April 2008

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Recommended Citation

Christine Anderson, Sandra Hirsh, and Andre Mohr. "Wheels around the world: windows live mobile interface design" *ACM SIGCHI* (2008). https://doi.org/10.1145/1358628.1358643

Wheels Around the World: Windows Live Mobile Interface Design

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CHI 2008, April 5–10, 2008, Florence, Italy.
ACM 978-1-60558-012-8/08/04.

Abstract
We present a unique interface design for mobile devices that addresses major user pain points with deep menu systems and page scrolling. Using a series of 1-5 wheels of content, arranged in a combination-lock style on a single mobile screen, this design enables a user to consume a multitude of personalized internet and web content without ever scrolling up/down or selecting from a menu. Additionally, the wheels are easily mapped to a personalized PC experience such as those from My MSN, live.com, and My Yahoo!, enabling users to access their PC content from anywhere. Results from iterative testing across US, Japan, and China show the model to be an effective and desirable mode of consuming personal and internet content on the mobile device, despite very different navigation paradigms and cultural expectations in each of the countries.

Keywords
mobile phones, navigation, mobile internet, interface design

ACM Classification Keywords
H.5.2 [User Interfaces]: Interaction styles, User-centered design.

Introduction

Many mobile devices, such as cell phones, smart phones, personal digital assistants (PDAs), and digital music players, are implemented to provide user access to large amounts of data via the Internet. Most provide a relatively small screen to view the available data through a visual and textual user interface. Typical implementations of the user interface include selectable list-based menus and submenus where to access a specific type of data a user drills down through the menu system. Alternatively, a large amount of data may be presented as a single page with only a small portion of the page viewable at any given time. In this scenario, the user scrolls up and down to access all of the data on the page. Several research studies have explored solutions to these types of issues on mobile devices. Kaikkonen and Roto [4] found that users prefer a more "compact" presentation of related information on mobile devices so that they do not have to navigate through complex menu structures. Buchanan, Farrant, Jones, and Thimbleby [2] found that the amount of vertical scrolling should be limited.

In order to simplify the navigation and content consumption experience on mobile phones, many services reduce or concatenate the content, giving users small tidbits of information per page. Another approach, as discussed by Borodin, Mahmud, and Ramakrishnan [1], is to enable users to see the most relevant information by providing additional context. Additionally, services may create simplified ways for the user to quickly navigate from one content type to another by using left and right arrows. In the latter scenario, the user typically navigates through a single row of icons by using the left/right arrows to move through the icons; arrowing left/right changes the focus from one type of content (such as weather) to another (such as news). One such example is Yahoo!'s Go Mobile interface (Figure 1). Yahoo! describes its interface as being a 'carousel' that allows users to navigate intuitively among various Yahoo! Go widgets [5]. A widget could be e-mail, local information and maps, news, sports, and finance. Using the carousel, the user scrolls to the widget they want (such as e-mail or maps) and is able to singularly focus on that type of content when they get there. Arrowing left and right takes the user to another single widget (Figure 2).

Figure 1. Yahoo! Go Mobile Carousel.

While impressive in its simplicity, this type of paradigm does not allow the user to focus on more than one type of content, such as news, at a time. It also has the tendency to get bulky, such that when the list of services in the icon row gets larger, it becomes more cumbersome to navigate.

Figure 2. Yahoo! Go Mobile Carousel, with Weather in focus (left) and News in focus (right)

This case study explored a new interface design that fit all of the available content, both personal and web, from a service (in this case Windows Live) on one non-scrollable mobile screen. The goal was to create an experience on the mobile device that quickly and easily enabled a user to stay up to date and in touch with the people and content they cared most about. The design would do this by giving the user an overview of as many as 5 types of content on one screen and enabling them to spin through the full set of content, stopping on content they desired, and thereby creating a useful, personal and fun experience for consuming content on their mobile device. An additional goal was to ensure that users who customized their internet experience on the PC on websites such as My MSN, My Yahoo!, and live.com could enjoy the same experience, unabridged, on the mobile device.

