Tablet Website and Application UX

Design Guidelines for Improving the Usability of Websites Viewed on Tablets and Tablet-Specific Apps

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Thank you!

Raluca Budiu and Jakob Nielsen, report authors

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Executive Summary

After 6 rounds of usability studies with tablet users, the good news is that tablet usability is reasonably good and has improved substantially since the initial batch of whacky iPad apps where people often didn't know what to do.

We've tested several generations of big and small iPads, as well as many models of Android tablets (including the Kindle Fire) and some Windows tablets (including Microsoft Surface). The common conclusion is that most websites are fairly usable on tablets, and only need limited adjustments to this environment. (This is in contrast to use of websites on mobile phones where the smaller screens necessitate many more design changes.)

When we ask people how they use their tablets, it doesn't come as a big surprise that web browsing is universally mentioned as a top activity.

Tablet applications have plenty of usability flaws, but mainly of the same nature that plague traditional application design: difficult features, mismatch with users' workflow, and poor instructions that aren't read.

Designing and building a high-usability application involve substantial work, and there are some additional issues to consider for tablet apps, including the need to modify the user interface for different tablet models. Combined with the popularity and ease of using websites on tablets, this begs the question why companies would have a tablet app in the first place. In fact, we advise most companies to stick to their website and invest the resources in improving web usability, which still suffers badly in most companies.

Only build a tablet app if you can offer value-added functionality over a website. This is often the case when the app can be focused on supporting a single main task.

Conversely, don't make your tablet app a scaled-up phone app. We've seen hundreds of apps (mainly on Android) that misuse screen space to offer tablet users the same basic design as phone users.

REVENGE OF THE FRAMES

In 1996, we condemned the use of frames in web page design. Sure enough, the original terrible frames are rarely seen today, though better design techniques such as inline frames and parallax scrolling are used to meet similar goals with better usability.

But like zombies, certain bad designs come back from the dead to haunt users, and frames-like concepts cause usability problems in many modern tablet designs. Two common mistakes are split-screen designs and temporary frames for things like search results.

Even though a tablet seems big compared with a phone, it's still a small screen that usually shouldn't be subdivided into even smaller frames or split views. Every time you split off part of the screen, there's less left to show content.

WEB UX BLEEDTHROUGH

The web is such a dominant part of computer use these days that concept from the web user experience bleeds through the platform divide and influences people's use

of tablet apps. Search dominance and heavy reliance on the Back button are primary examples of this finding.

Users frequently want to search on tablets, and they also want to return to their search results. Unfortunately many apps don't provide a proper SERP (search engine results page) as a primary navigation object that users can easily return to. Instead, search results are shown in one of those zombie-attack frames with a fleeting screen presence.

The *Back* button has long been users' lifeline on the web, and if anything it's even more important on tablets where accidental activation is a common consequence of the touchscreen interface. Unfortunately, testing revealed usability problems with some apps that did offer *Back*: sometimes the feature was hard to find and sometimes it didn't have the expected ability to undo the user's last action.

GESTURE PROBLEMS

Gestural user interfaces have several inherent problems that tablet apps need to minimize:

- Accidental activation: people touch something by mistake and need a way to get back.
- Swipe ambiguity: when the screen is divided into subregions (such as the frames we caution against) the same gesture can have different effects, depending on where it's activated. This problem is exacerbated by the trend toward flat design without clear demarcation of the regions.
- Invisibility: you can't see the gesture you just made, and you sometimes can't even see where you're supposed to touch. Again, this is made worse by flat design.
- Low learnability: all these problems combine to making gestures hard to learn and advanced gestures might as well not exist: only a few percent of users employ anything beyond basic gestures like tap, swipe, drag, and pinch

Despite these inherent problems, most of the tablet apps we tested employed gestures reasonably well. The exaggerated skeuomorphism of the early days has also subsided.

DANGERS AHEAD

The two main threats to tablet usability are:

- Flat design. Why not allow users to easily see what they can do? We need a golden middle ground between skeuomorphism and the lack of any distinguishing signifiers for UI elements.
- Rescaled design. Whether shoehorned down from a bigger screen or grotesquely exploded from a phone screen, too many Android designs simply don't fit the size of the actual tablet they run on. (While also seen on other platforms, poorly rescaled designs are less common on iPad and Windows tablets, probably because of smaller device diversity.)

The first of these threats is a fashionable trend that will hopefully subside before it hurts users (and companies) too much. The second threat will be with us longer, because it's caused by resource constraints and the naïve idea that a single design is good enough as long as it can adapt itself to the available screen space.

Research Overview

The main purpose of this research was to understand how people use their tablets and what makes tablet apps and websites usable. The result of our research effort is a set of design guidelines for tablet apps and websites. The recommendations are based on methodical observations and interviews, as well as expert reviews.

In this section we present a brief overview of our research project. For details about the methodology, please refer to the *Methodology* section in this report. The research project encompassed two different methods:

- Usability testing, and
- Design reviews carried out by a usability expert.

Usability testing. Over the course of 3 years, we carried out 6 separate usability-testing studies and numerous design reviews. All the studies were done in the U.S. In 3 out of the 6 studies, participants brought their own devices into our lab. The remaining studies were centered around new devices and, for those studies, the participants used our devices.

Where applicable, we asked participants to show us the apps that they had installed on their tablets; alternatively, if the device was unfamiliar to the participants, we gave them some time to familiarize with it. Then, we asked participants to complete a series of tasks that involved either applications or websites. Please refer to the *Methodology* section for examples of tasks.

We observed users as they worked and encouraged them to think aloud. Sessions lasted 90 minutes. Overall, we had 67 participants; 48 of them brought their own tablets into the lab. We studied 42 iPads (including 5 iPads mini), 9 Windows 8 tablets, and 16 Android tablets (out of which 7 were Kindle Fire tablets).

The 3 studies that revolved around unfamiliar tablets involved 19 participants. We gave users one of the following three tablets: iPad (7 people), 7" Kindle Fire (4 people), and Microsoft Surface RT running Windows 8 (8 people).

Expert Reviews. The last source of information for our guidelines came from expert reviews. Over the course of three years we reviewed many apps and websites on a variety of platforms. The list of these has become too long to include in this report, but the Methodology section contains a subset of sites and apps that were reviewed.

How People Use Tablets

When the iPad first came around, it looked like everything tablets supported could be done equally well or even better with a laptop or a smartphone. Could this new device find its place on the technology continuum? The answer seems to be yes. As early as three years after the introduction of the iPad, slightly more than 30% of Americans owned a tablet device, and that number seemed to be growing. (A June 2013 Pew Internet survey noted that a little more than 30% of Americans own a tablet, whereas more than 50% of Americans have a smartphone).

Now we know that people use tablets mainly for entertainment and playing games, as well as for consumption of information — checking the latest news, reading an e-book, watching a movie. More and more people report that they do some basic mobile banking (checking balances, transfers, occasional bill payments) and shopping, in particular with big retailers such as Amazon or eBay.

Large screen tablets tend to be left at home (unless the owner expects to spend a significant amount of time needing to kill time), shared with the other members of the household, and available around the house for quick circumstantial tasks such as checking facts while watching TV, browsing or shopping, as well as for catching up with the latest episode of a favorite TV series. All these tasks could be done with a laptop (and most of our tablet users owned a laptop or a desktop computer), but it's simply more convenient to do them with a tablet. And many of these tasks could be done on a smartphone, yet the larger screen is, not surprisingly, more comfortable. As one of our users noted, tablets are also more socially acceptable than laptops: "for some reason, it's less acceptable to use a laptop on the couch with others; it's almost as if the laptop separates me more from them than a tablet."

Although many of our users tend to say about their tablet that it replaced their laptop and they use it for almost everything, there are still activities that are hard to do on a tablet. When we asked people to find a hotel in Barcelona that is close to the Gothic Quarter, our users noted that they'd normally use a computer and open a separate window with Barcelona's neighborhoods. When we asked people to find information about Harvard's doctoral program in Psychology, many said that they'd rather use a computer because it was too difficult to figure out under which of the many Harvard schools Psychology fell. Almost any time when users needed to refer to multiple sources of information (that is, multiple applications or websites accessible in different windows), users said that they would rather use a computer. As one user put it:

> "Some of these tasks — I would never even consider doing on a tablet. I could probably do them on my desktop in maybe 10% of the time I am taking on the tablet — it's just ridiculous. Once I have to click more than 4-5 times to get to what I want it becomes really unnecessary and the experience is just not good on a tablet. That's why I use my tablet mainly for media consumption. For anything more complex such as booking a hotel […] I cannot think of a way when the tablet would be better than a desktop."

Many users are still reluctant to do significant purchases or more "serious" activities on their tablets for fear of making a mistake. As one user put it:

> "I don't do important stuff on my tablet."

Yes, we did find that tablets can almost replace a larger-screen computer because, for most people, the majority of the tasks they do can be supported reasonably well on the smaller tablet screen. However, there is only so much information that can fit on a 7" or even 10" screen; and for some tasks, that can be a serious limitation.

LARGE VERSUS MIDSIZE TABLETS

Many of our participants loved their midsize tablets and thought that their smaller dimensions offered some unique advantages. The most important of those was portability: midsize-tablet owners were more likely to report that they carry their tablet with them during the day than the large-tablet owners. Some of them seemed to also use them in a more spontaneous, circumstantial way — for instance, one of our participants, a pharmacist, mentioned that he kept his Kindle Fire in his coat pocket at work and used it to check drug information on the Internet as needed. He said that the tablet was easier to access than the few dedicated computers in his shop, especially since other co-workers may have needed access to those computers.

The midsize tablet was also a convenient way to kill empty time at work: people reported that sometimes it was easier to check personal email or browse the Internet on their tablet rather than on their work computer.

Several users stated that they liked to use their midsize tablets as e-readers: The smaller size made them not only easier to carry around in a bag, but also easier to hold.

At home, midsize tablets serve the same functions as the larger-screen tablets: browsing the web, reading, watching videos and movies, or playing games.

Overall, both in terms of usage, size, and design constraints, midsize tablets place in-between smartphones and large-screen tablets: their portability makes their use a more contextual and shorter-timed than on a large tablet.

TABLETS VERSUS PHONES

According to a 2012 survey, 68% of smartphone users say that they cannot live without their phones, while only 13% of the tablet owners say the same about their tablets[1]. Smartphone users keep their phones with them at all times, and that informs dramatically the usage differences between phones at tablets.

Because smartphones are available at all times (and connected at all times), phones tend to be used for almost anything. That doesn't mean that any type of task can be reasonably completed on a phone. A Google multi-screen study[2] showed that in fact many tasks that are started on a smartphone are completed on a different device. It just means that phone usage is more attuned to the contextual information needs that people tend to have during the day.

Because phones are small, pulling them out of a pocket or purse and using them for a few minutes at a time is a relatively low interaction-cost operation. Doing the same with most tablets is not worth the time investment if you only have 2-3 minutes available. Because of that, phone sessions tend to be shorter and more contextual; they often tend to be interrupted by external stimuli. Tablets are less portable, and, because many people use them at home or in an office, the sessions are often longer. People feel that they are more relaxed and not rushed when using tablets.

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[1] http://onlinepubs.ehclients.com/images/pdf/MMF-OPA_--_Portrait_of_Smartphone_User_--_Aug12_(Public).pdf
[2] googlemobileads.blogspot.co.uk/2012/08/navigating-new-multi-screen-world.html

Do You Need a Tablet App?

When the iPad first came out, we noted that full sites worked quite well on it, and mobile sites felt sparse and wasteful. That finding holds today, too.

In fact, one of the recurring themes in our user studies was that, for a lot of tasks, people prefer to use the browser and deal with a full site. It seems that we are past the app craze: many users are protective with their time and with their device's memory, and they don't want to go through the hassle of installing and maintaining an app when a website could do the job just as well.

It doesn't mean that people don't use apps on their tablet: they usually go back to a few apps that support a unique task. Examples include video-watching apps, recipes apps, news apps, banking apps. An app has to have a secret weapon that distinguishes it from the full website. Only then the app will add enough value to the user to justify going to the trouble of installing it.

But apps that include a subset of the content or functionality available on the web are losers: users stay away from them. If they get installed, they also get quickly deleted or forgotten.

We are aware that the decision to create a tablet app is often a political one: a manager or a CEO insists on having one because competitors also have one, and thus the ball gets rolling. However, creating an app just to have a presence in an app store is a poor investment of resources; the time and money would be better spent on making changes to the full website to better support access on tablets.

When trying to decide whether you should build a tablet app or just change your full website to make it more tablet friendly, start with a few questions:

(1) What functionality will we include in the tablet app? How does the functionality compare to our existing full site?
If the functionality of the app is the same or more restricted than the full site, then it may not be worthwhile building an app.

(2) Will the existence of the app enable our users to get a substantially better experience in context than what they would get with a full site?
A car-repair app that can be easily used in the garage is probably warranted, although the repair instructions may be available on the website as well.
A car-repair app that gives users directions to stores or lets people search for parts is not that useful, if users can access similar functionality on a website.

1. **If a tablet app replicates full-site functionality, then the tablet app should have some unique added value.**

    Often the full website is accessible and fairly usable on the tablet, so a simplified app that leaves out essential content from the full site is perceived as worthless. As a result, large-tablet users will not install an app that does nothing more (and maybe a lot less) than the actual full website.

    Many of our users shared that they never bothered with the e-commerce apps from big names such as Amazon or eBay; even though they had downloaded those apps, they felt that they were lacking features that they found highly useful and that were available on the website.

A Windows 8 user confessed that one of his hobbies was selling on eBay; he complained that the Windows 8 app was designed purely for buyers, and did not support sellers that well. In particular, when deciding how much to charge for an item, he often tended to check prices for similar items that had been already sold on eBay. He could easily search completed auctions on the full website, but that feature was not available in the eBay app.
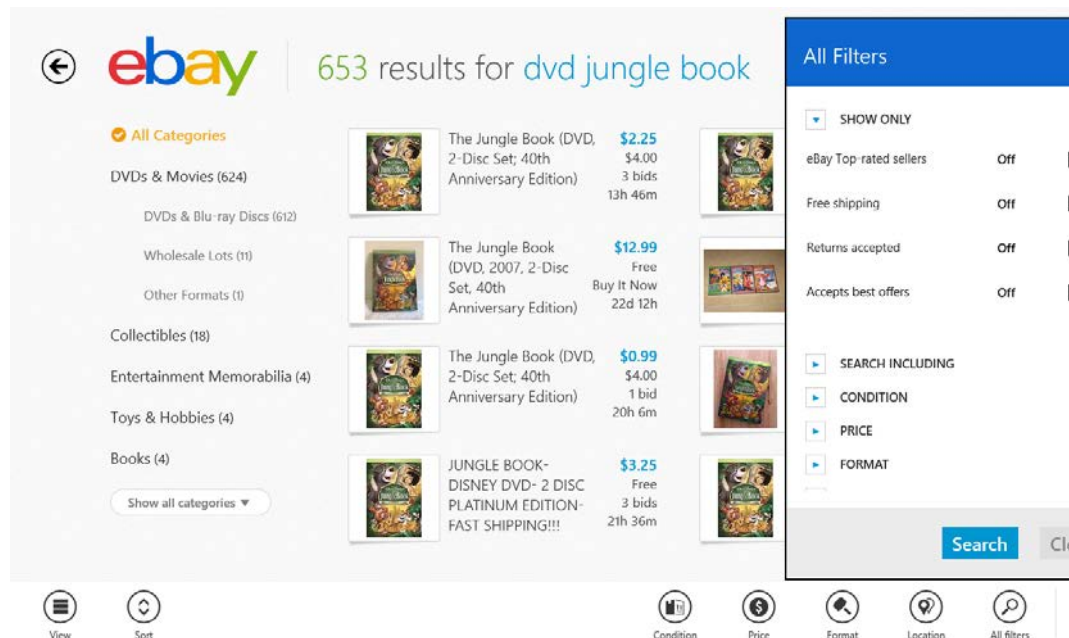
eBay for Windows 8: Users can filter by a variety of criteria; however, not all criteria present on the full site are available in the app (for instance, users cannot look at completed auctions only).

A Redfin user was disappointed that her search returned no results even after trying to expand her search. She said:

"I would not keep playing with the app; I would just go to the website where I know they have a lot more options. At this point I would just delete the app to make space on my iPad."

One of our participants complained that, although on Zappos.com it was possible to log in using an Amazon account, this feature was not available on mobile.
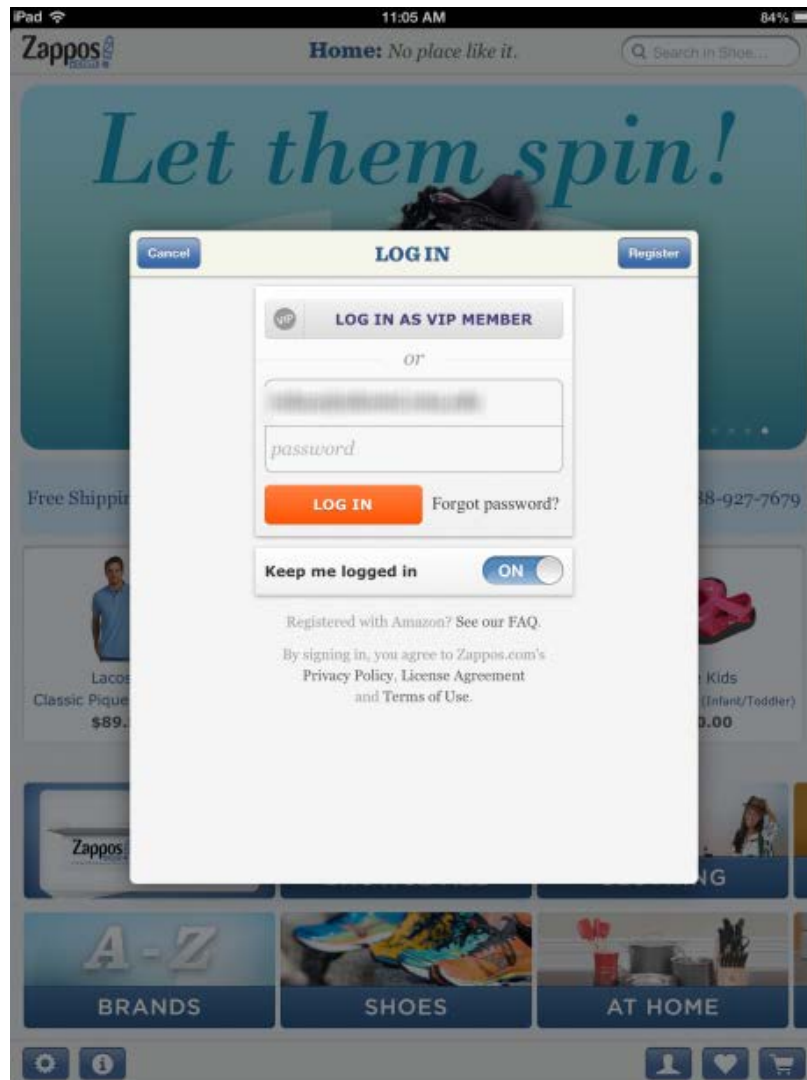
Zappos app for iPad: Users cannot log in with their Amazon account; however, this is possible on the full site (below).
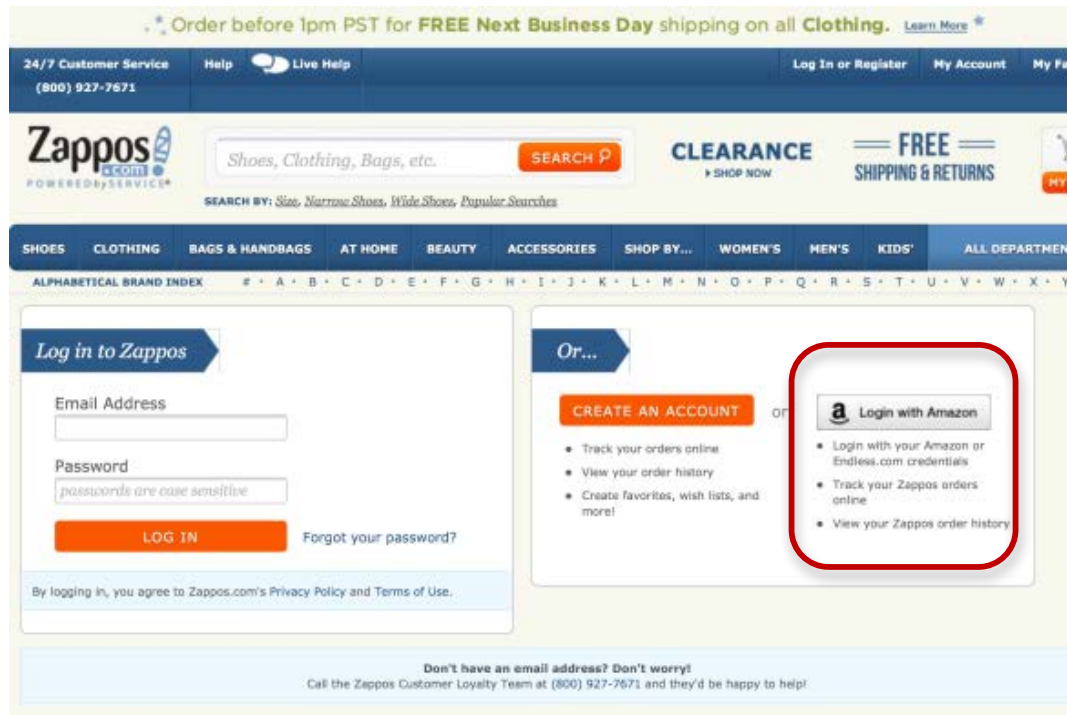
2. Users prefer apps to full websites when the app is supporting a single main task.

