delivered links to the mobile versions of these sites.

In summary, the Google Mobile App voice search service's voice recognition ability improved significantly when queried with keywords, and its ability to deliver the intended result improved somewhat. However, the improvement was not meaningful enough to promise a satisfactory search experience.

Vlingo for iPhone: We expected Vlingo's voice recognition capability to have the flexibility needed to understand keyword queries, and we expected its ability to deliver the intended results to improve as well since Yahoo!, a keyword search engine, would likely be better able to process search queries that had been pared down for this purpose. VR of keywords was high (accurate in 66.7% of tests) but less than achieved in the natural language tests (72.2%). The service recognized this difficulty on occasion, asking for feedback in three cases. Vlingo's ability to deliver the desired result increased to 50%, a substantial increase over its performance in the natural language tests, when it delivered the intended result just 27.8% of the time. Some of its more interesting results included its response to the query "best recipe short ribs," where the top result was a link to a Yahoo! shortcut site of short ribs recipes that have received the highest rating by users. The query "Weather Atlanta, Georgia" yielded a relevant results set with a "value-add" forecast for two days complete with graphics.

In summary, Vlingo for iPhone's VR capability remained high and its ability to deliver the intended result increased substantially, however the service was still not reliable enough to promise a satisfactory search experience.

5. Summary and Analysis

The study presented in this paper was designed to compare the performance of three mobile voice search services that were available on the dominant device used in the U.S. for mobile search in January 2009—the iPhone 3G. The three solutions tested included ChaCha, an SMS-based service that uses live agents to help interpret and answer search queries that are spoken into the iPhone via the voice channel; Google Mobile App, which includes a voice feature for accessing the search engine; and Vlingo for iPhone, a voice-powered interface to the Yahoo! search engine.

Following are our observations from this research:

Overall performance: As Table 6 illustrates (and Section 4 presents in greater detail), ChaCha's use of human guides to listen to spoken queries and deliver the intended results proved superior to both the Google Mobile App's voice feature and Vlingo for iPhone. This advantage was exhibited in both the natural language and keyword tests, even though ChaCha's performance diminished when given keyword queries. The Google Mobile App and Vlingo for iPhone services did not provide satisfactory search results when queried with either natural language or keyword terms, though the search results of each service did improve when given keyword queries. The Google Mobile App and Vlingo for iPhone were substantially faster than the non-automated ChaCha in all tests.

Table 6:
Summary Data: Performance of iPhone Voice Search Applications using both Natural Language and Keyword Queries

Natural Language Queries							
Search Application	No. of Queries Tested	Key Taps Required (Range)[1]	VR Accurate No. (%) of Tests[2]	Seconds to Result (Range/Mean/Median)	Type of Result	No. of Queries Yielding Results	Intended Results Delivered No. (%) of Tests
ChaCha	18	1 to 8	17 (94.4%)[3]	60-480/253.1/227.5	Answer	17	16 (88.9%)
Google Mobile App	18	1 to 2	3 (16.7%)	8-15/11.7/12.0	Links	17	4 (22.2%)
Vlingo for iPhone (with Yahoo!)	18	1+ press and hold	13 (72.2%)	8-30/15.5/14.5	Links	18	5 (27.8%)
Keyword Queries							
Search Application	No. of Queries Tested	Key Taps Required (Range)[1]	VR Accurate No. (%) of Tests[2]	Seconds to Result (Range/Mean/Median)	Type of Result	No. of Queries Yielding Results	Intended Results Delivered No. (%) of Tests
ChaCha	18	2 to 11	16 (88.9%)[3]	60-390/169.1/159.0	Answer	16	11 (61.1%)
Google Mobile App	18	1 to 2	9 (50.0%)	5-12/10.1/10.0	Links	18	7 (38.9%)
Vlingo for iPhone (with Yahoo!)	18	1+ press and hold	12 (66.7%)	8-13/10.9/10.5	Links	17	9 (50.0%)

Notes

1. *Total key taps is the sum of key taps required to generate a result. Counting began with the opening of the application from the iPhone home screen and concluded when the answer/list of links was delivered to the handset. In some cases, the service requested a zip code or additional key taps to confirm a search query; these key taps are included in the total. Note: Total key taps excluded taps necessary to explore the list of links or surf the Web beyond receiving the results on the handset. Conveniences were employed wherever possible to minimize the number of key taps needed. For example,* ***ChaCha*** *was accessed via a redialing function to facilitate one-tap calling rather than entering the entire 800 number for each test.* ***Google Mobile App*** *has a motion sensor that can activate the voice recognition technology without any key taps. It also allows the user to tap the microphone icon to initiate a voice-enabled search. Both approaches were used because the motion-activation feature did not always work.* ***Vlingo for iPhone*** *allows users to press and hold the "speak" button while saying their query or, alternatively, to tap, speak the query, and tap again to close the query. For tests involving the Vlingo service, the press-and-hold approach was used. Also for convenience and consistency, all Vlingo searches were launched via the "home" tab.*