In that business goals for Windows Live required development to create a single scalable design that would be effective when localized and distributed across multiple unpredictable device types, this case study also explored user expectations, device usage, and navigation paradigms across cultures and analyzed each countries' user behaviors with the proposed design. An iterative testing and design process was used where, rather than testing the same design in multiple countries, user data was analyzed in an individual country, designs were updated to address that particular feedback, tested in another country, iterated on, and so forth. Research studies with users in 3 countries -- Japan, China, and the United States -- were conducted from 2005 to 2006.

Device and Navigation Paradigms

Paramount to creating a single interface design that will work for users from a variety of different cultures is understanding the existing mobile device and navigation paradigms in each culture and also understanding existing user needs and behaviors in that regard. In the beginning of each study, ethnographic questions were asked about the users' current practices and photos were taken of their devices. At the end of each session, quantitative and qualitative questions were asked about their experience and the words they used to describe their experience were analyzed. Considerable time was also spent in deep dive conversations with the local researchers running the study to understand how what was studied that week extrapolated out to what that researcher sees in the overall market. Key findings related to device and navigation paradigms are discussed.

Japan: Results from a 2005 study with mobile phone users in Japan indicated that many Japanese users were accustomed to a navigation model in which the right arrow would advance them forward (deeper)

through content, while the left arrow would allow them to navigate back to the content they had viewed previously. User expectations were based on Japanese mobile phones, which typically offered three soft keys, as shown in red in Figure 3. Users can press the center button to confirm a selection or move deeper into the selection. Most Japanese mobile phones have a specific button to move back to the previous page or screen, which is normally named "Clear" button, circled in purple below.

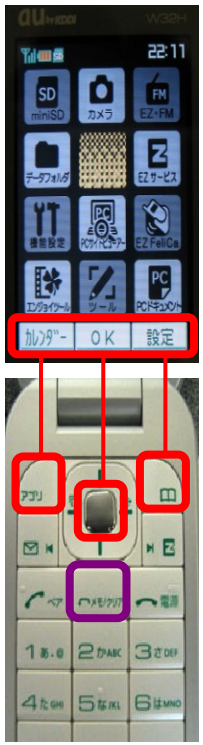

Figure 3. Japanese phones have 3 soft keys (in red) plus a "clear" button (in purple)

Japanese users expect that this "clear" button enables them to go backward or to cancel the previous entry.

Additionally, all of the participants in this study personalized their mobile phones, for example by attaching one or more phone decorations/bling (Figure 4). Users expressed their personal identities through these decorations on the exterior of their phones.

Figure 4. Japanese users decorated their phones

China: In a 2006 study in Shanghai, users frequently used gaming phones like the one in Figure 5. They used their phones both as a basic communication tool, and for entertainment, such as playing games, listening to music, and web surfing on the way to and from work/school. They downloaded games from websites and played games that were already installed on their phones.

Figure 5. Chinese phones were game-like

Additionally, when asked to engage in participatory design activities related to mobile phones, participants in the China study frequently sketched designs that were clearly influenced by their experiences on the PC. For example, the mobile search function that users drew looked like current search engines on the PC (the users said "It is a baidu.com like search box"), as shown in Figure 6. Another participant sketched video chat features that looked a lot like PC messenger.

United States: Several studies were conducted in the United States between 2005 and 2006 and consistent findings emerged from these studies. First, participants frequently were not aware of the features that were commonly available on mobile phones because their mobile phone plans or service did not offer them; this was evident through participatory design sessions with mobile phone users who frequently dreamed about future mobile experiences that currently existed, such as voice control. Additionally, users frequently discussed problems with using their mobile phones, such as being confused by complicated menu structures ("It has too many submenus and I don't like that.") and getting frustrated when required to do a lot of scrolling on the mobile devices ("I can't tell you how many times I've pressed this ?#$@* down arrow!").