None of our users said that they'd rather watch videos in the browser, or that they'd rather read a book in the browser. Whenever an app was dedicated to a unique task and it was highly adapted to that task, users appreciated it and tended to prefer it to a website. Besides e-readers and video players, another type of app that was fairly popular (at least for some users) was the cooking app. Reading a recipe in the kitchen is easier when the font is big, the steps are clearly delineated, and app offers voice control, like Crock-Pot for iPad does.
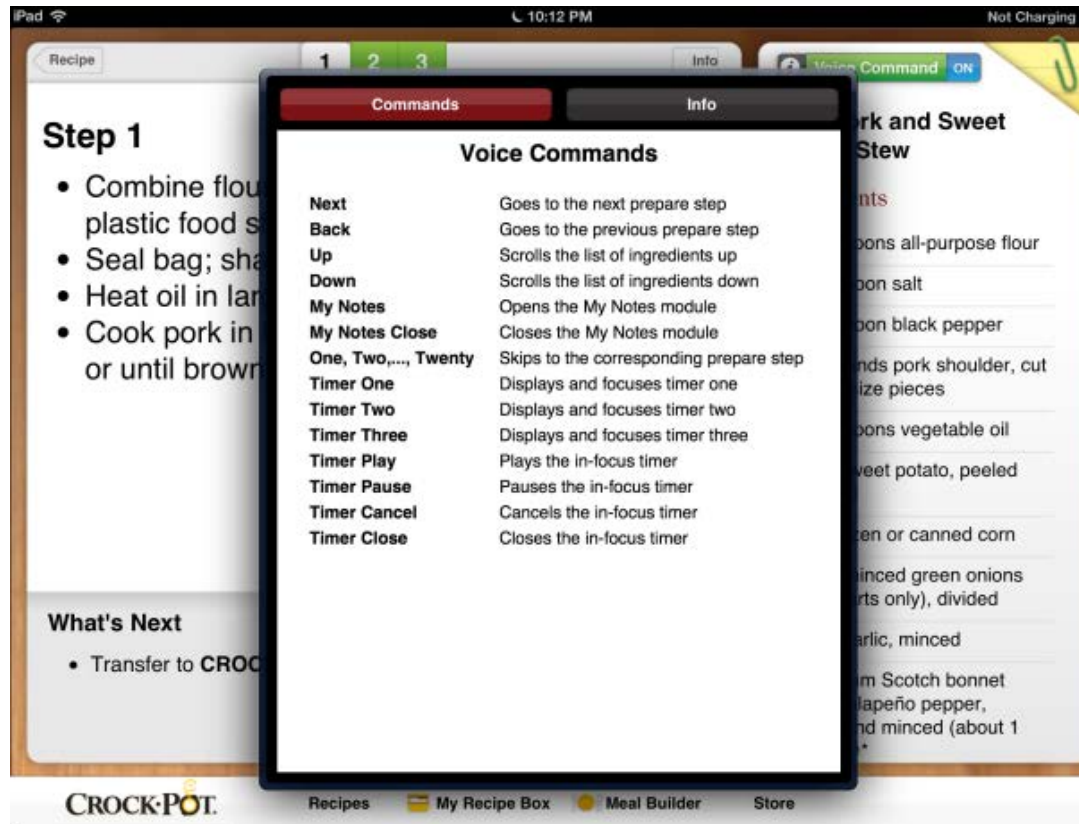
Crockpot for iPad: Simple voice commands allow the users to interact with the app without touching the screen — a very useful feature in the kitchen, when your hands are dirty.

DESIGN FOR TABLET, NOT FOR PHONE

One of the common misconceptions in designing for tablets is that they are just phones with big screens. Often, we see simplified designs that are moved from phone to tablet, with multiple pages of a phone app crammed within a single page in a tablet app.

One difference between tablets and phones is that phone sessions are typically shorter and more contextual. People keep their phones around in their pockets all day, and take them out whenever they have a few minutes to kill. Most tablets are less portable, and tablet sessions are often longer. As a result, people often expect more complex content on the tablet and more details.

(We have a separate report with usability guidelines for designing for mobile phones. Please see www.nngroup.com/reports/mobile-website-and-application-usability .)

3. **Tablet apps should have more in-depth functionality than phone apps. Strive to give users access to details that may be not available on the phone.**

4. **Do not design your tablet app or website by simply combining pages from your mobile phone app.**

   Sometimes, the functionalities of the tablet and phone apps are very similar (e.g., a mail app, a task management app), and then it makes sense for the interfaces to be similar. But even in those cases, make an intelligent transition to the larger screen and keep in mind the conventions and the usability of the resulting design.

   Mortgage Analyzer for the iPad consists of a single page, which combines all the screens in the Mortgage Analyzer iPhone app. Except for the Feedback screen, all the action happens on this page: this is where the data is entered and where the results are displayed. Although having multiple types of information present at the same time helps the user by minimizing the load on their working memory, in this case many of the options add to the clutter and to the information overload, since some users will not actually access them all at once or from the beginning. More importantly, many of the targets on the screen are too small and crowded, the text is hard to read, and the main button Calculate is far away from the main form fields (Loan Amount, Interest Rate etc.).

Mortgage Analyzer for the iPad consists of a single page. Except for the Feedback screen, all the action happens on this screen.

Mortgage Analyzer for the iPhone has exactly the same functionality as the iPad apps, but it appropriately makes use of more screens.

5. **Whenever possible, design a separate tablet app rather than making the phone app available on the tablet or just replicating the phone-app design in the tablet app.**

Because tablets have larger screens, they can accommodate more complex content and interactions. Applications that were designed for phones often work on a tablet, but look impoverished and poorly designed. People typically complain that they don't want the "mobile version" on their tablet — rather, they want better use of the space and more features and complexity. (Many Android tablet apps are simply enlarged versions of the regular phone apps, and although they can be tolerable on a midsize tablet, they are pitiful on a large 10" screen).

The Costco example below illustrates the case of a phone app that was adapted for a tablet. Because of the larger screen and the higher resolution, the icons and the text appear small on the tablet. As one of our users commented, the app has "a lot of negative space — they didn't stretch out as needed." In fact, although on the tablet there is space for more icons at the bottom of the screen, users have to swipe horizontally and go to the next screen and see more icons. The empty space at the bottom of the screen makes people think that the screen is "complete", so they are very unlikely to discover the second screen.
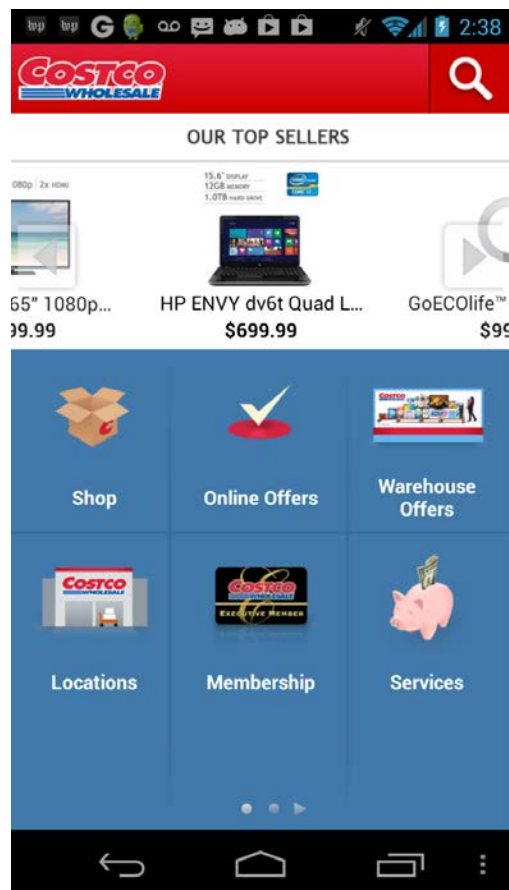
Costco app for Android on a mobile phone.
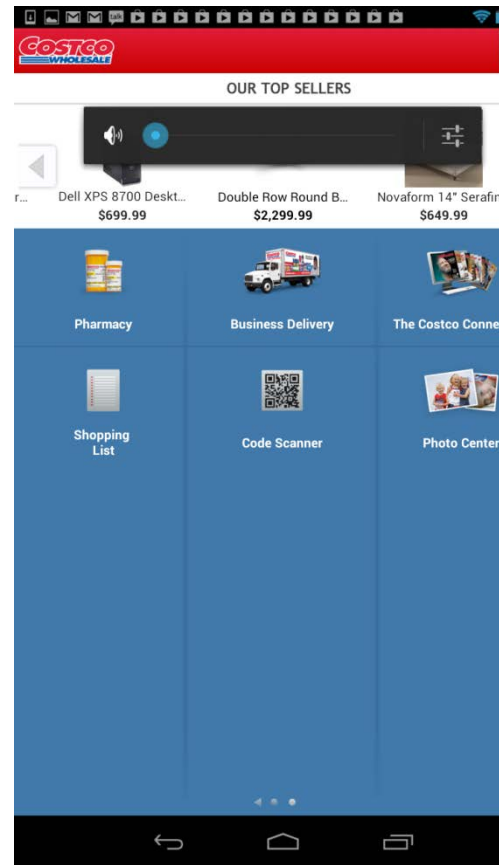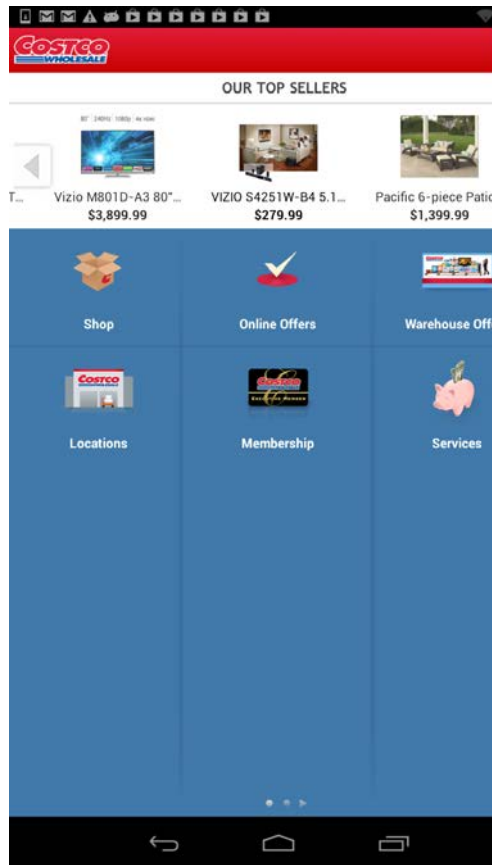
The Costco app on an Android tablet. The tablet app is practically identical to the phone version. As you can see, the design wastes space on the larger tablet screen. Moreover, users still have to navigate to a second screen to access the additional navigation options.

Baby Bump is an iOS app with two different version: iPad and iPhone. Although the iPad version is separate from the iPhone one, the interfaces are exactly the same, only bigger on the iPad. Unfortunately, although this type of design is fast and economical, it is not often appreciated by the users, who feel that the app does not take full advantage of their tablets.
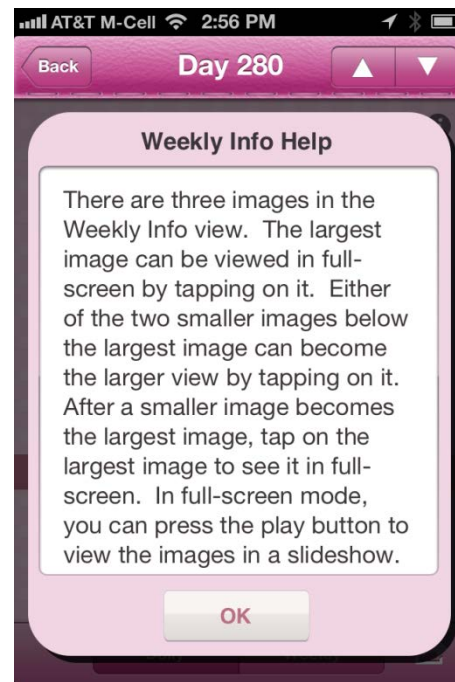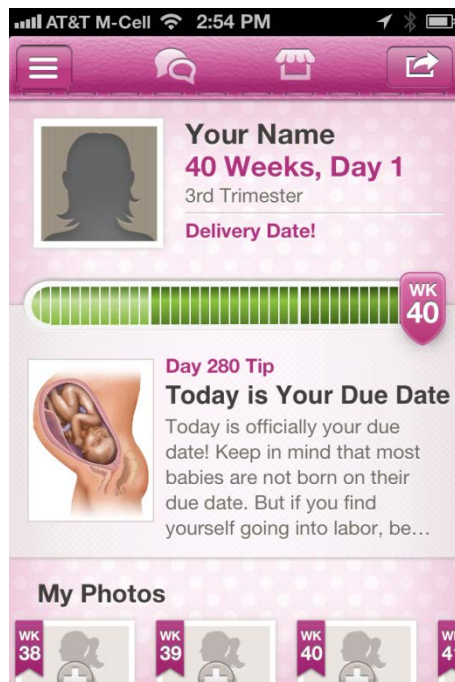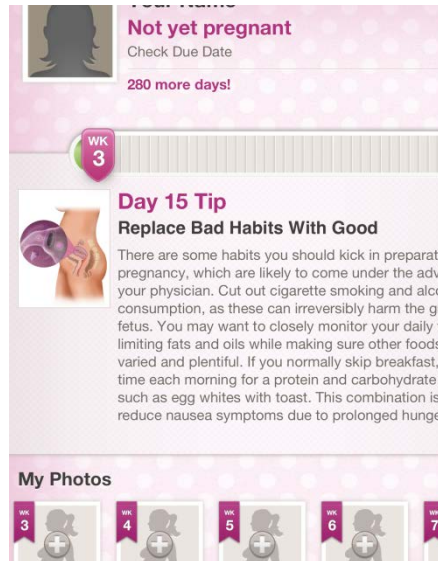
BabyBump for iPad (top row) and for iPhone (bottom row). The app has an identical interface on the iPad and the iPhone. Many screens look underutilized.

Guidelines for Making Desktop Sites Tablet Friendly

When the iPad came around, one of our first usability findings was the **read–tap asymmetry:** content from a full site is fairly readable, but not easily actionable because it's simpler to hit smaller targets with a tiny mouse cursor than with a fat finger. Building a tablet-friendly site (or, better, adapting an existing desktop site) is a fairly easy task; most of the work revolves around making it easier to tap.

6. **If you don't have a tablet version of your website, direct the user to the full (desktop) version of your site and not to the mobile version.**

   Why not take tablet users to mobile sites? Most are already optimized for touch, they have big targets and easy to read content, so making people use them seems like an obvious choice.

   That's just in theory. In practice, we've seen many users complaining when, instead of the full site, they got the mobile site on their tablet. The main reason is that the mobile site looks empty and sparse, and people feel like they're missing out on important content. There is a lot of empty space and the screen feels underutilized; users feel cheated when a tap buys them so little content.
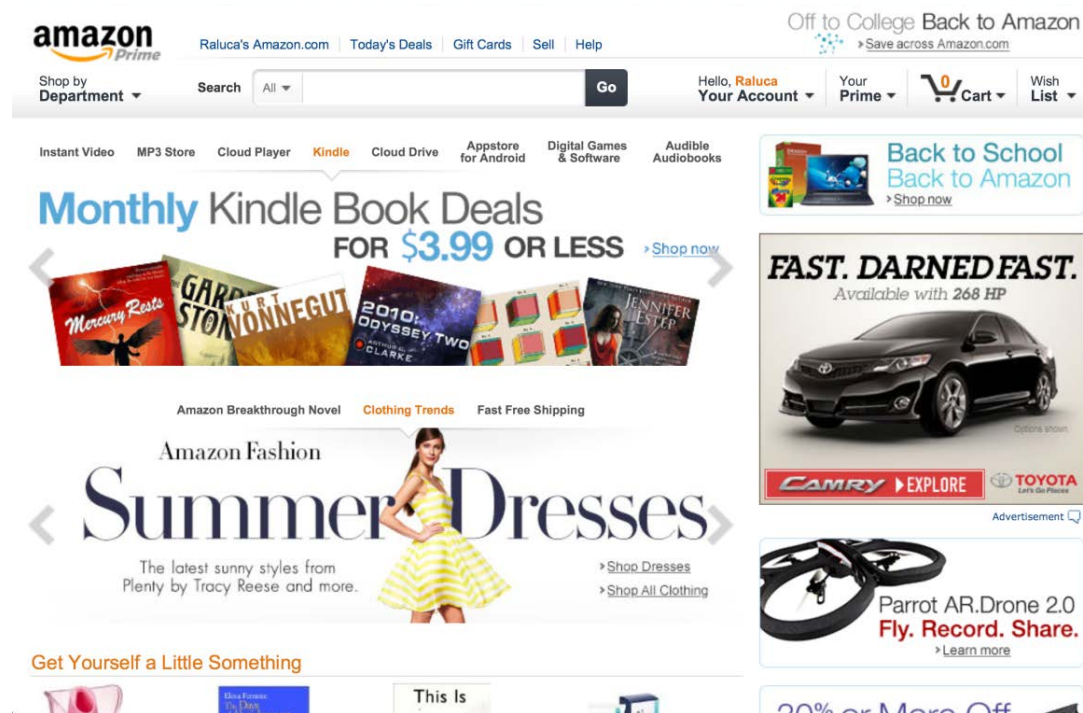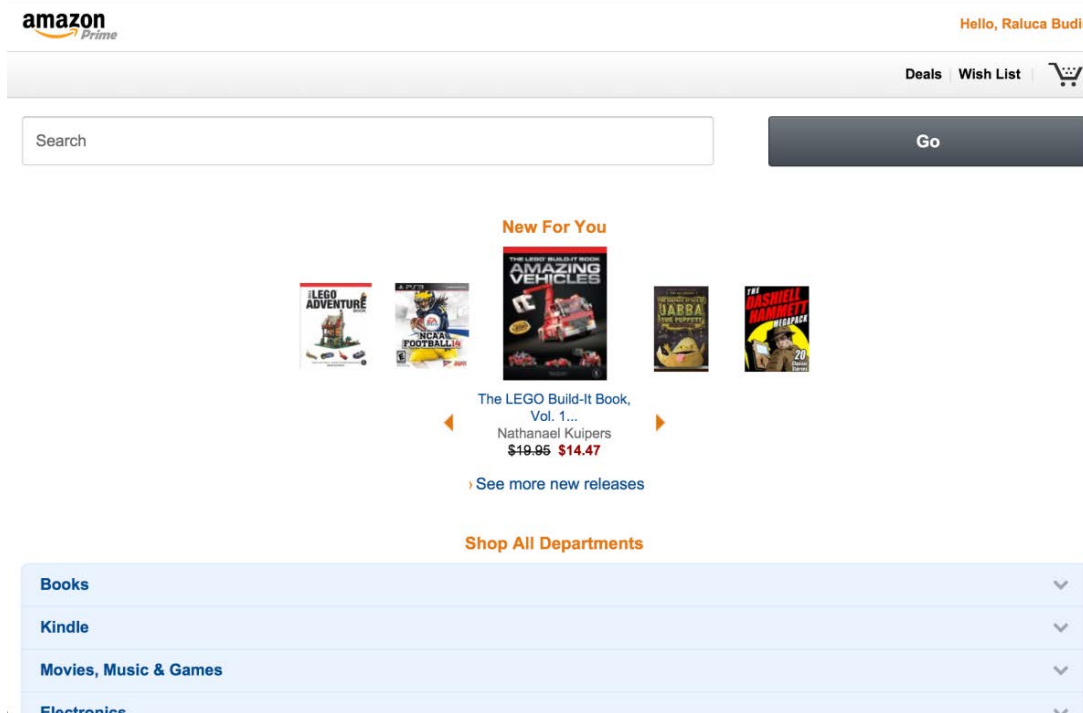
Amazon.com: Full site on a tablet (top row) and mobile site on a tablet (bottom row). Although the targets are big, the mobile site has a lot of white space. The full site seems to make a better use of the large screen.

7. **Consider using responsive design techniques to make the layout more tablet-friendly.**

Responsive design is a way to adapt your layout to different screen sizes and orientation. Essentially, the design elements are laid out on a grid; the cells in that grid can be rearranged to respond to different screen sizes.

We've found that responsive design is truly successful when it deals with a small range of screen sizes (e.g., designs that span 7–12 inch sizes, or tablet to desktop designs). For mobile, one can question whether it's appropriate to always have the same features present on desktop and on mobile; for tablets, it's a lot less arguable.

Many of the responsive design techniques give priority to content on a small screen by compressing the navigation in menus or replacing the search box with a search tool, or moving navigational elements around. As we will see later in this report, some of these are less successful than others on a tablet.