2. *Voice recognition (VR) was judged as accurate if it correctly understood all words in a query. The misinterpretation of any key words in a query produced an inaccurate VR. In some cases, an inaccurate VR contained enough information to generate an accurate result.*

3. *ChaCha uses human "guides" rather than technology to interpret and transcribe spoken queries. Nevertheless, the accuracy of its VR was measured and evaluated with the same techniques used to evaluate the other solutions.*

Source: Albright Communications/MSearchGroove

The importance of accurate voice recognition: Contrary to what one might expect, the relationship between voice recognition accuracy and the ability of a service to deliver the intended result is not a simple one. Clearly, precise voice recognition contributes to a service's ability to deliver an accurate result, as ChaCha's superior performance in understanding natural language queries and delivering the intended results to those queries demonstrates. (ChaCha's use of live agents, or "guides," to interpret and transcribe queries did give it an advantage compared to the other options.) However, the performance of the VR variable alone cannot be used to predict the accuracy of a search result, as demonstrated by Vlingo for iPhone, which exhibited high voice recognition accuracy but still had difficulty delivering the intended search results regardless of query format. Looking at this from yet another perspective, Google Mobile App's voice recognition engine was the poorest performer of the three, and its ability to deliver an accurate result was also the weakest; thus despite the advantages of its powerful search engine, this solution was not able to overcome the inadequacy of its voice feature.

Natural language vs. keywords: We included both natural language and keyword versions of our queries in this study in order to accommodate the three solutions' various strengths and capabilities in each of these search formats. As a result, we gained additional perspective on how the products perform in the differing usage environments. As

Table 6 and Section 4 of this paper detail, ChaCha performed highly in both rounds of tests, though it was better able to deliver the intended result when given natural language versus keyword queries. The voice-enabled Google Mobile App and Vlingo for iPhone were each better able to deliver the intended result when given keyword queries.

People-powered vs. algorithmic search: Another clear finding that emerged from this study is that the use of human agents to help interpret spoken queries and conduct searches makes a positive difference in the quality of results delivered when compared to traditional search engines that use algorithmic software to find requested documents or information on the basis of keyword matches. ChaCha's test results illustrated that a people-powered approach, which effectively infuses human preferences and judgments into computer algorithms, can in some cases better pinpoint relevant information. The approach also injects an element of personality into the results, as was evident in the ChaCha responses, which often had conversational flavor. It could be argued that the conversational character made possible by the ChaCha service model is an early example of the type of two-way communications, or "dialog," that Bill Meisel, in the foreword to this paper, believes should play a role in voice search and speech recognition in the future.

However, there is a down-side to consider: A service model that involves the use of people to interpret and respond to queries (with a text-message in this case) does require significantly more time to produce a result. While the particular use-case that ChaCha developed for its service—customers simply wait to receive a message containing the information they are seeking rather than watch a small screen to deliver the results—and its superior results make it worth waiting for, the dependency of the service on human engagement potentially raises a question about scale: How broadly and deeply can this service grow? On the other hand, the algorithmic solutions used by Google Mobile App and Vlingo for iPhone are likely to improve in quality and to scale with comparative ease to serve higher volumes of users. The latter solutions also have capability to integrate voice-access with phone dialing and other device operations, providing additional advantage. These issues will be worth watching in the coming years.

Answers vs. Links: We realize that the delivery of a result in the form of an "answer" to a query is not the same as delivering a link to a Web site (typically with meta descriptions or snippets of information about the site), which typically requires further navigation. ChaCha was designed to deliver answers; Google Mobile App and Vlingo for iPhone were designed to deliver Web links. Yet both types of results can be considered accurate depending on the purpose of the service and what the user expects. Thus, as we explained in the methodology and in Table 1, we considered that each form of result was a characteristic of the solution studied and we did not compare the results of one form against the other. An accurate result could be achieved in either form.

Location Awareness: While location capabilities were outside the scope of our study, we documented each service's ability to understand and use location-specific information when responding to mobile voice search queries. Not surprisingly, a request for generalized information that is readily accessible on the Web, such as current weather conditions in Atlanta, GA, proved easier to fulfill than the requests for movie theaters and restaurants in close proximity to the test location. The latter tests, in fact, showed substantial room for improvement among all of the solutions tested, even when the service understood the query and the user's location. While it is difficult to assess the precise usage and popularity of mobile local search services in the market, the sheer variety of applications that harness location data—ranging from price comparison and mobile coupon schemes to services that allow users to explore points of interest nearby—indicates a high interest in this market.