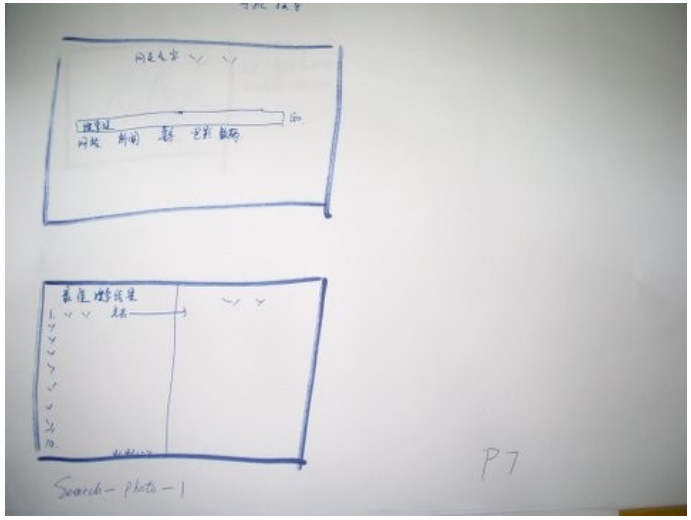

Figure 6. This Chinese user wanted to have a Baidu-like search experience on his mobile phone

Wheels Interface Design

The underlying principle of this design was to fit all of the available content, both personal and web, from a service (in this case Windows Live) on one non-scrollable mobile screen. This is achieved by arranging the content as a stack of 'wheels' similar to that of a multiple combination lock (Figure 7).

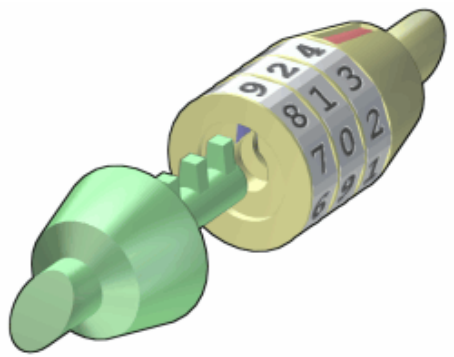

Figure 7. Multiple Combination Lock [3]

As illustrated in Figure 8, each tile that is currently displayed is associated with a wheel that may include any number of additional tiles. The additional tiles can be accessed by rotating a wheel to the left or to the right. Each wheel spins independently of the others, and when a user navigates up or down to another wheel, the previous wheel remains in its current location. A tile from each of the wheels is simultaneously visible. Accordingly, the number of wheels is limited only by the vertical size of the display screen of the mobile device. In this way, there is no vertical scrolling needed to access all of the available data tiles with a variety of personal content showing from user profile, to horoscopes feeds, to news, to weather. The top wheel also provides the opportunity to search for content. Each tile on the search wheel represents a different type of search, such as local, web, and entertainment.

The goal of the Windows Live Mobile design was to keep the experience as simple and as playful as possible (Figure 9). To that end, the only keys needed to use the interface are left/right/up/down/OK. Especially because each international market and service provider has different experiences for soft-keys and hardware keys, only the most standard of keys were counted on. Additionally, by incorporating the concept of 'spinning wheels', the design rendered itself playful, such that users could quickly arrow through the wheels to get an overview of content and stop the wheels at their whim.