8. **Use jump links to take the user back to the top of the page quickly.**

Because the tablet screen is too small to contain all the information needed for most tasks, users may have to scroll down through a lot of screenfuls before they get to the bottom of the page, and then they may need to go back to the top of the page to access navigation or other action buttons. Make it easy for them to go back to the top by including a jump link or a button at the bottom of the page; consider making this jump link persistent so that users see it as

soon as they start scrolling. (Note that on the iPad, tapping the status bar takes the user back to the top of the page, but few people are aware of this feature).
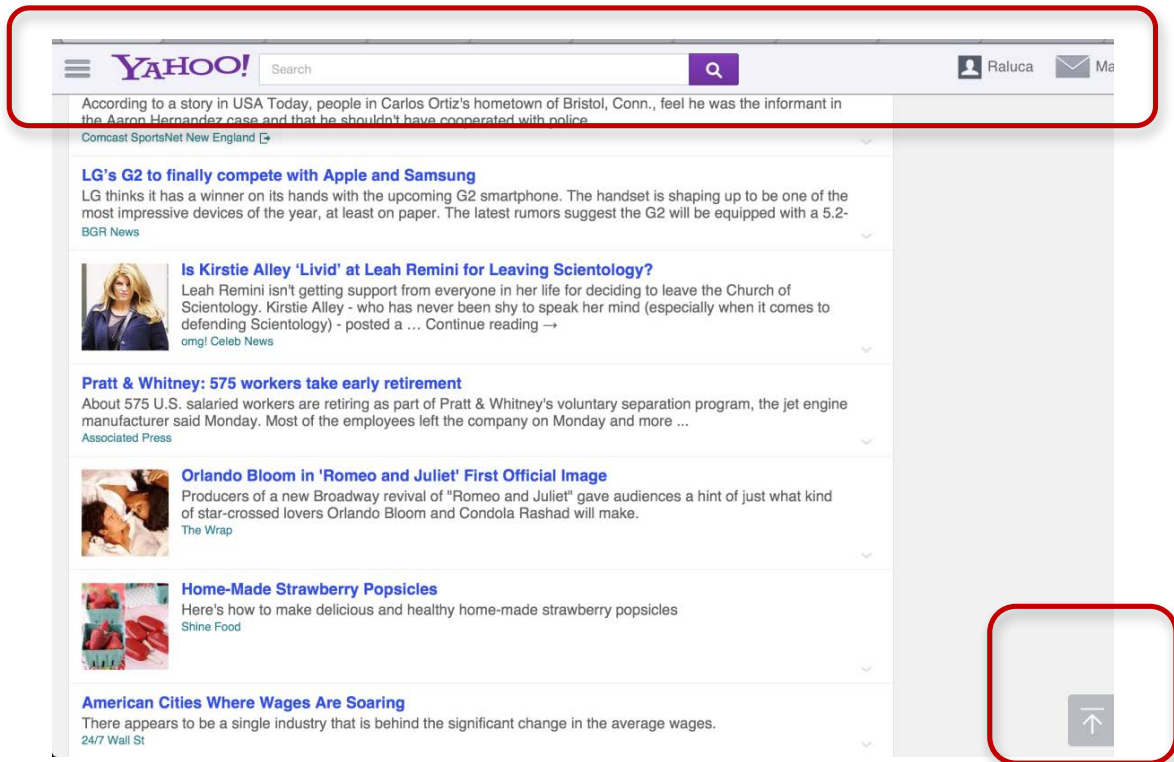
Yahoo.com: The arrow at the bottom is persistent, and appears as soon as the user starts to scroll down. The arrow takes the user back to the top of the screen. Note also that the top navigation has been compressed in a menu (top left corner) to occupy less space. The navigation button and the search bar are persistent on the screen: they stay pinned at the top even if the user scrolls down the page. (However, hiding navigation under menus can be dangerous because some users may miss it — see our section on navigation).

9. **Use persistent buttons to make it easy for people to access important features as they scroll down the page.**

Navigation or Add-to-cart buttons tend to be placed at the top of the page. When people scroll down on a page, it can be tedious to have to scroll back again to access the features placed at the top. A jump link to the top can help, but one extra step can be saved by making essential buttons persistent.

The Yahoo example in the previous guideline illustrates pinned-down navigation and search. Amazon used to also pin down the Add to Cart button in older versions of the website, but no longer does it. eBay adds a persistent search button (as well as an arrow that takes users back to the top of the screen).
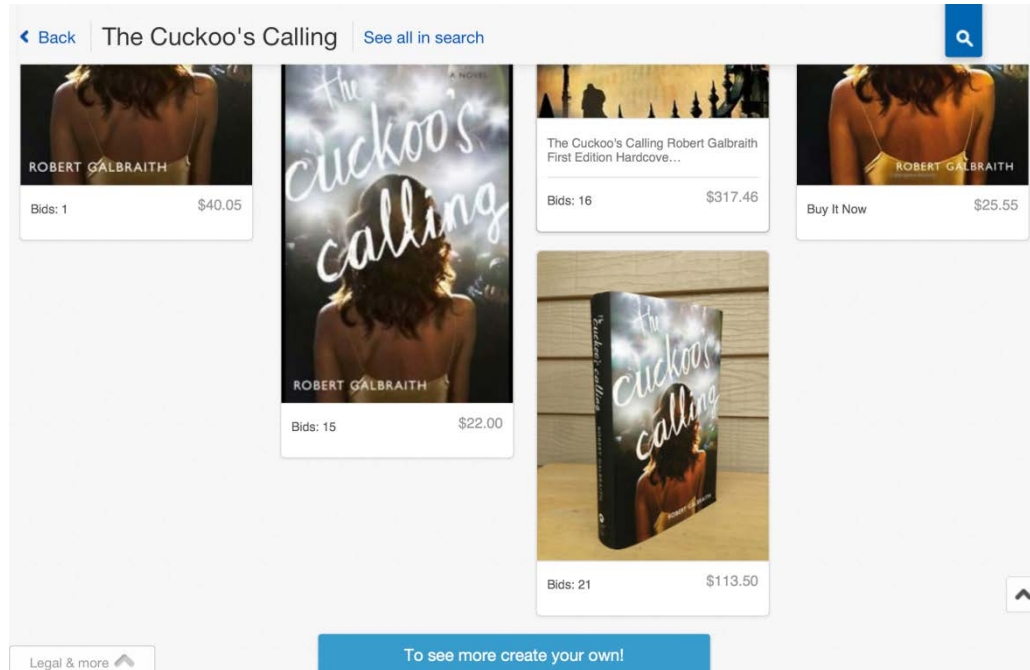
eBay.com: The persistent search button in the top right corner, and the name of the product (as well as the persistent arrow taking users back to the top of the screen) make navigation easier for tablet users.

10. **Avoid small fonts: They are hard to read on the web, and can be even harder to read on a small screen.**

11. **Use good contrast to help users see the content in a variety of lighting conditions.**

    Full web pages are relatively easy to read on a tablet screen provided that the font size is reasonable. Once the font size becomes too small, people need to zoom in to increase the font size, which leads to loss of global context and horizontal scrolling.

Klm.com: Some of the links on the page have tiny text and are hard to read. Note also that not all the buttons display well on the iPad.
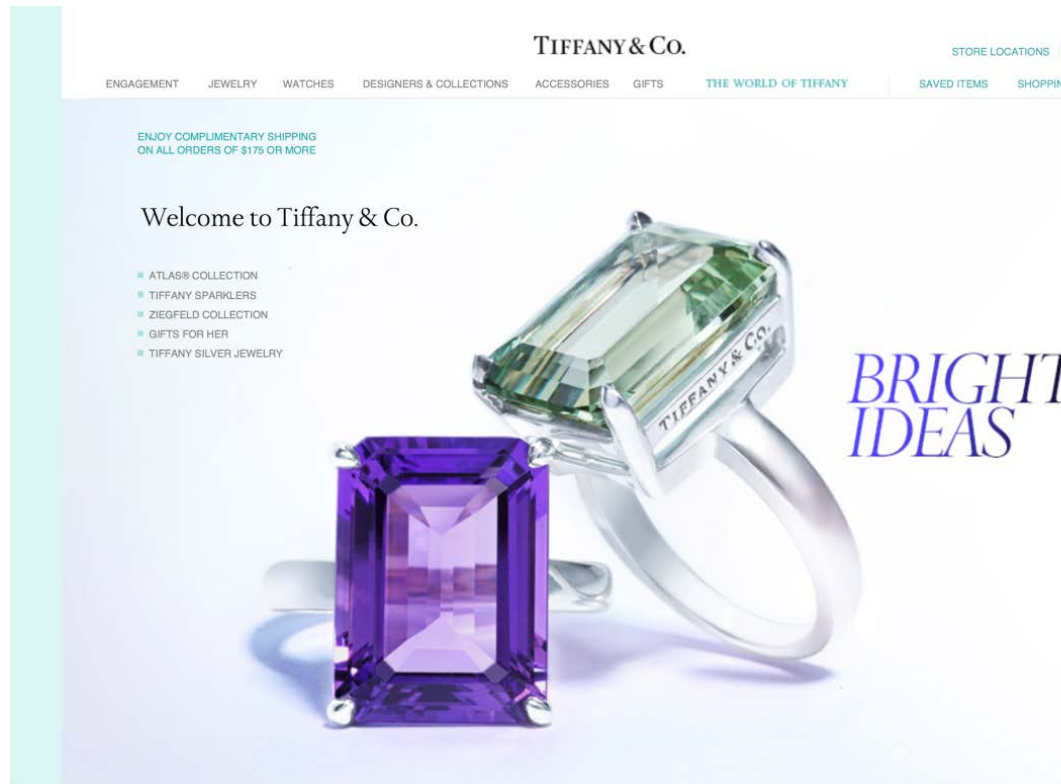
Tiffany.com: The text is small and the contrast between the text and background is poor.

12. Make sure that all the information that disambiguates a link is close to that link or in the link text. Group related information.

Looking at a full site on a small screen is like looking through a magnifying glass: some of the overall context in which content appears may not be present on the screen. People may interpret information incorrectly when the proper context is absent.

We had several participants getting lost on Harvard's site when looking for admission requirements for the Psychology doctoral program. Some found themselves on Harvard Business School's page, following the words "Doctoral". The page did not really mention to which program the listed requirements corresponded; the only cue was the logo and the words "Harvard Business School" listed at the top of the page. (And even if they noticed that, some people may still wonder whether Psychology was part of the Business School.)

On pittsbrghkids.org (a responsive site), users had to check if there were any discounts for AAA members. The discounts were all put together in a PDF document that was at the bottom of the page. Because the PDF was far from the actual place where the discounts were mentioned, it was easy to miss it and think that a sloppy webmaster had forgotten to include it.

Pittsburghkids.org: Some people missed the list of discounts because it was separated from the text describing the discounts.

Harvard.edu: Some participants looking for the doctoral program in Psychology ended up on the Business School page. Note that the links and

the text do not mention the doctoral program. The Harvard Business School is only mentioned in the black banner.

13. **Whenever appropriate, use the device GPS to detect the current location.**

People are more and more used to their device being able to take advantage of the GPS to detect their current location. Initially, that was only possible in native apps, but today most browsers can use GPS information. Take advantage of that capability to make it easier for people to input information.

TARGETS

When it comes to reaching targets, both the mouse and the human finger are subjected to Fitts' law[3]. Fitts's law is a famous human-computer interaction finding, which says that the time depends on the distance to the target and the size of the target. More specifically, the farther away a target is, the longer it takes to reach it; and the bigger a target is, the faster it can be reached. For those mathematically inclined, here is the actual formula:

$$= \ + \ \log(2 \quad),$$

with   being the distance to target, W the target width, and $a, \ b$ two device-dependent constants.

For our discussion, the two constants a and b are the main source of difference between the optimal target size for mouse versus finger. In other words, human fingers are fatter and thus need bigger target size in order to hit targets fast. But the bigger target size is actually going to benefit mouse users as well.

If you are adapting your full site to tablets, change target size with touch in mind.

14. **Make links and targets big enough. The touch-friendly size for buttons and other widgets is 1cm x 1cm or larger. If that cannot be achieved, you can compromise a little in height rather than width of the targets.**

15. **Leave space around links. Consider padding widgets to make them easier to touch.**

Parhi, Karlson & Bederson (2006)[4] showed that, for touchscreen portable devices operated with one hand, the optimal target size was a 9.6mm square (approximately $1cm^2$) for discrete tasks (that is, tasks that involved an isolated click, as opposed to a series of clicks; a series of clicks is more representative of typing).

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[3] Fitts, P.M.(1954). The information capacity of the human motor system in controlling the amplitude of movement. *Journal of Experimental Psychology, 47*, p.381-391.
[4] Parhi, P., Karlson, A. K., and Bederson, B. B. 2006. Target size study for one-handed thumb use on small touchscreen devices. In *Proceedings of the 8th Conference on Human-Computer interaction with Mobile Devices and Services* (Helsinki, Finland, September 12–15, 2006). MobileHCI '06, vol. 159. ACM, New York, NY, 203-210. DOI= http://doi.acm.org/10.1145/1152215.1152260

Therefore, all these interfaces must build in some tolerance to error by (1) leaving generous amounts of space around widgets that need to be clicked (buttons, arrows for dropdown boxes, links, scrollbars), and by (2) increasing the target size of these widgets. The first condition ensures that people will not accidentally click on the wrong widget. The second condition builds in some room for reaching error.

Go back to your site and look at the links and buttons. Are they big enough for touch? If not, try to resize them and space them so that it's less likely to make an error when on a touch screen.

Footers are often places with many tiny targets close to each other. Luckily, the footer structure can be easily changed because the footer is the last thing on the page and its redesign should not affect much the other elements on the page.

Restaurant.com's full website on a large-screen tablet. While many of the buttons and links on the page are big enough for a touch screen, the links in the footer are too close to each other. These links are hard to select on a tablet.

16. **Protect against accidental touches by asking confirmations for any irreversible action (or action that may be hard to revert — e.g., placing an order).**

Because people often move their hands across the tablet surface in order to reach a target, it's really easy to accidentally touch something. Luckily, browsers have a built-in back button, so, if the touch leads to navigating to a new page, users can easily go back. Problems arise however when the touch results in an irreversible action (e.g., delete, place an order, send an email).

One of the authors was checking her LinkedIn page on her tablet, looking for new connections. The speed was quite slow, and she was trying to scroll down to see more people. However, instead of carefully planning the scroll on the side of the screen, she carelessly scrolled on top of the connections. As a result, some of the Connect buttons got pressed inadvertently. Unfortunately, LinkedIn does not ask for confirmation before sending an invitation to connect, so the result was unintended and irreversible.
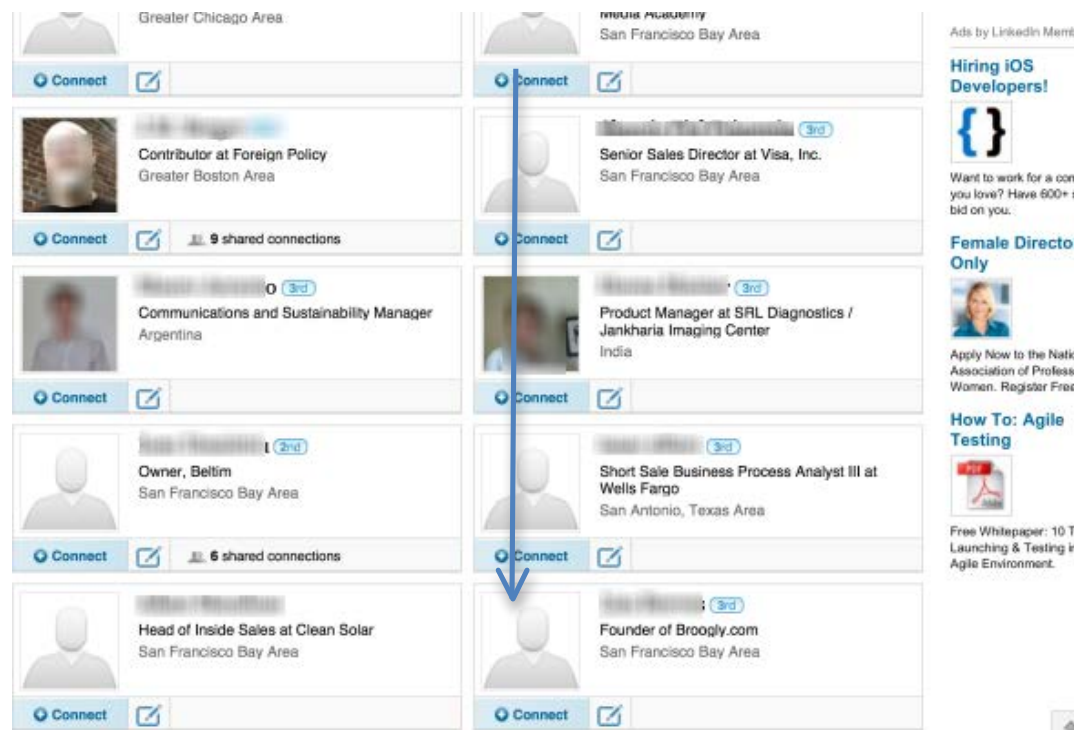
Linkedin.com: Scrolling on top of the Connect buttons inadvertently led to some of these buttons being pressed. As a result, invitations to connect were sent.

17. **Do not use mouse-specific functionality (e.g., hover states, right button clicks).**

Some styluses have an extra button that is the equivalent of a right click on the mouse. However, the majority of tablet owners use their fingers and do not have access to anything else but a tap. Avoid relying on functionality that is inaccessible on touch screens.

PLUGINS

Many of the technologies fairly common on the web do not work on certain types of tablets. Avoid them whenever possible (or be aware that some may break).

18. Do not use Flash.

19. Test your Javascript code to make sure it works on tablets.

Although both iOS and Android support Javascript, there can be incompatibility issues between their versions and those that run in desktop browsers. Thus, certain Javascript-based features of your website may not work well on tablets.

eBay's iPad app has an embedded browser that takes the users to a desktop page to finish the registration as a seller. That page relies on a Javascript version that is not supported by the tablet browser.
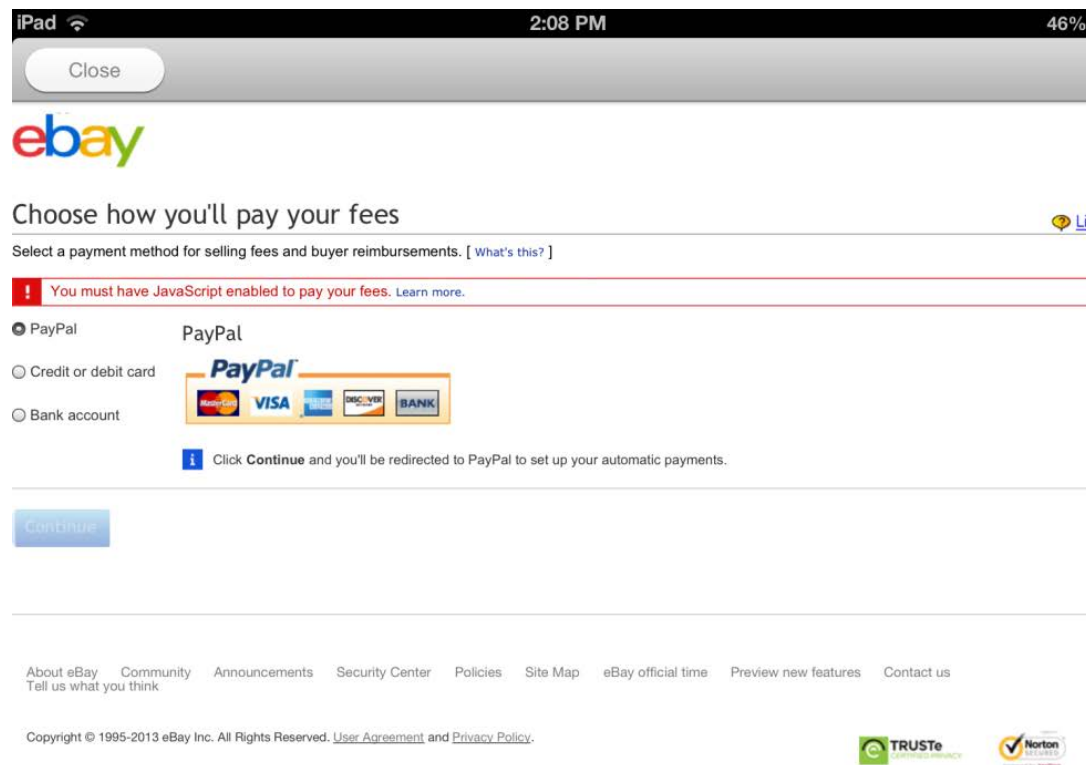
eBay for iPad. The within-app browser displays a Javascript-related error message when a desktop page is displayed.

20. Do not use PDFs. They break the flow and some users have difficulty reading them.

We recommend against PDFs on desktops and on tablets. We've seen people struggling to read PDFs on tablets: some Android users had to check their

Downloads app and access the PDF from there, then go back to the website they were originally interacting with.

As one of our users put it:

"I really don't like when a website makes me use a PDF. I really don't like them — it's not 1990, put them on the web."

Naming the App

The name of the app serves to enable the user to find the app in the app store, and later on, after the user has installed in, on the user's device. Some participants associate apps with the name of the company that created it, especially if it is a well-known brand (e.g., AAA, Amazon, Reuters). That association needs to be preserved and reinforced when choosing a name for the app. You want users to find the app when they search by company name both in the app store and on their own device.

21. **Make sure that the name of the company is included in the name of the app and in the keywords that are associated with the app, especially if it's a name that users are likely to know or recognize.**

Although the icon for Reuters' app "The Wider Image" contained the Reuters logo (and the name Reuters was included in the splash screen, as well as the description in the app store), when searching for Reuters on the iPad, this app did not appear as one of the results.