Advertising: In recognition of the increasing role of advertising in search, we took special note of how advertising was presented. ChaCha and Google Mobile App, in particular, employed distinct advertising strategies that leverage their particular business models. ChaCha used a variety of targeted keyword advertisements and click-to-call messages, incorporating an advertisement in nearly 70% of the "answers" delivered via SMS to the user. Google Mobile App took advantage of the search engine's underlying advertising business to insert sponsored links in its results listings; however it inserted these links in just 14% of the test cases. Vlingo did not offer any advertising, which we found curious given that the search engine used, Yahoo!, certainly has that capability. While several mobile research and forecasting companies have revised their mobile advertising projections downward, many more remain bullish on the segment.

Value added features and services:

During the study, we noted various value-added features and services that each solution offered. We noted some—such as the use of advertising or location awareness—during our testing, although these attributes did not impact our analysis of the services. However, based on the increasing importance of these and other features, such as the use of maps, access to the phone's address book, and others of interest to stakeholders in the emerging business ecosystem, we deemed it valuable to identify some of these attributes for each service studied. Perhaps the performance of these features could become a topic of future research. A list of the value-added features the individual solutions provide is included in Table 7.

Table 7:
Value Added Features for Each Service

iPhone Voice Search	Value-Added Features
ChaCha	Human "guides" Links to web sites SMS advertising Click-to-call ads Friendly personality Seeks feedback to clarify queries
Google Mobile App	Links to mobile sites "Local results near" suggestions Sponsored links Location aware Search history page Google Maps Access to address book for voice dialing Dropdown menu to choose search categories Seeks feedback to clarify queries
Vlingo for iPhone	Offers choice of Yahoo! or Google search Optional tabs designate search categories Location aware Google Maps Facebook and Twitter applications Access to address book for voice dialing Seeks feedback to clarify queries

Source: Albright Communications/MSearchGroove

6. Closing Comments

This was a small study, limited to three services as experienced on a single device. However, the study produced nearly a thousand data points for use in evaluating the performance of these three mobile voice solutions. This paper presents what we consider to be the major findings contained in this data.

It is important to acknowledge that other mobile voice search solutions are commercially available on many other devices. While these other solutions were beyond the purview of this project, their evaluation in a subsequent study is warranted. To mention just a few interesting examples, both Vlingo and Nuance are presently available on various BlackBerry devices, and after this study was conducted, but prior to its publication, Google Mobile App announced its availability, with the voice feature, for selected BlackBerry devices. ChaCha, a toll-free service, can be accessed on any device. It would be interesting as well to compare the Google Mobile App voice feature to the voice search solution that Google developed separately for Android devices; the latter is integrated into the Android platform and thus has its own operating and performance characteristics that differentiate it from the iPhone app. It would also be interesting to compare Yahoo!'s oneSearch with voice, which uses the Vlingo voice recognition technology, with these others and Vlingo's self-branded applications as well. Finally, another study worth conducting would be an evaluation of the Microsoft voice-enabled mobile search solution that Microsoft has said will be introduced on the Verizon

Wireless network. Like many others in the industry, we will be watching to see when that becomes available and how it performs.

Independent studies of these types, forthcoming from Albright Communications and MSearchGroove, will be published as the *Mobile Search Performance Report.* The reports will be announced and discussed on MSearchGroove.

7. Notes

1. AdMob, in its Mobile Metrics Report for December 2008, found that among smart phones used in the U.S., the iPhone dominated mobile web usage during the last month of 2008, representing 48% of advertising requests, impressions, and clicks during that study period.
2. Interview with Mike Thompson, senior vice president and general manager of Nuance Mobile, March 10 2009.
3. Email correspondence from Cory Pforzheimer, senior manager, corporate communications at Yahoo!, Inc., March 4 2009 and December 30 2008.
4. AOL listed its top mobile search terms on December 1 2008, in a press release, "AOL Reveals Top Web, Mobile and Video Searches of 2008." Yahoo!'s top 10 mobile searches for 2008 are published on www.mobile.yahoo.com/top10mobilesearches2008.
5. Email from Lisa Kennedy, a ChaCha spokesperson, May 7 2009.
6. Email from Carolyn Penner, a Google spokesperson, March 4 2009.
7. Email from Erin Keleher, senior marketing communications manager at Vlingo, on March 11 2009.
8. Ibid.

Publisher's Statement

This white paper is published by MSearchGroove, a division of MGroove Media. It contains the findings of independent research and analysis carried out by Peggy Albright, Albright Communications, and Peggy Anne Salz, MSearchGroove in January 2009. The research methodology was developed by Peggy Albright. The research was sponsored by ChaCha. The opinions expressed in this white paper are those of Peggy Albright and Peggy Anne Salz, and do not reflect the opinions of the organizations referenced in this paper.

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ABOUT MSEARCHGROOVE

MSearchGroove.com (MSG) provides analysis and commentary on mobile search, mobile advertising, and social media. Through primary research and interviews with c-level executives and industry luminaries, MSG is the essential read for companies seeking ways to monetize their digital assets, drive mobile advertising revenues, and harness the power of empowered consumers. www.msearchgroove.com

SPECIAL THANKS TO:

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