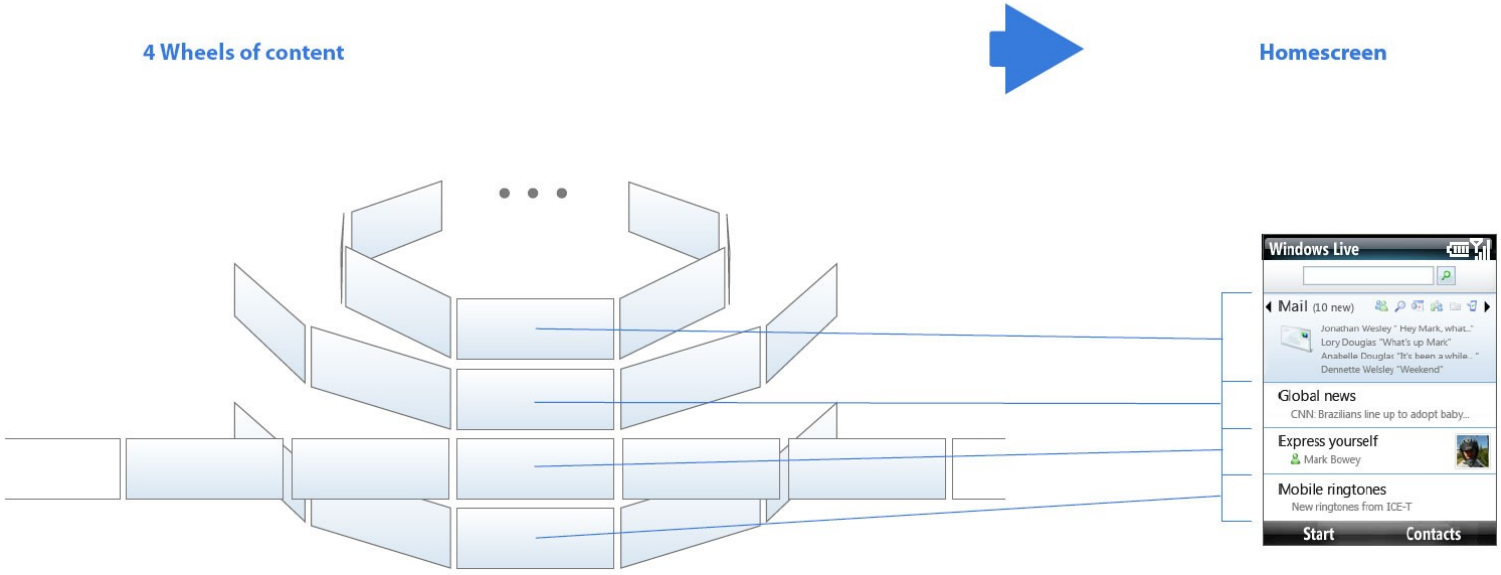

Figure 8. Wheels of content can include many tiles.

Because the content on each wheel is not limited, dots are used to indicate the total amount of content and the location within the wheel. The dots on each wheel represent the number of data tiles in the wheel, with the darker dot indicating exactly which tile the user is on at any given time. In Figure 9, the second wheel indicates there are 6 tiles of content, with the user profile being first.

Figure 9. Windows Live Mobile with 5 wheels of content

Content stored on each wheel can vary. In Figures 9 and 10, content is organized such that search is in the top wheel, personalized internet data such as e-mail, contacts, and calendar are next, followed by a wheel with entertainment feeds, then news feeds, and then location specific content (such as weather).

Figure 10. Five wheels of content with entertainment feeds in focus (e.g., horoscopes).

During the iterative testing process, several different categorizations were explored, including categorizing according to content type (shown in Figures 9 and 10), categorizing according to more general buckets (such as 'start' which would include all applications, 'know' which would include all feeds, 'express' which would include all personalization experiences such as photos, and 'discover' which would include search), and categorizing according to a user specified structure (such as mapping to columns from a users' personalized PC site). Results from these types of

categorizations in each country studied are discussed, as understanding of the wheels' structure and behavior was sometimes dependent on understanding of the categorization (i.e., knowing where to look for a certain type of content).

Japan. Participants in the Japan study tested a wheels design with content labels Start, Know, Discover, and Express on each wheel. Participants in the Japan (and earlier U.S. studies) had difficulty anticipating and learning what type of content and services was included in each of these categories, and this contributed to lower task success rates (Table 1). As a result of these user difficulties with the Start, Know, Discover, and Express content structure, subsequent iterative designs replaced this content structure with one that matched more directly the user's personalized PC web content organization; these content structures were used in later U.S. and China studies.

China. Most users in the China study understood the structure of mobile live.com pages. It was clear to most users that the interface displayed their personal content on the second wheel (such as e-mail and contacts) and that other internet information was presented on the other wheels. A couple of users thought the categorization was not very clear and sometimes had trouble finding the content; however, this was mostly because they did not create the categorization in the prototype themselves so they were less familiar with which wheel the other internet information was located.