Users may associate apps with the company, but may not remember exactly the name of the app. For instance, in the case of Reuters, they may remember that they have a news app and a photo essay app from Reuters, but may not know exactly how these apps are called. If the names of these apps do not include Reuters, it's hard to find them either by search or by looking at a list of apps.
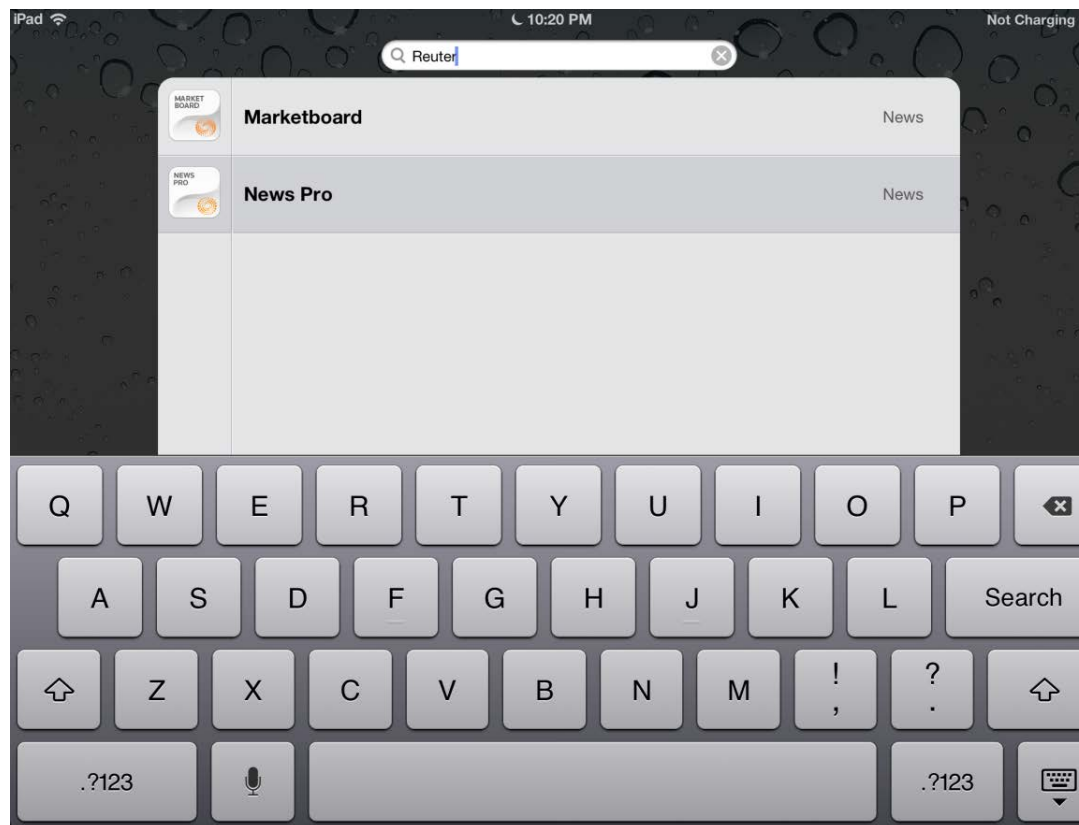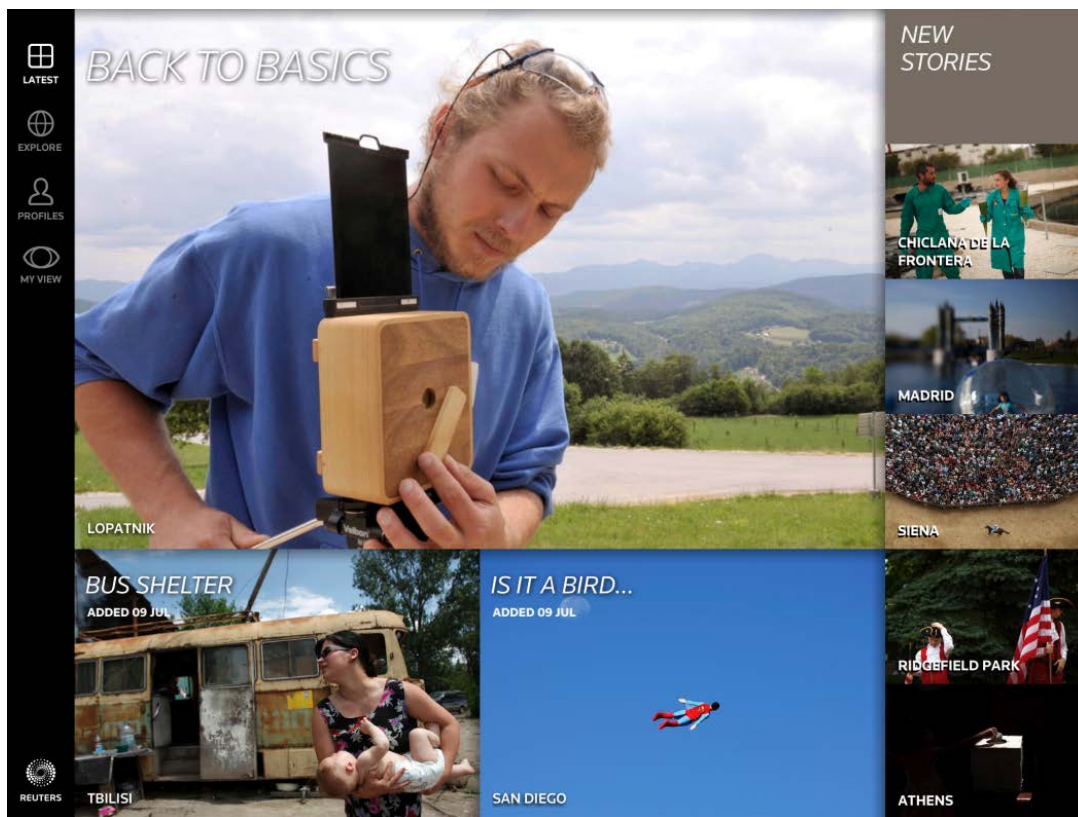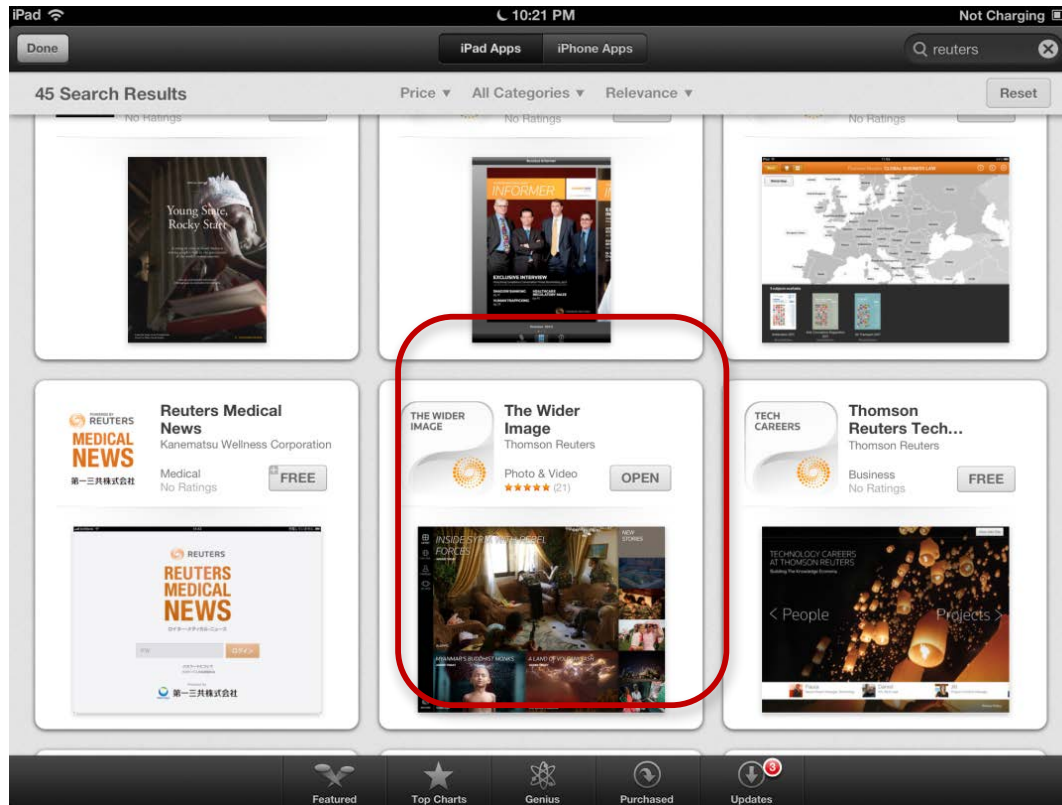
INFO@NNGROUP.COM   Naming the App

Sometimes companies use nonstandard abbreviations to shorten the name of an app. One of our participants had a hard time finding a recipe app from Better Homes and Gardens in the Play Store because he was searching for "Better Homes and Gardens" and the app appeared as "BHG recipes" in the Play Store. The participant commented that he was not familiar with the "BHG" abbreviation.

22. **When a company provides multiple similar apps, the icons and the names should help the user differentiate between apps.**

When all apps from a company have the same logo, it's hard for people to distinguish between them, both in the app store and on their own device. As one user commented:

"Same icon for different apps — I am questioning myself, which should I buy?"

Although the app name and the icon should include the logo and the company name, some variation in design will help users differentiate between these different products.
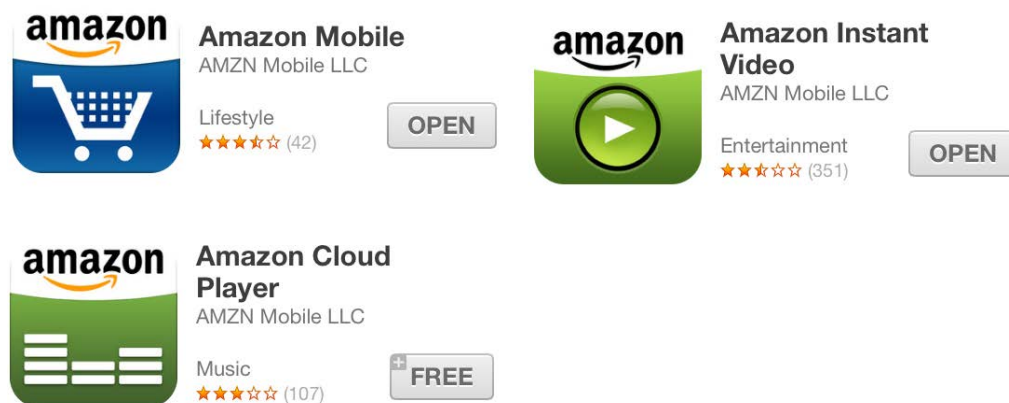
Three apps from Amazon. They all contain the Amazon logo in the icon and the word "Amazon" is part of the app names.

Skeuomorphic Design

When the iPad first came out, with it came a wave of skeuomorphic (or immersive) designs. Magazine apps were all designed to behave like real paper magazine. E-books were lined up on shelves that look as if they were made of wood.

Skeuomorphism is a fancy word for design that mimics a real-world object. Beyond the charm of an e-reader app in which e-books look like physical books, the assumption behind skeuomorphic design is that users are already familiar with the real-world object from their daily life, so they will naturally know how to use a digital objects that replicates the look of the real one. This assumption is a reasonable one; unfortunately it doesn't always stand up in the digital world. There are three situations when the skeuomorphic design typically crashes:

(1) The skeuomorphic design may not copy the real-world object closely enough;
(2) The skeuomorphic design may clash with the mental model of a digital object;
(3) The skeuomorphic design can make the user work more than a simpler design.

The Contacts app on iPad is an example of skeuomorphic design that creates the wrong affordance by copying the look of an old-fashioned telephone book, but not supporting flipping through the pages by swiping.

The original magazine apps clashed with the mental model of a hyperlinked electronic document; for instance, the story titles on the cover were not tappable. We talked about this issue at length in our first iPad report, and, luckily, it got fixed. Most modern magazines have hyperlinking and managed to successfully walk the fine line between the physical magazine mental model and the electronic document mental model.

Finally, the third instance where skeuomorphic design fails is when it makes a complicated interface of something that could be quite simple if it followed the current standards and practices. This type of situation often arises from the need to make an application unique and fun. An example is the popular bookshelf interface for documents. The big disadvantage of this interface is that the titles can be a lot harder to read and cannot be sorted easily. (Proponents of the bookshelf design argue that people see more of the book cover in this interface, and that the book cover helps identify the book. Unfortunately, with digital books, most users don't actually see the cover very often: they just restart the e-reader and continue to read from where they left, without navigating to the bookshelf. Thus, unlike with a physical book, they are not exposed frequently to the book cover, so their familiarity with it and their ability to recognize the book by its cover are quite reduced.)

Contacts for iPad: Because of the ressemblance with a book, users may be tempted to swipe to turn pages. However, that gesture does not work.
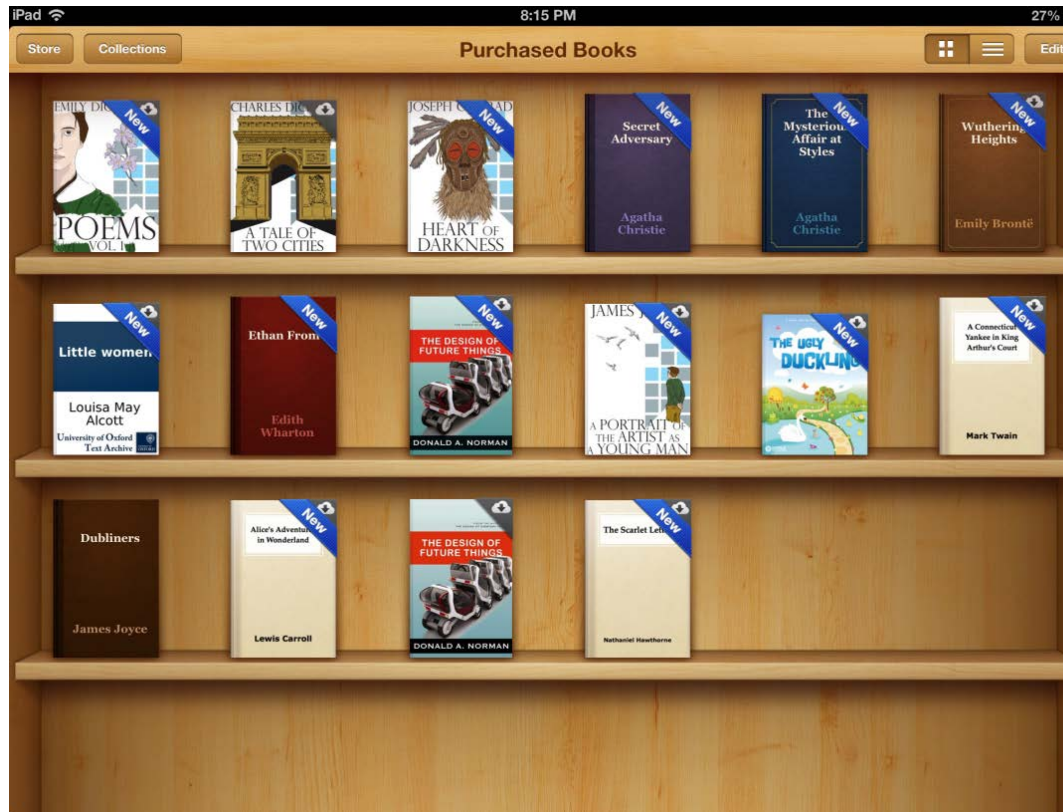
iBooks app for iPad is an example of skeuomorphic design. The books are placed on real-looking shelves.

A more serious example comes from one of the apps that we tested, CVS for iPad. The app used a brick-and-mortar–store-like navigation scheme that puzzled one of our users, who wanted a search box to enter the product he was looking for. He did not want to spend the time and guess what the different clickable areas in the virtual store meant. The user commented:

"I am tempted to go to Google… What's the point of these icons [+ signs] right here? I don't shop at CVS so often to know what the different aisles are… So this is the first screen that pops up? Not good…"
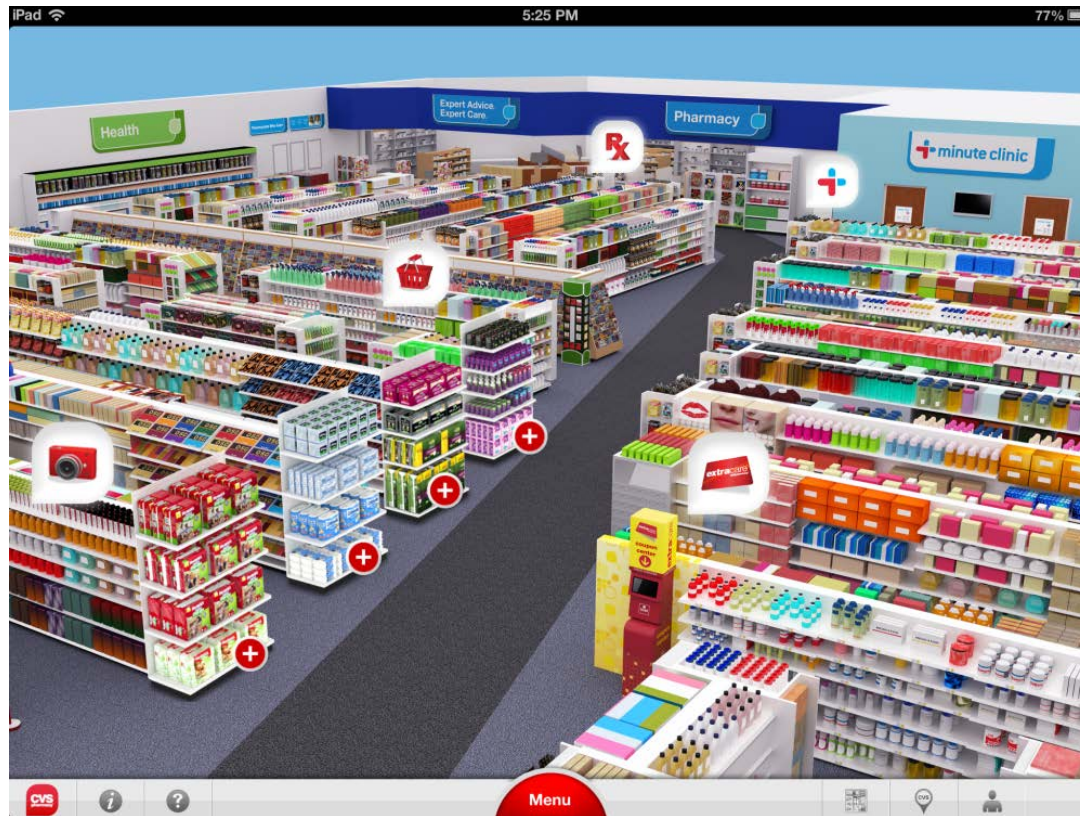
CVS for iPad: Users wanted a search box instead of this virtual shop.

Navigation like this is actually recommended for young children who don't know how to read and do not know how to use the Internet. Most adults are way past that stage and don't have the patience for egg hunting.

23. **Make sure that your skeuomorphic design makes things easier for the user rather than more complicated.**

Unfortunately, first and foremost, apps have to be easy to use and to make the user efficient at their task.

Touch Targets

In the previous section, <u>Guidelines for Making Desktop Sites Tablet Friendly</u>, we talked about Fitts' law and the recommended target size for touch screens. Of course, those recommendations stand whether you want to design a tablet app/ website, or you just want to improve your existing site for touch screen users.

24. Make targets big enough. The recommended size is 1cm X 1cm.
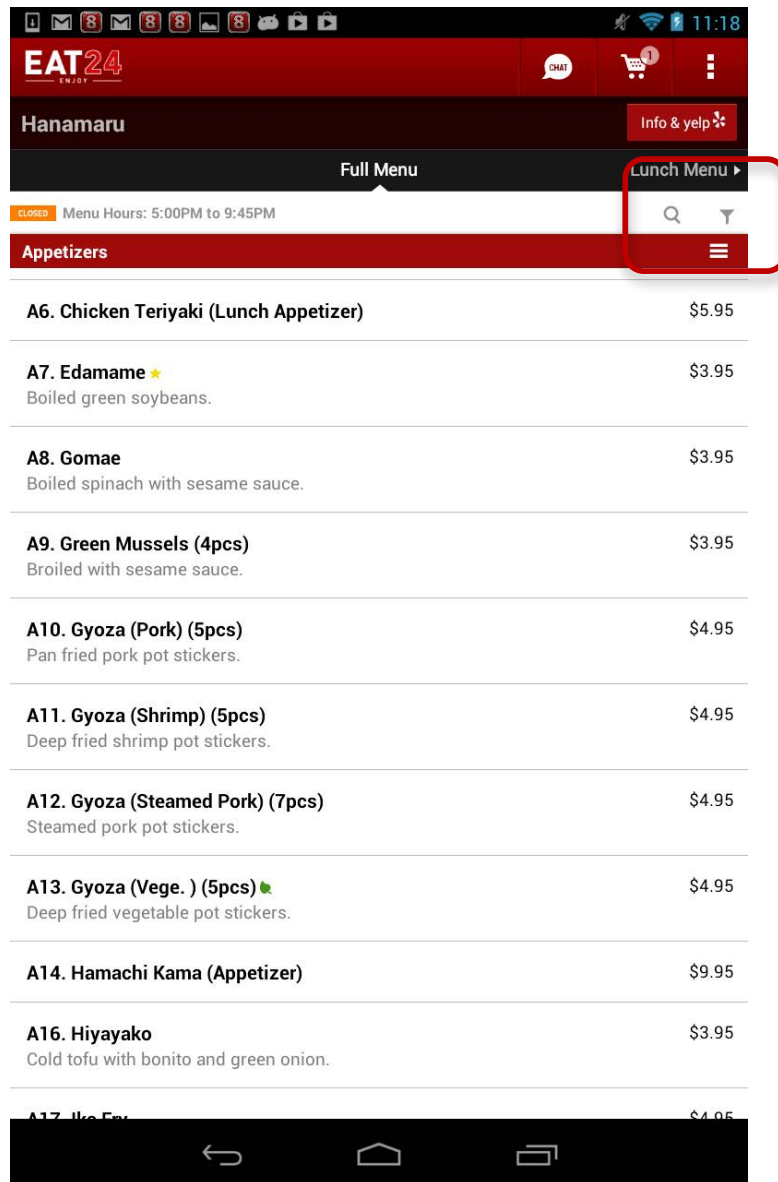
Eat24 for Android: The icons for Search, Filter and menu categories are tiny and too close to each other.
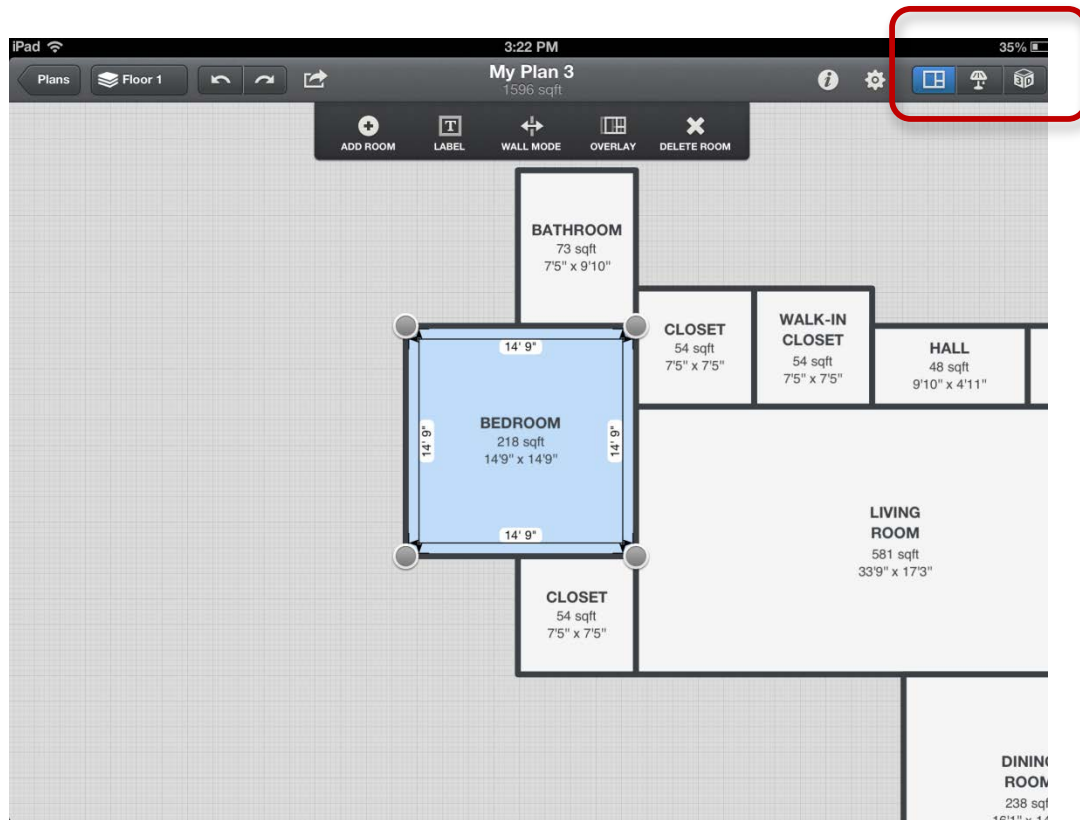
Interior Design for iPad: The targets in the top right corner are too small.

Lennox icomfort: Most target sizes are big and easy to tap.

25. **Avoid crowding targets.**

We've pushed these guidelines since we published our first report on Mobile Usability; they are still valid today. We still see designers succumbing to the desire to make room for content by minimizing interface controls. While the desire is laudable, it causes users a lot of grief.

26. **Choose familiar icons and strive to have labels for all your icons.**

Icons can be small and obscure, and may cause difficulty for users. Adding labels to icons is a way to increase the target space and also disambiguate the meaning of icons.
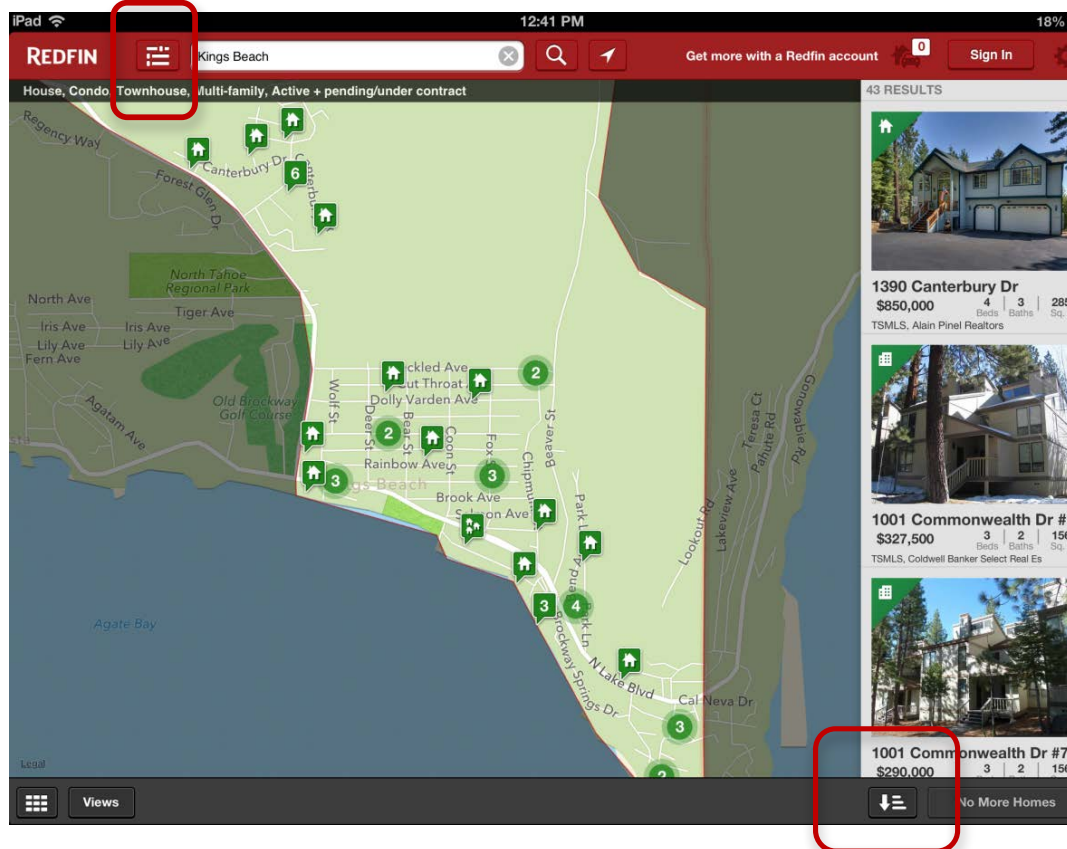
Redfin on iPad: Some of our participants complained that the meaning of the icons was not clear in this app. The top left icon led to filters and the bottom down one stood for sorting. Note that separating filters from sorting options is not a standard design choice.
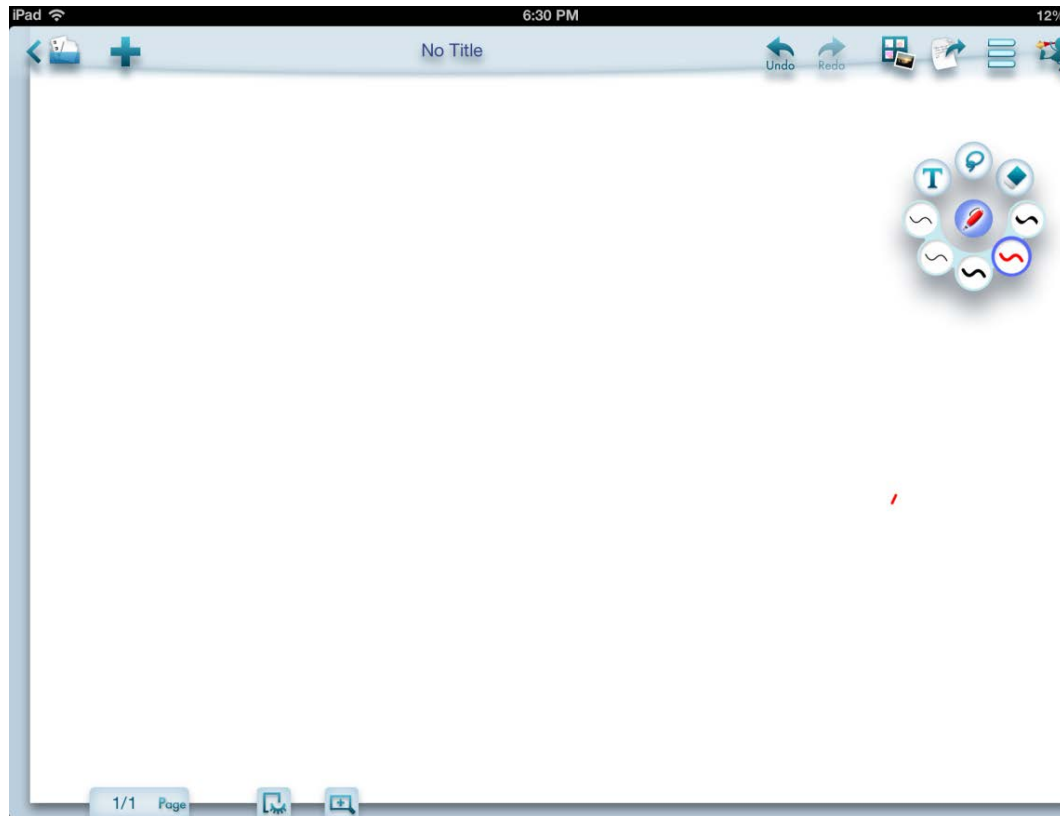
Note Anytime for iPad: The icons are small, crowded, and have no labels. It's hard to guess what they stand for. However, note that the targets are well signaled (they appear raised above the canvas).

27. **Make sure that the targets stand out visually, so people notice them. Avoid targets that blend with the background.**

Busy backgrounds interfere with our ability to observe superposed objects.

Booking.com has a little button on the side of the map, allowing users to search in the area displayed on the map. However, that button blends completely with the map and is hard to notice.
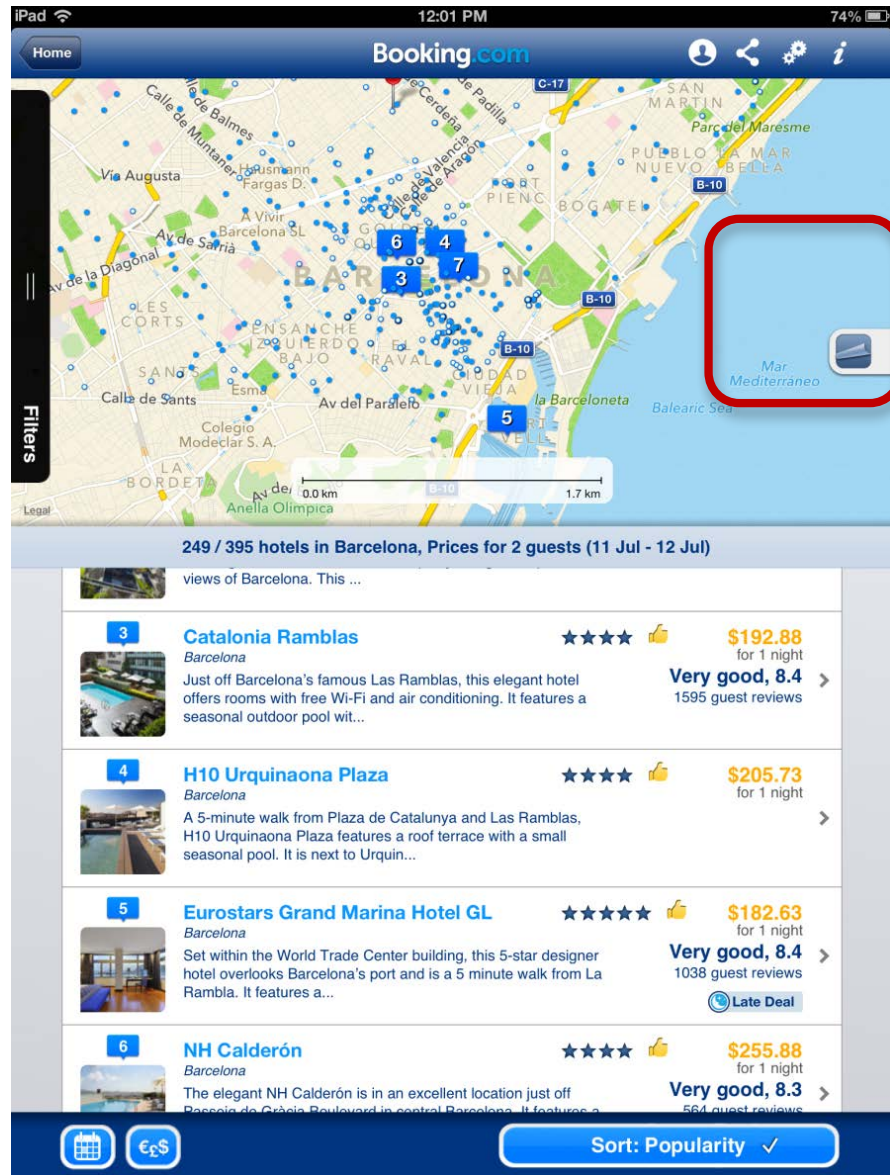
Booking.com for iPad: The button on the right expands to show some map options. However, because it blends in with the map, it is hard to notice.

28. **Build touch affordances by making sure that targets look tappable.**

29. **Do not build false touch affordances by adding 3D dimensionality to elements that are not tappable.**

It's important to make sure that people know what they're supposed to tap on. The current trend towards flat design (exemplified by the Windows 8 interface) makes it difficult to figure out which design elements can be tapped. It becomes really important to settle on a set of tappability cues that are used consistently for all targets in the design.

Android (starting with version 4.0 Ice Cream Sandwich) also favors a flatter style of menus that can be sometimes hard to notice — check the little arrow and the very subtle 3D cues that accompany buttons in the example below.
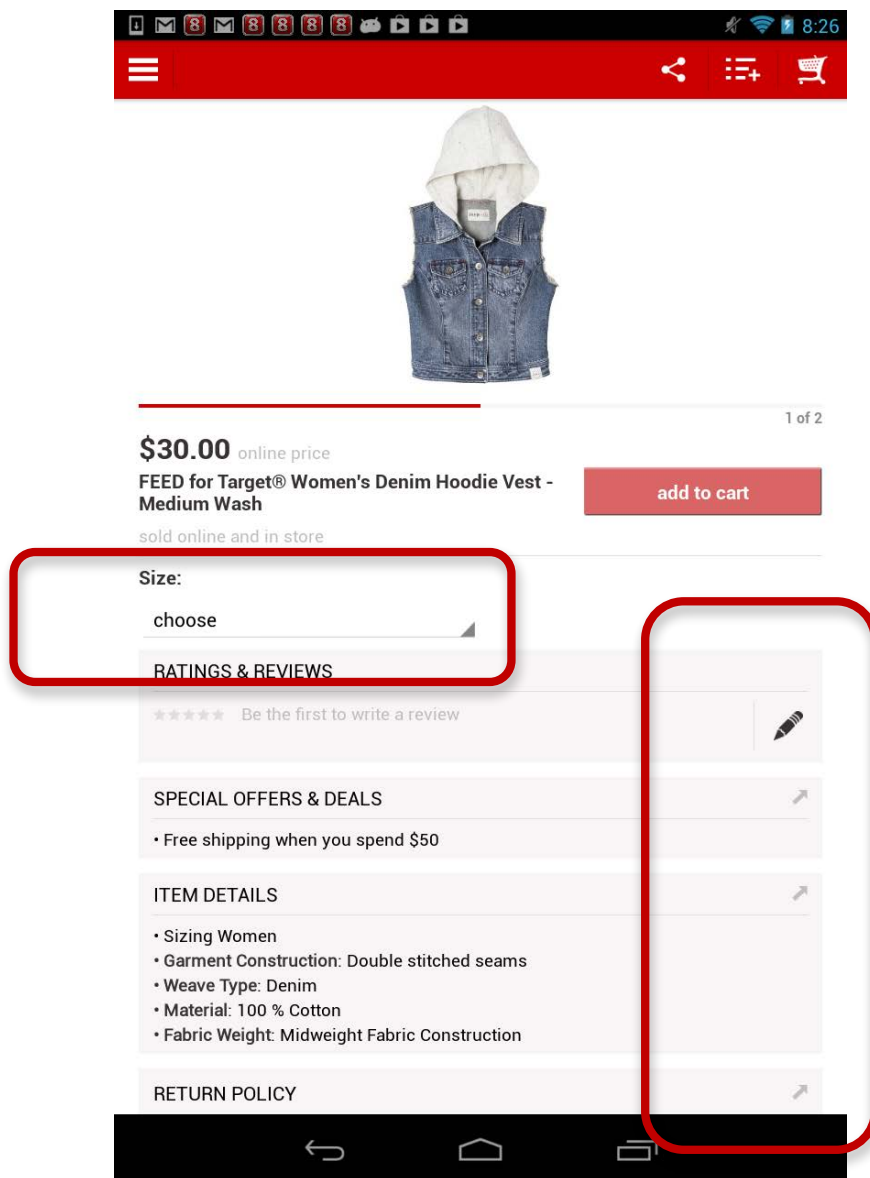
Target for Android. Many of the tappable targets on the screen are easy to miss due to the flat design and to the fact that they blend so well with the background. (Remember that users don't get to see our nice rectangles to direct attention to the proper part of the screen.)

In the Windows 8 example, some targets are accompanied by an icon and some are not (they are just text). People didn't always know how to distinguish between titles and descriptions and targets.
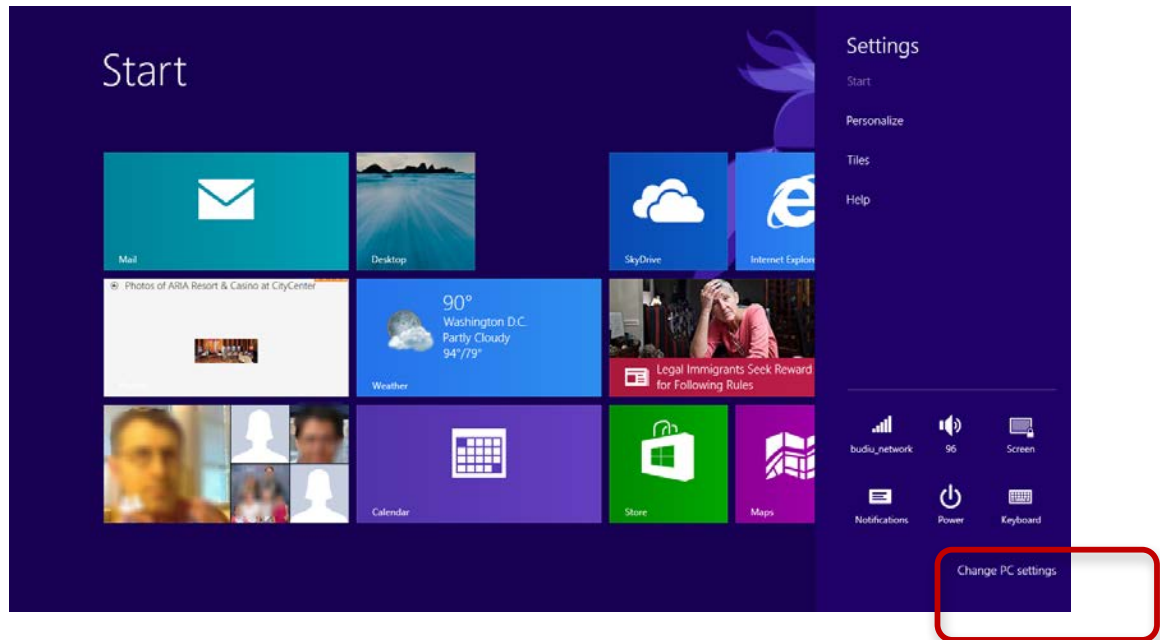
Homescreen on Windows 8: Many users did not realize that the "Change PC settings" was tappable.

PADD for iPad: The app (built for *Star Trek* fans) has many design elements that look like buttons, but are not part of the interface.

Input and Forms

TYPING

Typing on touchscreens is a hassle and most people hate it. Although the keyboard keys are bigger on a tablet than on a smartphone, the process of typing on a tablet is still quite tedious because of the lack of haptic feedback. Whenever people type on a tablet, they have to switch attention between the keypad area and the area containing the string that they are typing.

As one of our users put it:

> "Typing on a tablet is horrendous compared to a computer… It's a hassle to have to type on the screen."

Therefore, one of the basic principles on both tablets and mobile phones is to minimize typing. We briefly enumerate here some of the ways in which it is possible to make users work less at inputting information.

30. **Minimize the amount of typing that the users need to do.**

31. **Whenever possible save searches and any kind of information that people typed in a form field. Allow users to reuse that information later on when they need to fill in a similar field.**

32. **Be tolerant of typos; offer auto corrections.**

    One user mistyped "bouillabaisse" and the BHG Must Have Recipes app wasn't able to find any result. The user corrected his typo, but noted that he wished that the app "would have corrected my typo like Google does."