United States. Several iterative rounds of testing were conducted in the United States, starting with early prototypes which used the Start, Know, Discover and Express content structure. Users consistently had difficulty understanding this content structure; users were not able to reliably predict which bucket their internet content was likely to be placed in. When the content structure was changed, to either a default organization of content (starting with search, followed by personal content such e-mail, and then feeds and other internet information) or to a mapping that was based on a customized personal webpage, user understanding of the content that they would find within each wheel improved. Users in the U.S. generally had little difficulty in selecting different types of content on the wheels, once they understood the structure of the content. They also explored what type of content was contained within each wheel.

Wheels Navigation

The user navigates to each wheel using up/down arrows and then across each wheel using left/right arrows. In this design, there are as many as 5 wheels of content on the screen, with each wheel having one or more data tiles. One data tile from each wheel is simultaneously viewable, and each wheel spins independently from the other wheels to allow a user to view each of the data tiles on a particular wheel. The interface remembers the last position of the wheels so, if a user navigates away from the wheel-based user interface and later navigates back to it, the position of each of the wheels remains unchanged. For example, if the user leaves Messenger in view on the second wheel as shown in Figure 9, then navigates to the Wired News wheel, Messenger stays in focus in the second wheel. Additionally, the amount of content showing in each wheel not in focus (such as Horoscopes, Wired News, and the Weather in Figure 11) can vary based on the number of total wheels on the screen. For example, if

there were only the top 3 wheels rather than the 5 pictured in Figure 11, more Horoscopes would be listed in the Horoscope tile.

When the user navigates to a particular wheel, the data tile that is currently highlighted, or has focus, is larger than the other tiles that are not currently highlighted. In the illustrated example in Figure 11, the second wheel currently has the focus. Accordingly, a right arrow command will cause this wheel to spin clockwise, revealing the next tile on the wheel, as shown in Figure 12. Similarly, a left arrow command will cause the wheel to spin counter-clockwise, revealing the tile in Figure 11 again.

Pressing the Enter/OK/center button on the mobile device hardware on the tile in focus takes the user to more details about that particular content. For example, pressing OK on Mail in Figure 11 takes the user to their Inbox; pressing OK on Messenger in Figure 12 takes the user to the conversation with Simon Brown. Once in this detailed view, the interface allows the user to scroll up and down through content that goes well past one visible screen (for example a news article could scroll several screens). A wheels based interface at this next detailed level of content was also explored but it is not discussed in detail in this case study.

Key findings related to the wheels navigation model from research studies during the iterative design process are discussed.

Japan. Participants in Japan had difficulty initially using the right/left arrows to explore other content and services that were available because mobile phones in

Figure 11. Wheel showing second tile, Mail

Figure 12. Wheel showing third tile, Messenger

Japan at that time used different conventions for the right and left arrows (Figure 13); for example, using the left arrow meant "back" in most of phones in Japan, so it was initially confusing for the left arrow to wheel them through additional content. Additionally, the muted color palette and more textual design treatment

in the earlier designs tested in the U.S. and Japan sometimes presented problems in understanding how the wheels interface worked. It took some users considerable time learning there was more than one wheel they could explore by pressing the down arrow. For example, when in the top wheel in Figure 13 and asked to find personal content such as movies playing near them, users didn't initially realize they could arrow down to other wheels. Some would spin through the top wheel for a while without thinking there was anything behind the other wheels (i.e., weather was simply weather, not a wheel with personal content). Despite these initial difficulties, participants in Japan were able to explore the functionality on the mobile live.com page and quickly learned how to navigate through the content using the right/left arrows.

Figure 13. Wheels design tested in Japan.

China Study. As a result of user feedback from the Japan and earlier U.S. studies, significant changes were made to the visual design as well as content ordering. The content buckets used in earlier studies were changed so that instead content was presented in a custom ordering that a user could have created on live.com (Figure 14). The visuals were infused with light, selected tiles were given a gel-like effect, and larger and more playful graphics such as arrows and icons were added. Most users had little trouble using navigation (up, down, left, right) to move between content; they noticed and understood the left/right arrows and that the arrows indicated that more content was available. Many users knew they could select on a wheel to see more details both on home screen and on detail pages at the second level.

Figure 24. China users were able to quickly understand the navigation model.

United States. Participants quickly learned how to navigate right and left through content on the mobile phone home screen, even when they did not understand the content ordering. One of the user interface elements that provided users with valuable navigation cues included the arrows that appeared in each wheel, suggesting that users could navigate right and left. Some participants initially thought that the right/left navigation would take them through more of the selected content. For example, for Horoscopes (see Figure 15), some participants initially expected that moving right would take them through all of the astrological signs. However, they quickly learned that navigating right moved them through **different** content.

Figure 35. U.S. users were not certain what would happen when they arrowed to the right on Horoscopes.

PC to Mobile Mapping

Many Windows Live, Yahoo!, and Google users choose to customize their experience when they are online on their PC through sites like live.com, My MSN, and My Yahoo!. These web sites often allow a user to personalize the presentation of data by providing a grid of rows and columns in which various data tiles or modules may be placed. Users typically arrange data tiles such that those of most interest to the user are placed near the top of the grid, while data tiles of less interest to the user are placed near the bottom.

Data tiles can include RSS feeds (e.g., News, Entertainment), gadgets (e.g., people look-ups), location-based content (e.g., weather, movie times), and personal content via APIs (e.g., latest mails sent, latest calendar appointments). A sample personalized page from Windows Live is shown in Figure 16.

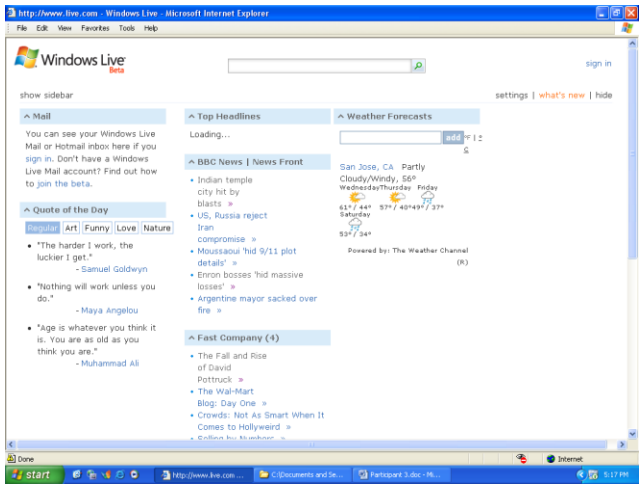

Figure 16. Personalized Windows Live content from PC

As a primary goal of the mobile design was to ensure users had access to the people and information they cared about from anywhere, the wheels interface was designed to be both a stand-alone interface and to map to the structure of these modular personal websites.

The wheel-based mobile device user interface maps to the typical row-column structure of modules/data on a web page, such that each wheel represents a column on the web page. The wheels are basically columns, turned on their sides (see Figure 17).

Findings from one study in the U.S. showed that users typically arranged content on their personal web page such that the content with the most interest to them is in the top rows, above the page-scroll/fold. Figure 16 shows one such example of a personalized web page created by a participant in this study. The study found that users typically placed content that they were less interested in at the bottom of the columns (rather than at the top). Users also tended to categorize content by columns, such that all content of one type (such as feeds) was grouped in one column.

Taking this type of organization into account, the wheels interface is designed such that each wheel is mapped to a column and then each data tile on the wheel is mapped to the modules in that column. Figure 17 illustrates this concept. The wheels interface is dynamic in that the number of data tiles associated with each wheel is not limited; each wheel can have a different number of tiles than the other wheels. The end result is that all of the users' PC content is accessible on the phone, again without the user ever having to do page scrolling past one visible mobile device screen. Additionally, since users expect easy access to their personal services such as e-mail and to Search, these wheels are added to the interface above the wheels that map to their PC content modules.