33. **Offer autosuggestions or autocomplete.**

    These often save users significant typing and they also relieve them from the burden of correct spelling.

34. **Allow the use of camera, voice, and GPS as input devices.**

    All these methods are quick ways to enter information. Many apps now support voice input, and it's become a standard to use GPS information to input a current location. The camera is frequently used by apps to scan bar codes, and even credit cards.

35. **Whenever possible, compute information instead of asking people to enter it.**

    The state and city can often be computed based on the zipcode; the credit card type can be often inferred from the credit card number.

36. **Use sensible defaults based on history and personalization.**

37. **Allow users to copy and paste.**

38. **Make text boxes long enough so that users don't have to scroll within a text field.**

Scrolling within a text box is best to be avoided on a touch screen. Always make sure that a text box will be big enough for the majority of input strings.
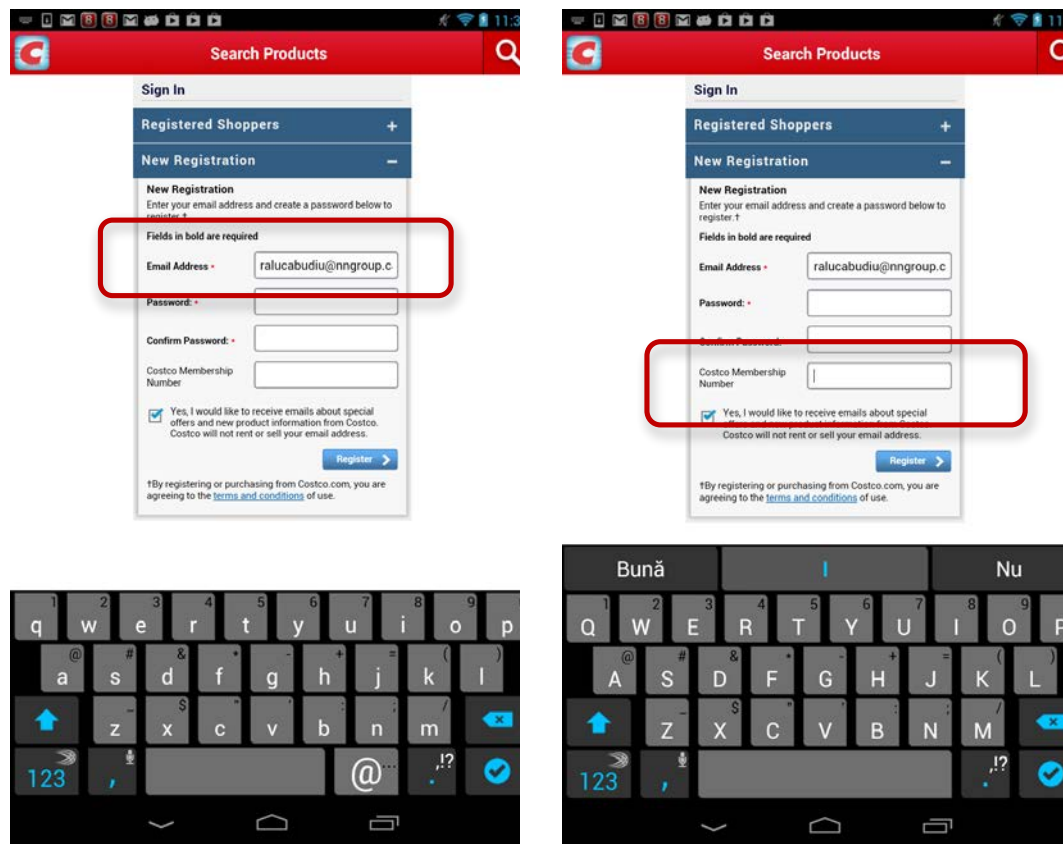
Costco for Android: The email field is too short (left). The numerical keyboard would be more appropriate for the membership number (right).

39. **Make sure that the users can see what they type in both orientations.**

Sometimes the text fields get covered by the keyboard or pushed outside of the visible part of the screen. Typing on a touch screen is already difficult; not seeing what you type can make it even more aggravating.

Sometimes the field is perfectly visible in portrait orientation, but is covered in landscape orientation.
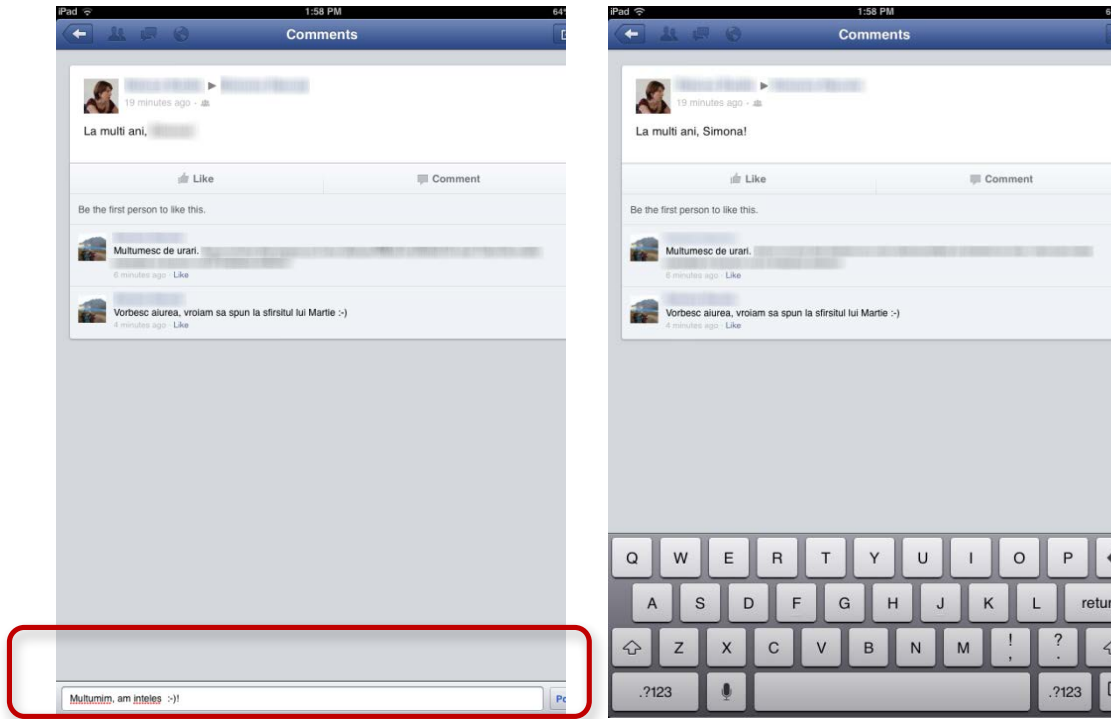
Facebook for iPad (older): In an older version of Facebook, the comment field was covered by the keyboard.

40. Use the keyboard that is appropriate for the field type.

If the field is numerical, show a numerical keyboard.

41. Auto-format fields rather than asking people to type fields in a specific format.

Don't ask for spaces or dashes in a phone number; but let people use them if they want and post-process the input to bring it to a desired internal format.

DROPDOWNS AND PICKERS

Scrolling through a long list within a small region of the screen can be tedious and counter-productive. It may be a lot faster to type a few letters of the string than to pick an option in a long list.

42. Do not use spinning pickers for dates. Consider a calendar widget to input dates.

Spinning date-and-time pickers are slow and error-prone for tasks where users are likely to need to specify a wide range of dates.

A calendar widget is usually more efficient for specifying a date, because it shows an entire month at a glance. (Or even multiple months in certain designs.) By visualizing the relationship between dates, calendar widgets also reduce the frequency of certain user errors.
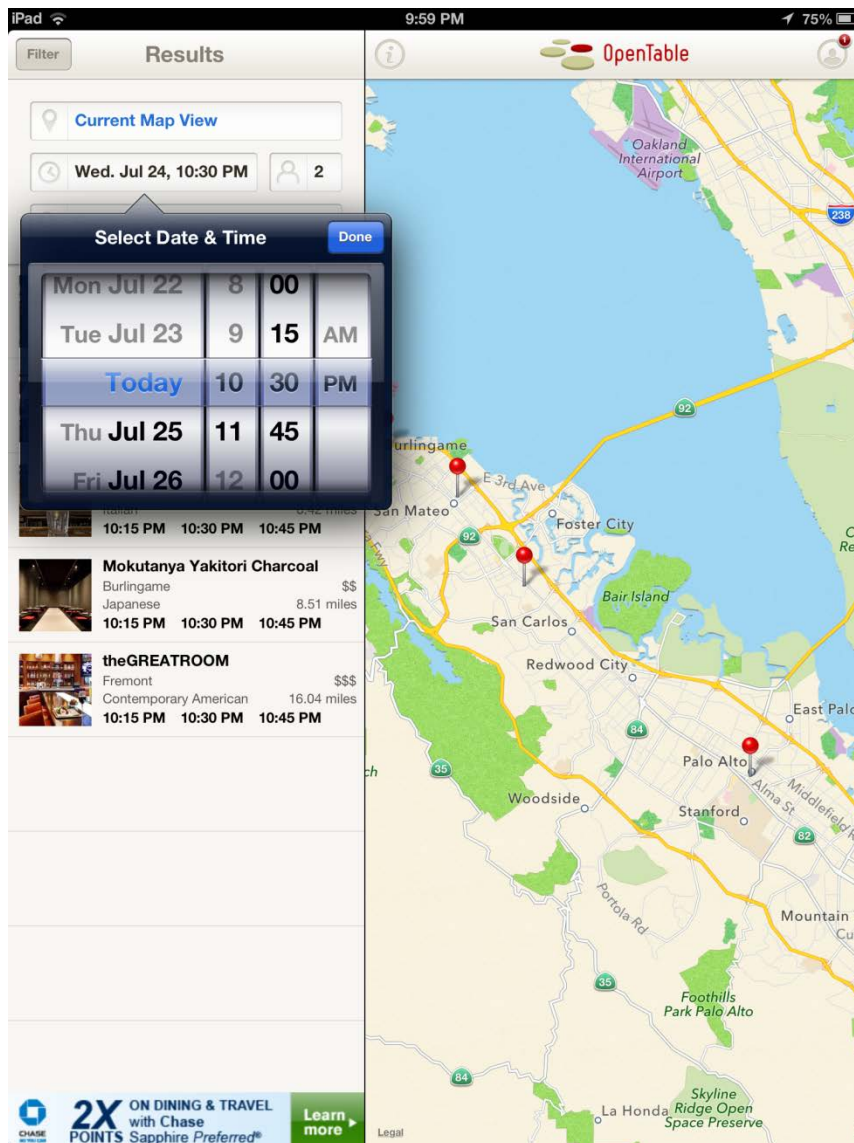
OpenTable for iPad: The date picker is easy enough to use when making restaurant reservations for today or tomorrow. But it's awkward and requires a lot of spinning when planning further into the future.
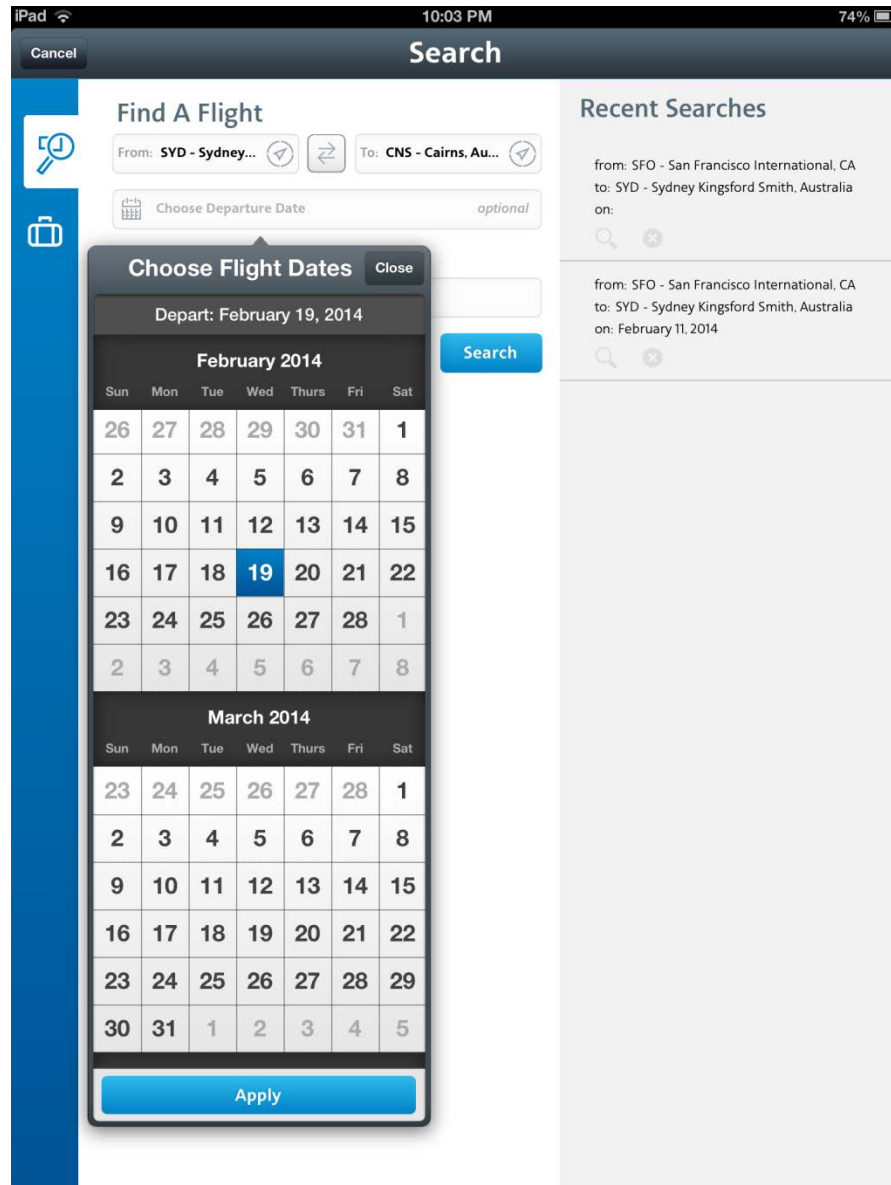
American Airlines for iPad: The calendar widget makes it easy to specuify dates within a two-month window by a single tap. It's also reasonably efficient to slide the calandar up by a few months at a time to make reservations further into the future. By showing two months at a time, the design makes it highly likely that a round-trip ticket can be booked without the need to further change the display for the return trip.
On the tablet, the touchable area for each date is only 8×8 mm, which is smaller than the 1×1 cm we recommend. It would be better to enlarge the calendar somewhat since there is room on the screen. But even with the slightly-too-small touch targets, it's still faster to specify a date with this widget than by either typing or using a spinner. (Also note the ability to redo recent searches by a single tap in the right margin: another way AA reduces the need for users to enter input.)

43. **Use drop down boxes and pickers only when there are just a few options available (4-6).**

Both pickers and dropdowns have the disadvantage that they use only a small fragment of the screen on iOS. The situation is somewhat better on Android, but even there dropdowns do not cover the full screen. As a result, a long list in a dropdown will require a lot of scrolling.
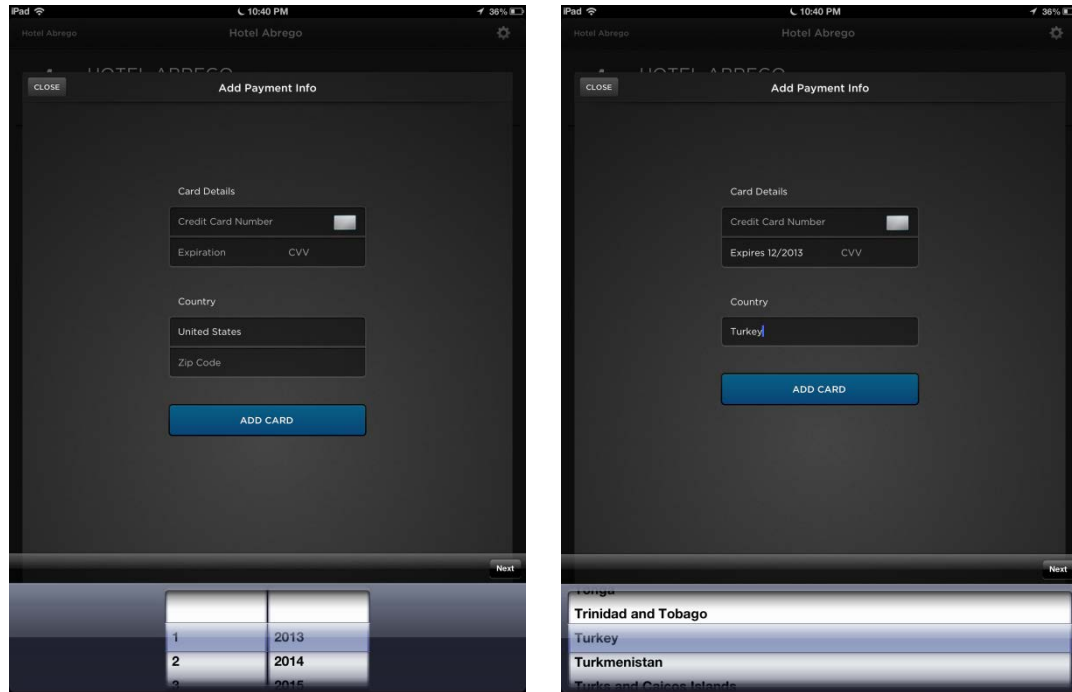
Hotel Tonight for iPad: Users must scroll through tiny pickers to select the credit card expiration date (left). The country is also selected with a drop down (right). In both cases typing would have been faster.

Big Oven for Android: Android dropdowns occupy a larger part of the screen.
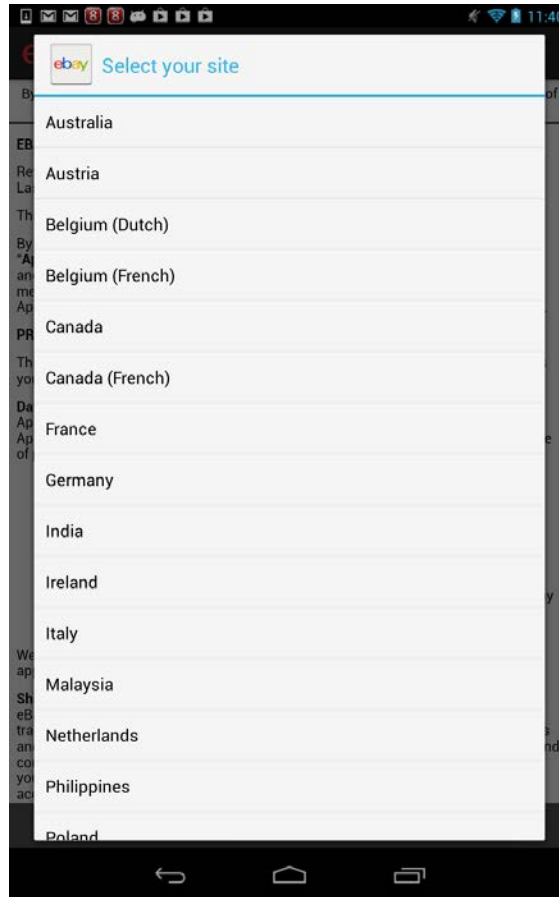
eBay for Android: This dropdown on Android makes more efficient use of the space.

44. **Use field descriptions rather than placeholders.**

Placeholders must be memorized; field descriptions are persistent. Especially if an interruption occurs while the user is typing, when they come back to the task they may need to remember what information they were supposed to fill in.

Nordstrom for iPad: The labels for the text fields are placed in the fields and disappear once the user starts typing. The user must memorize what they're supposed to type in that field.

Hotel Tonight for iPad: Some of the fields lack proper descriptors; they only have placeholders.

45. **Whenever using placeholders, erase the placeholder when the user starts typing in the field.**

There's nothing more annoying than having to erase the placeholder by hand.
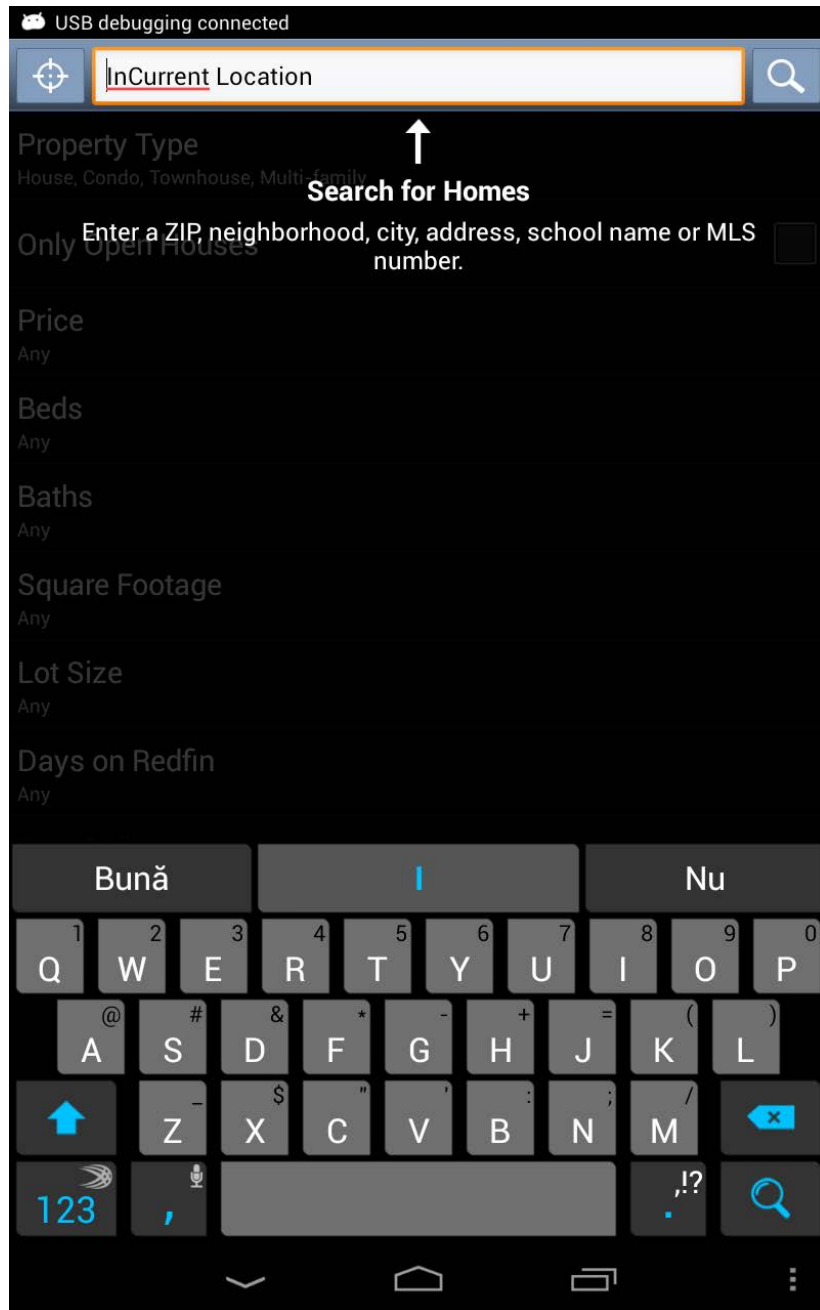
Redfin for Android: The placeholder stays in place, although the user has started typing.

46. **Do not use sliders for fields that require precise values.**

It's pretty hard for people to use a slider when the exact value is known and matters. For things like prices it is easier to type what the minimum or maximum price should be than to find the desired point on a small slider. The slider may not be sensitive enough to pick up a difference that is significant to the user.

For instance, the Redfin app for Android requires users to specify a price for a house by using a slider. As users go the upper end of the scale, it's harder to specify prices in small increments — that is, your max price can be either $1.5 million or $1.75 million (these prices are quite common in places such as Sillicon Valley or New York City). Thus, anybody whose limit is, say, $1.6 million is just unlucky — they will have to filter by hand the prices out of their budget.
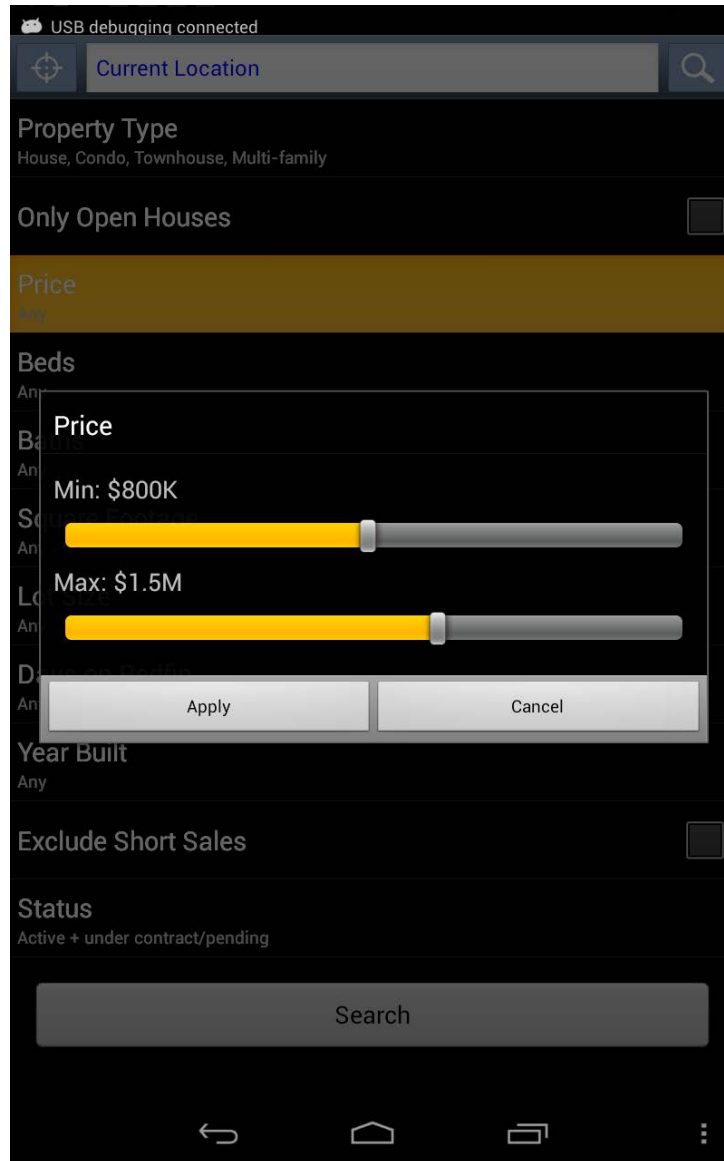
Redfin for Android. The real-estate app requires users to specify prices for houses by using sliders for minimum and maximum prices. The maximum slider is has bigger and bigger granularity as prices increase. It would have been simpler to let the users type a desired price limit.
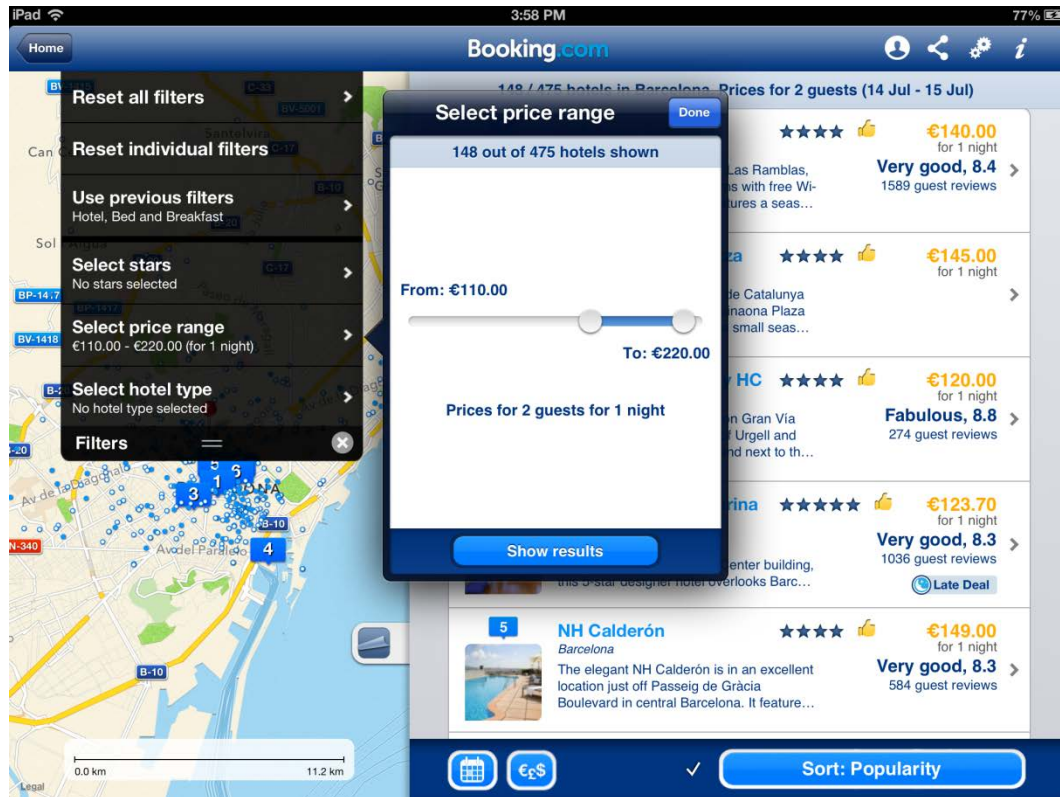
Booking.com for iPad: The slider makes it difficult for users to select the exact price.

FORMS

47. **The Submit button (or equivalent) on a form should be displayed under the form fields rather than above them.**

On iOS, the Done button is often displayed in a navigation bar at the top of the page. Sometimes the form Submit button (whether called submit or something else — e.g., Place Order) is also placed at the top of the form. This pattern has started to trickle to Android apps as well.

Even on iOS we recommend against following this pattern for the simple reason that it goes against the users' tendency to scan down the page and then press Submit. By placing the Submit button at the top of the screen, it gets separated from the other fields of the form. As users fill in the form, they usually do it top to bottom. When they get to the end of it, they expect to find a Submit button right there, next to the last field they've completed. Most of the times, when people don't find it there, they get confused and start looking around, not knowing what to do.

The examples below illustrate this pattern.
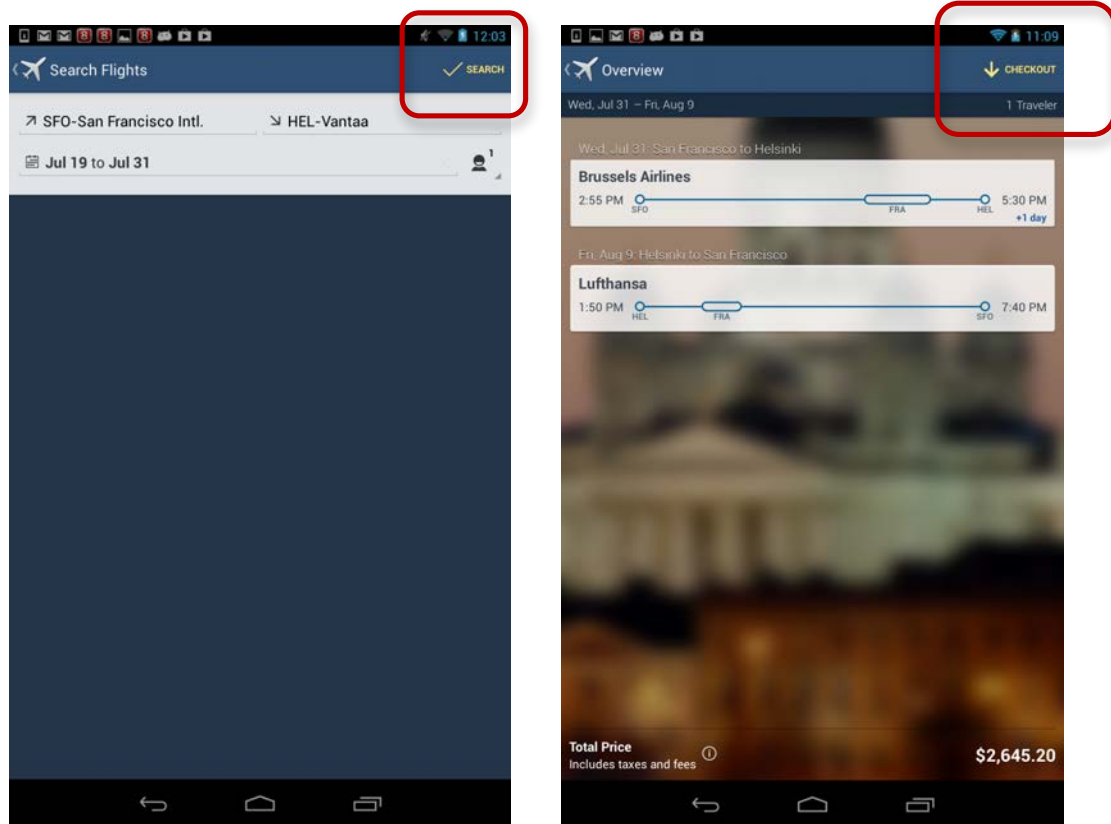
Expedia for Android: The submit-type buttons (Search, Checkout) are in the top right corner. Users can easily miss it, especially given the flat visual design of these buttons.
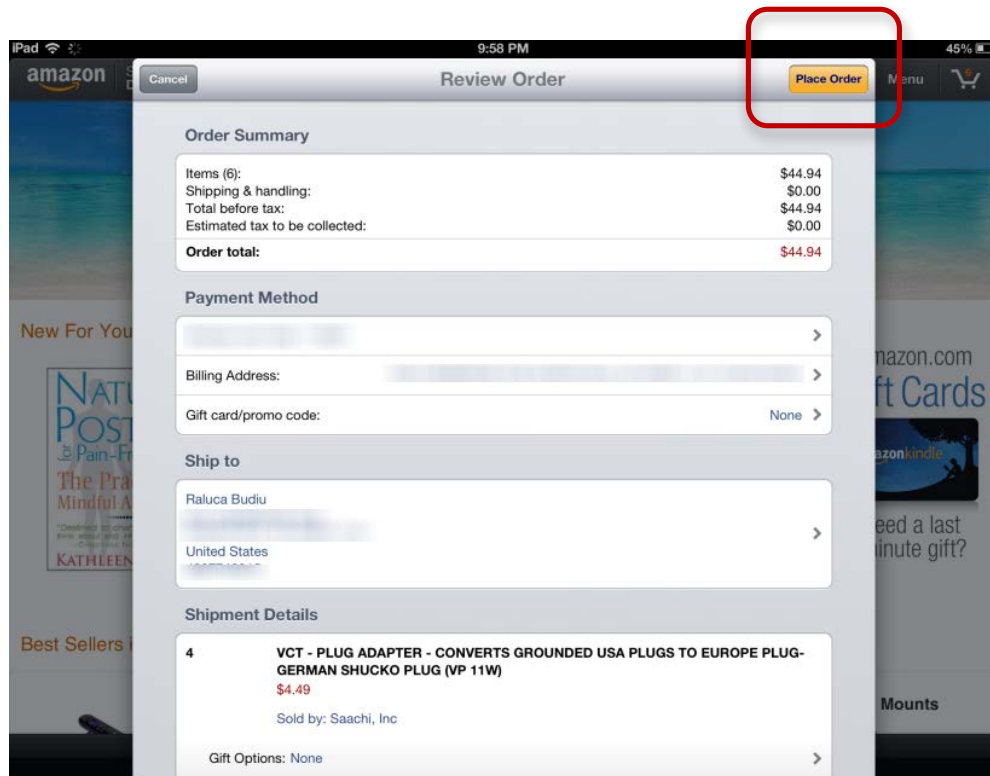
Amazon for iPad. The Place Order button is positioned against the natural flow of the page, at the top of the screen.
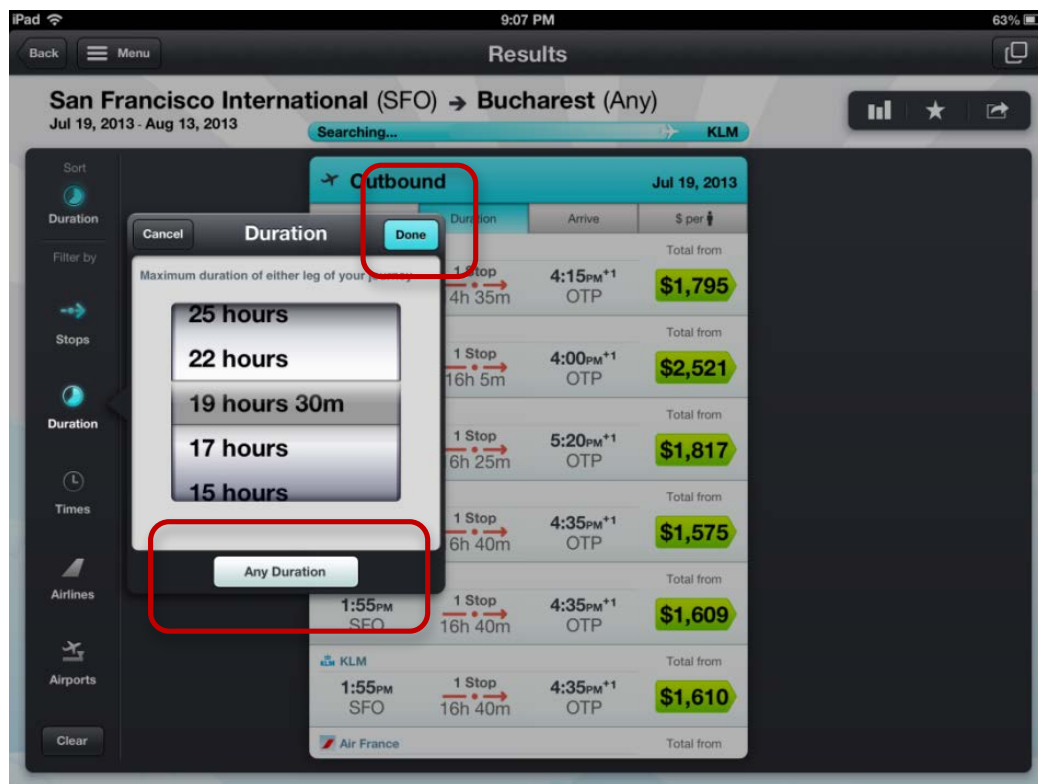
Skyscanner app for iPad: Users naturally press the "Any Duration" button that is shown under the picker, thus invalidating the selection they've just made. The "Done" button is at the top of the form.

It's a lot better to follow the natural flow of the page and place the Submit button next to the last field of the form. If making that button accessible at all times is important, then you can make it persistent, so that it's visible at all times.
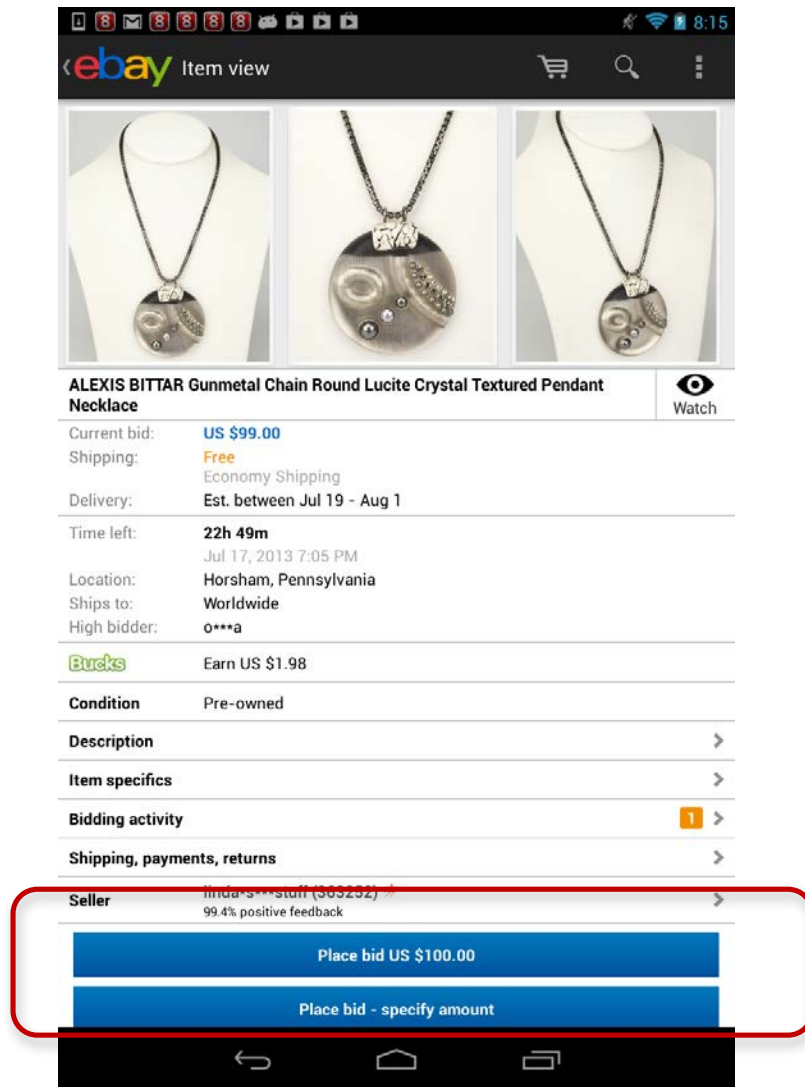
eBay for Android. The Place bid buttons are correctly positioned at the bottom of the form.
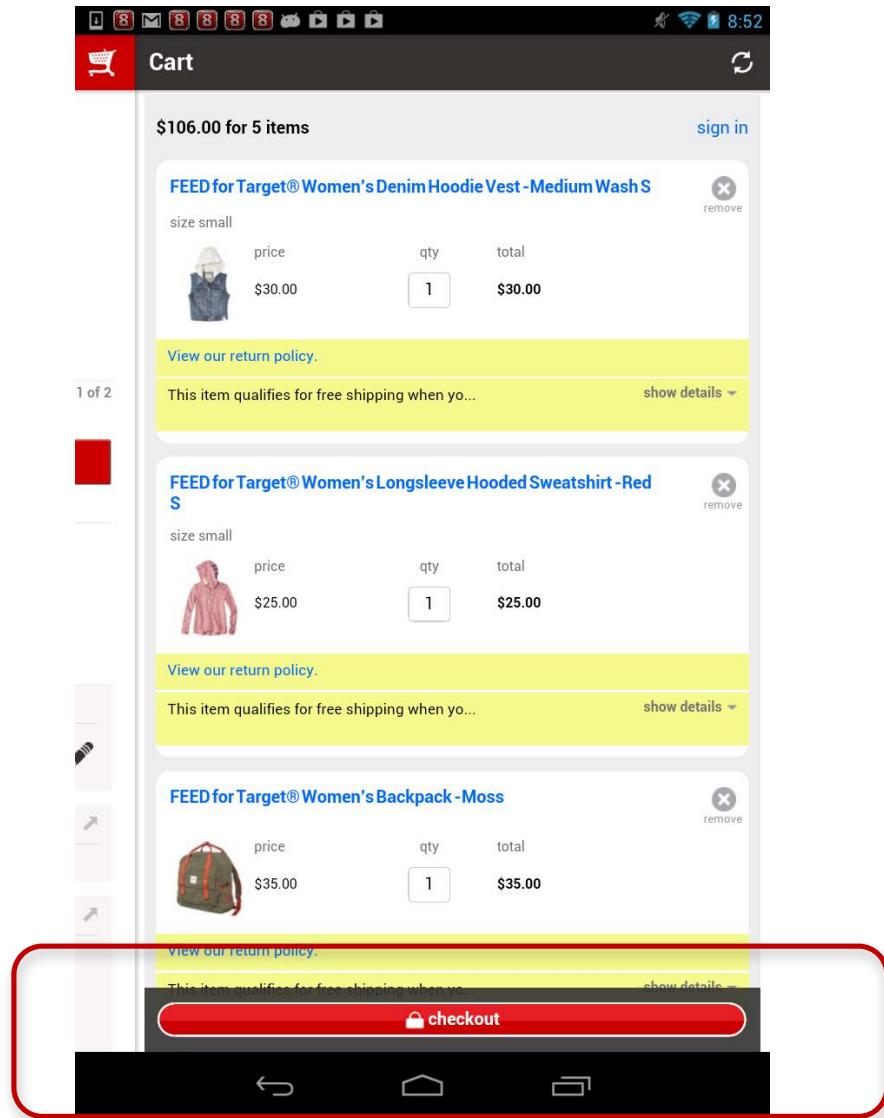
Target for Android. The Checkout button is placed at the bottom of the screen and is persistent.