Results from one study in the United States found that users do not immediately notice the mapping between the mobile and the PC. This could be due in part to the fact that users were not looking at their own personalized web page for the study, but rather one that was made up for them. While users were given tasks to help them become familiar with the personalized web page prior to using the mobile version, this was not sufficient for most users in this study to notice the relationship between the content structure on the PC and the content structure on the mobile device. That said, users were able to complete key tasks for discovering content on the PC and the mobile device with 80% or more success. Additionally, as noted previously, during participatory design sessions, users in the China studies tended to ground all of their thinking in how to design a mobile interface in their PC experience. Their expectation was to see the device mapping to their experience on the PC. Given this finding, it is reasonable to recommend that mappings such as this will be well received by users and should be further explored and studied.

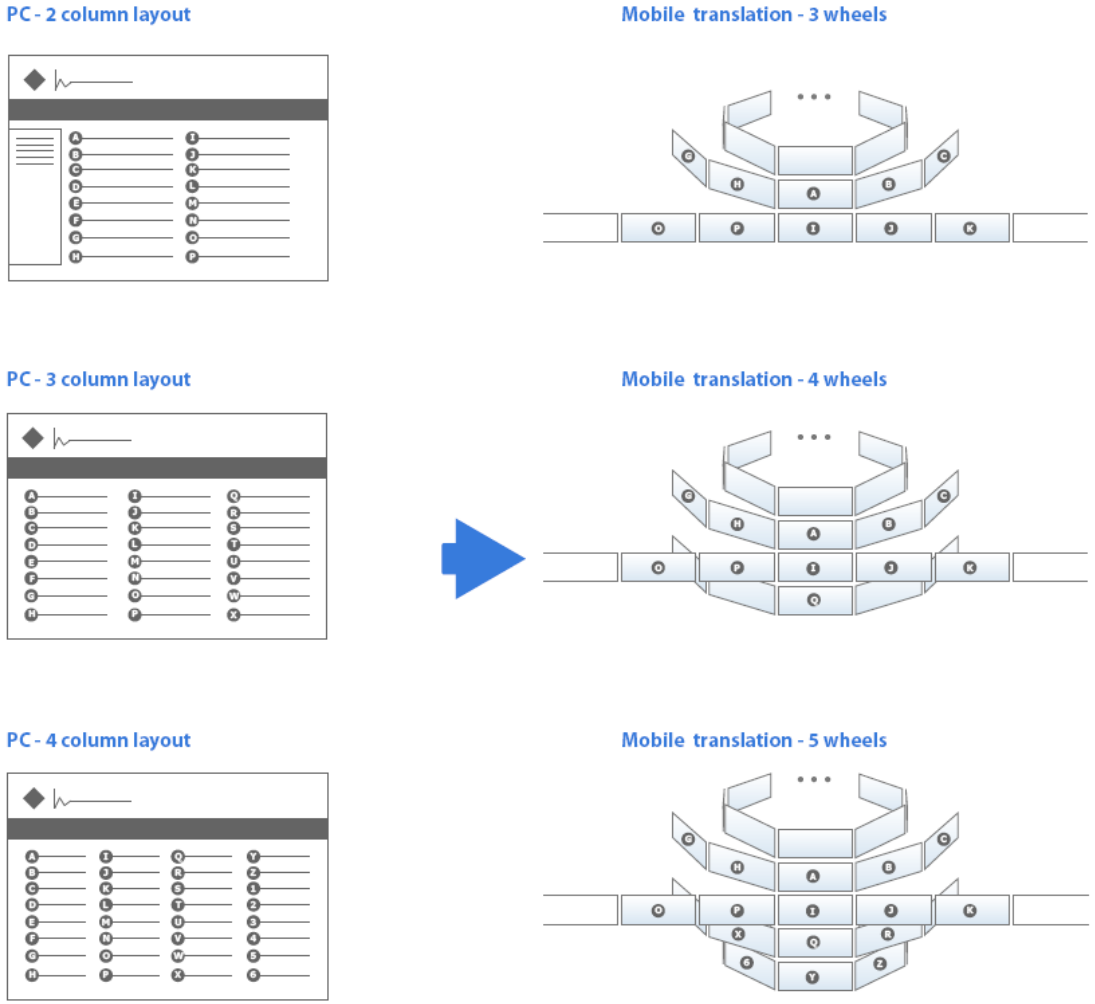

Figure 17. Columns of content from the PC are turned on their sides to form wheels of content in this design

Cross-country iterative design

The series of studies referenced in this paper were conducted over the period of a year on iterative designs of the mobile framework for navigating through personalized web content on live.com, with user feedback collected from mobile users in the United States, Japan and China. For all of these studies, active mobile phone users (typically 8 participants per study), who also used the phone to frequently text message, browse the mobile web, send/receive instant messages, do internet searches, and/or send/receive e-mails, were recruited. Participants interacted with an interactive flash prototype on a SDA T-Mobile Smart Phone, with the live.com prototype loaded on it. Prototypes were localized into Japanese and Chinese for studies in those countries (Figure 18). Participants performed a similar set of tasks using each of these prototypes, with the results from each of these studies used to inform the next iterative design that was tested. Users were also asked to complete perceptual ratings of their experience using Windows Live Mobile.

Figure 18. Iterative Wheel Framework Mobile Designs.

Success rates on the early mobile prototype in Japan were not high (Table 1), with only 40% of the tasks achieving the desired success metric of 80% or higher across users. Lower success rates were largely due to problems with the content structure (Start, Know, Express, Discover) and initial issues with the right/left navigation model.

Country	% Tasks Achieving Success Metric
Japan	40% (4/10 tasks)
USA	64% (7/11 tasks)
China	73% (8/11 tasks)

Table 4. Success data on Wheel Framework Mobile Designs.

Based on the feedback from users in Japan and early studies in the United States, the design was improved to better reflect the ways that users think about content on the mobile devices. Additionally, improved visuals were applied to the interface after the study in Japan, which gave the mobile interface a more engaging and playful feel. Once the content structure issues were addressed, the wheels navigation worked at the top level on the home screen for most users; users explored the wheels and content naturally, even without labeled content categories. Success rates progressively improved with each design iteration, as shown in Table 1. One issue that needs additional investigation is how navigation works at the second detail level; for example, once a user selects a content type, explorations of different approaches are needed to determine what happens when using the right/level arrows.

In the U.S. and China studies, users were also asked to

perform ratings on perceptual statements using a 7 point scale ("1" means strongly disagree and "7" means strongly agree) (Table 2).

Emotional Outcomes	USA	China
It's so easy to use this service I just used.	**5.8**	**6.1**
It's so easy to keep track of news and information that I am interested in using this service.	**5.7**	**6.3**
It's easy to navigate to content.	n/a	**6.4**
I would like to use this service on my own mobile phone.	**5.8**	**6.3**
My experience using this service today was simple.	5.4	**5.9**
The service I used today was fun.	5.4	**6.6**

Table 2. Mean Emotional Outcome Ratings

Statements receiving an average score of 5.5 or higher were considered to have achieved the metric (these appear in bold). In the U.S., nearly all of the statements achieved the metric (or were very close) and in China all of the statements achieved the metric. Users were very positive about the wheels navigation design and felt that the experience was "fun" and "personal." Japan study data are not included because statements measured were different from those used in the later studies in the U.S. and China.

Conclusions

User studies on iterative versions of the wheels interface and navigation designs for Windows Live Mobile in the U.S., China and Japan have found that the final design, as tested in China and also in the U.S., successfully addressed major user pain points with deep menu systems and page scrolling. The design used 1-5 wheels of content on a single mobile screen to enable users to consume personalized internet and web content without having to page scroll up/down or having to select from a menu. Users understood how to find and select content using the wheels design, both when they used a default content display and when the content was mapped directly to their personalized PC experience on live.com. Results from iterative testing across U.S., Japan, and China show the model to be an effective and desirable mode of consuming personal and web content on the mobile device, despite very different navigation paradigms and cultural expectations in each of the countries.

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