48. **Distinguish between link buttons and Submit buttons. Submit buttons are usually placed at the bottom of the form; when link buttons are positioned there, they can create confusion.**

Some forms contain buttons that lead to subforms. The placement and labeling of these buttons is important because it can mislead users into correctly understanding the purpose of the initial form.

In Taptu for Android, participants got to the page in the figure below. The button at the bottom of the screen (Merge and remove Streams) is a link button, but our participants thought it was a submit button and couldn't figure out how to indicate which streams to merge on this page. (In fact, they cannot. They need to click the link button at the bottom of the page, and that will lead

them to a new page where they can accomplish the merge). This page allows
users to change the stream order.
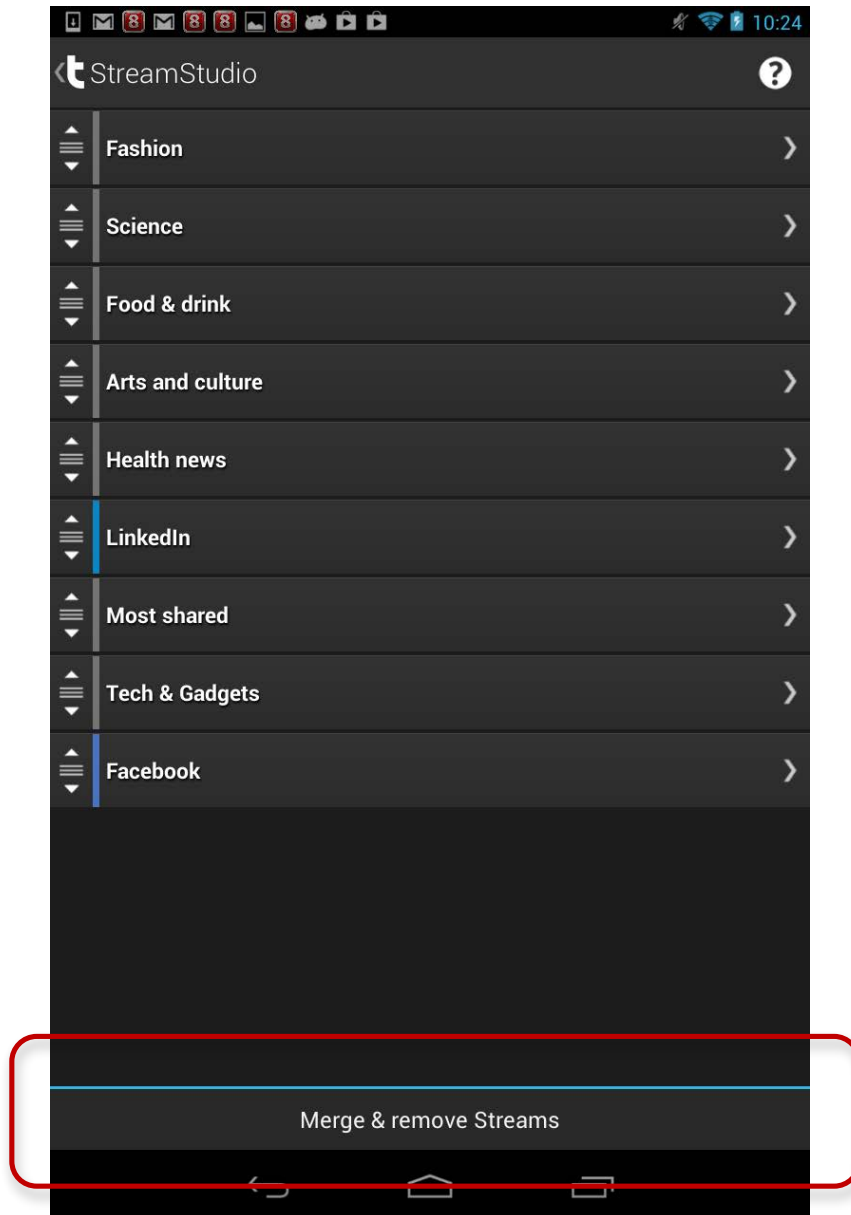
Taptu for Android. The button at the bottom of the screen (Merge and
remove Streams) was incorrectly interpreted by the participants to be a
Submit button, although it was in fact a link to a page where they could
merge and remove streams. As a result, they thought that the form in the
screenshot was for merging streams when in fact it was just for
reordering them.

49. Do not use non-modal dialogs for forms.

If the form is displayed in a non-modal dialog or popover, it's easy for users to accidentally dismiss it if they touch somewhere outside the form.

One of our users was trying to create a new house plan in the iPad app called Interior Design; she accidentally tapped outside the form that had her select the types of rooms and as a result she lost all her work — she had to reenter all her data again.
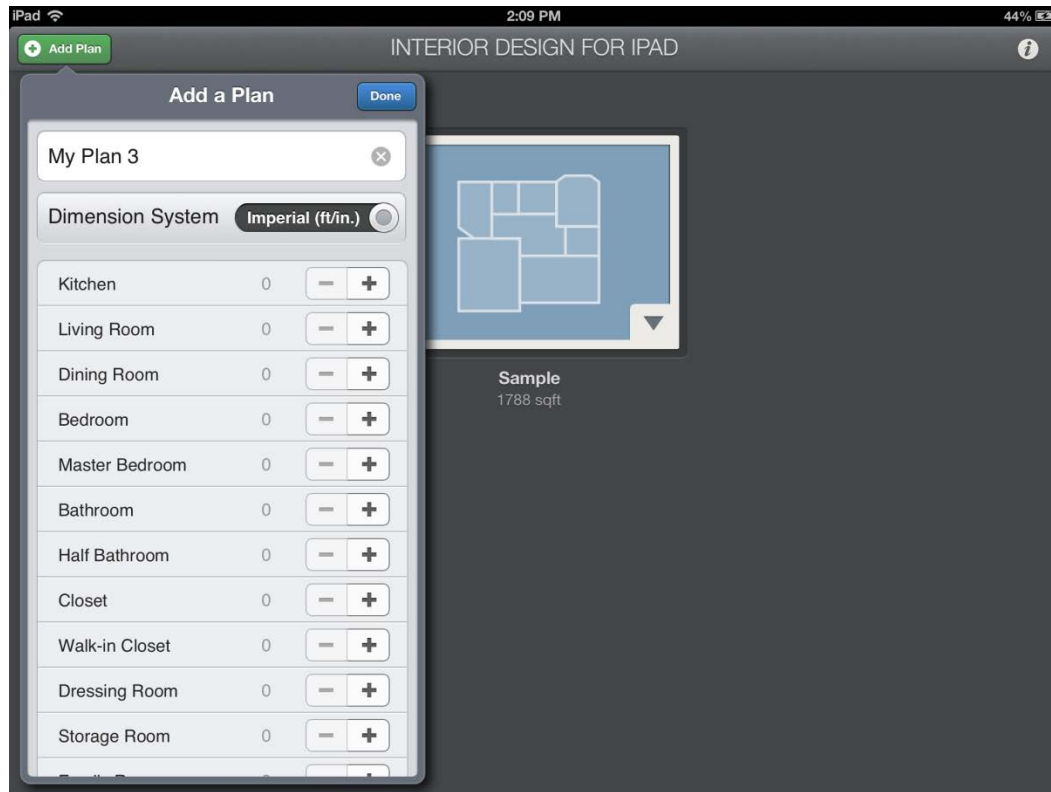
Interior design for the iPad: the form for creating a new plan is displayed in a non-modal popover; if the users touch somewhere outside the popover, the form (and all the data entered so far) disappears.
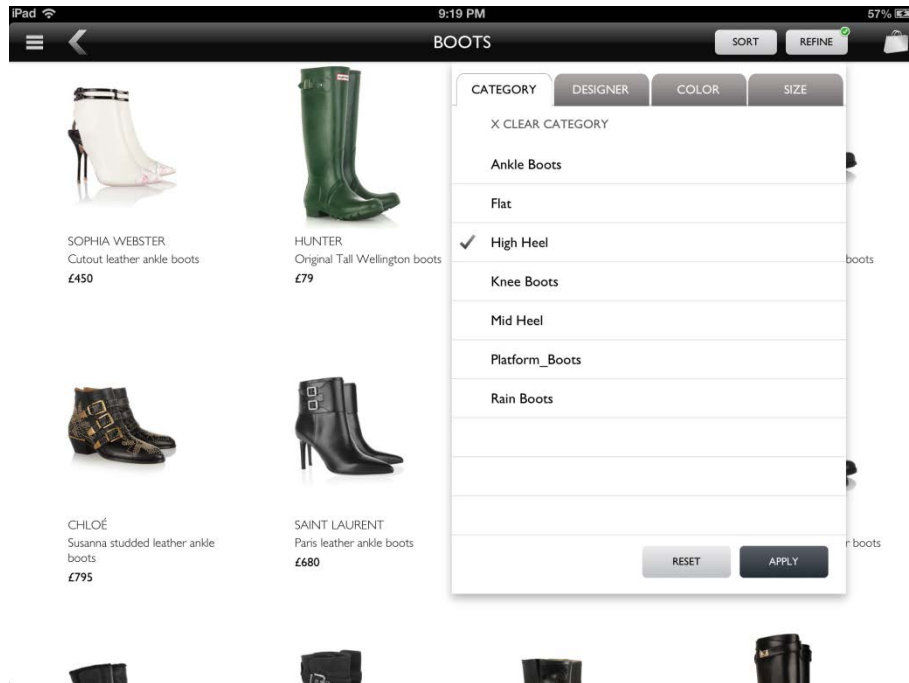
Net-a-porter for iPad. The filters are displayed in a nonmodal popover; the values are lost if the user accidentally taps outside of it.
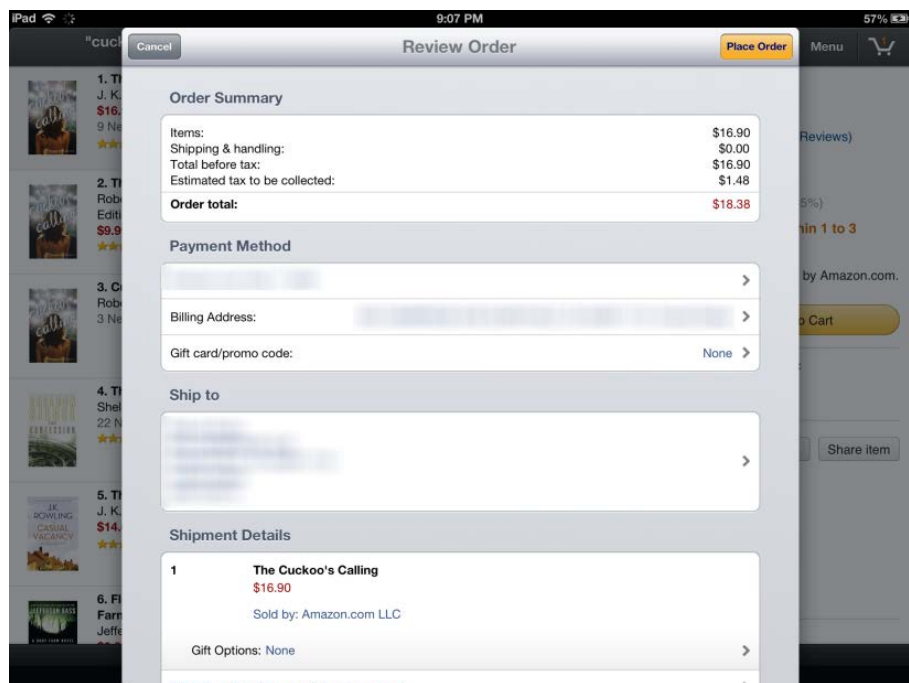
Amazon for iPad. The order form is viewed in a modal lightbox; people must press a button to dismiss it, so there is less chance to accidentally lose their work.

50. **If you must use a non-modal dialog for a form, save the state of the form, so that users could recover their work.**

Make sure that people can go back to the form and continue what they were doing in case they dismiss it by accident.

51. **Do not use forms over forms in popovers or lightboxes.**

Sometimes a form may contain other subforms. If that is the case, avoid the temptation of stacking a set of lightboxes (corresponding to the different forms) one on top of the other, especially if a button from a previous form is visible in the most recent one.

Hotel Tonight exemplifies this situation. If the user wants to reserve a room, a form detailing the reservation is displayed. The form has a big Add Payment button at the bottom. If the user decides to change the name of the guest, a new form is display on top of the first one. However, the old Add Payment Info button is still visible on the screen, although it cannot be tapped.

Hotel Tonight for iPad. If a user taps the Guest field in the first form, the app display a second form for editing the guest information. The Add Payment Info is part of the previous form and cannot be pressed, but is visible on the screen and can confuse some users.
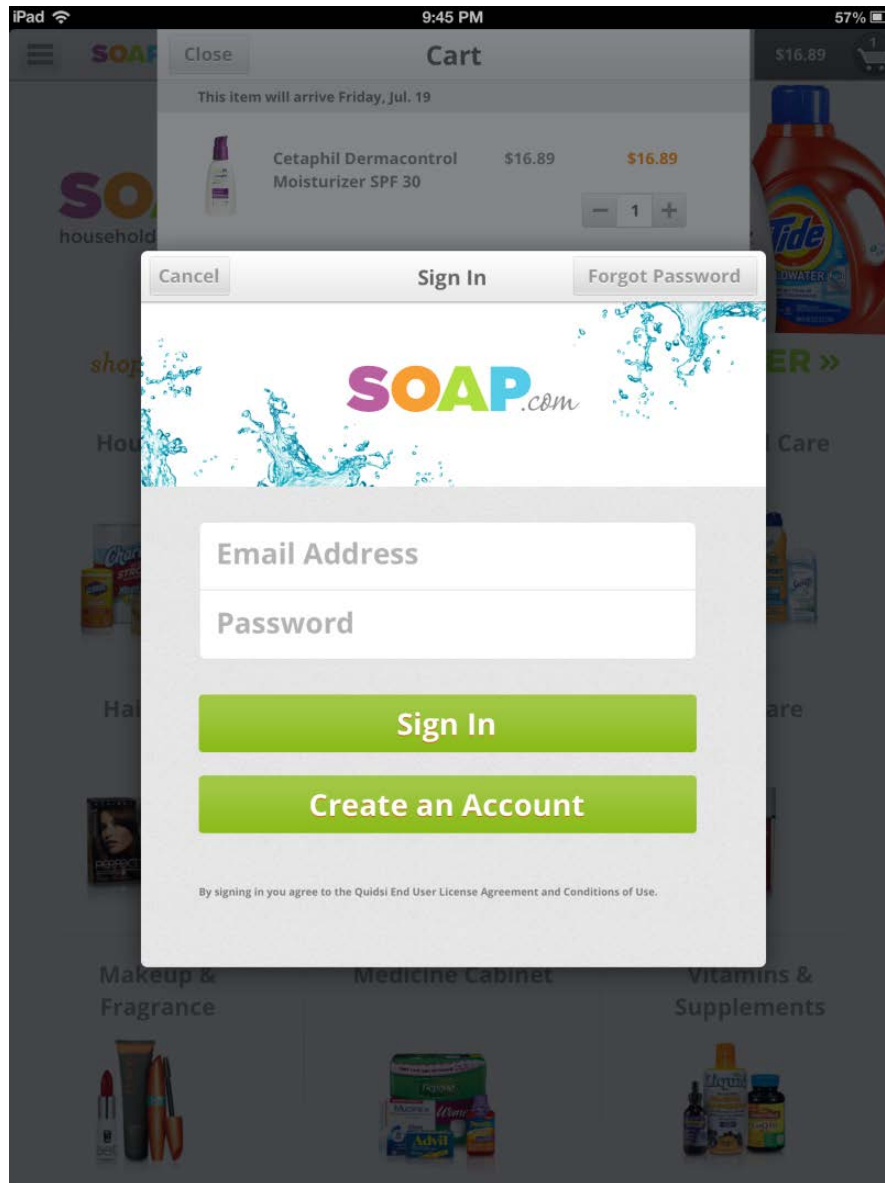
Soap.com for iPad: The Sign In form is displayed on top of the cart lightbox. The controls from the background form are visible (although dimmed).

Registration and Login

Registration and login are special types of forms that deserve a separate treatment. Over the many testing sessions that we witnessed, we never noticed a user happy to have to create an account. Creating an account (as well as signing in with an existing account, although to a lesser extent) was always perceived as a major chore. Here are some quotes from our participants:

> "One of the things I hate is when apps require you to register — I mean, just take me here and when I want to do something that requires registration, make me register."

> "Any time you have to create an account is no good."

> "I would normally not register".

People avoid registrations as much as they can. It's not only that filling in a registration form is difficult on a touch screen; the other major problem is keeping track of an extra password and remembering it at a later date. (Many of our users report that they keep their passwords in a file on their computer or even next to their computer — if they still happen to favor paper).

52. Don't start the app with a request to sign in or register.

Registration is major time and effort investment for the users, and they will only do it if they are highly motivated. Motivation can be increased if people are shown the value proposition of the app first; if they can try the app and decide it is useful and trustworthy.

When the news reader Trapit for iPad is first launched, users are asked to register or sign in. They cannot try the app before they do so. Whereas having to register may feel acceptable from a service such as a bank, it seems unnecessary and gratuitous from a news app.
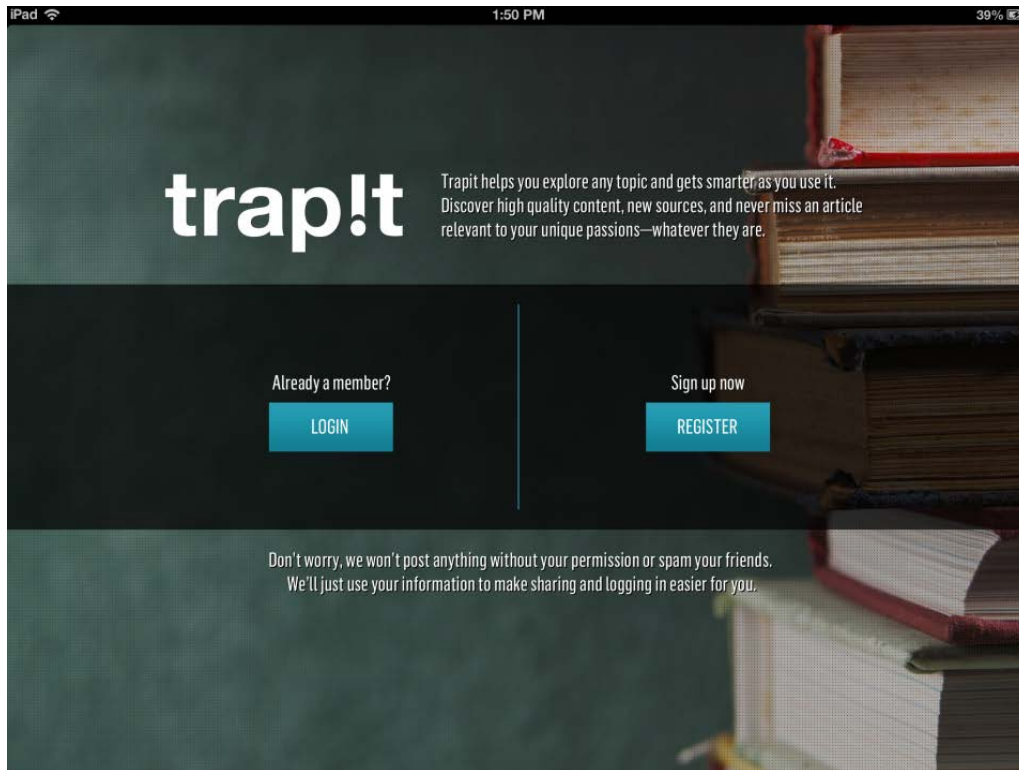
Trapit for iPad: Users are asked to log in or register before they can see
what the app is about.
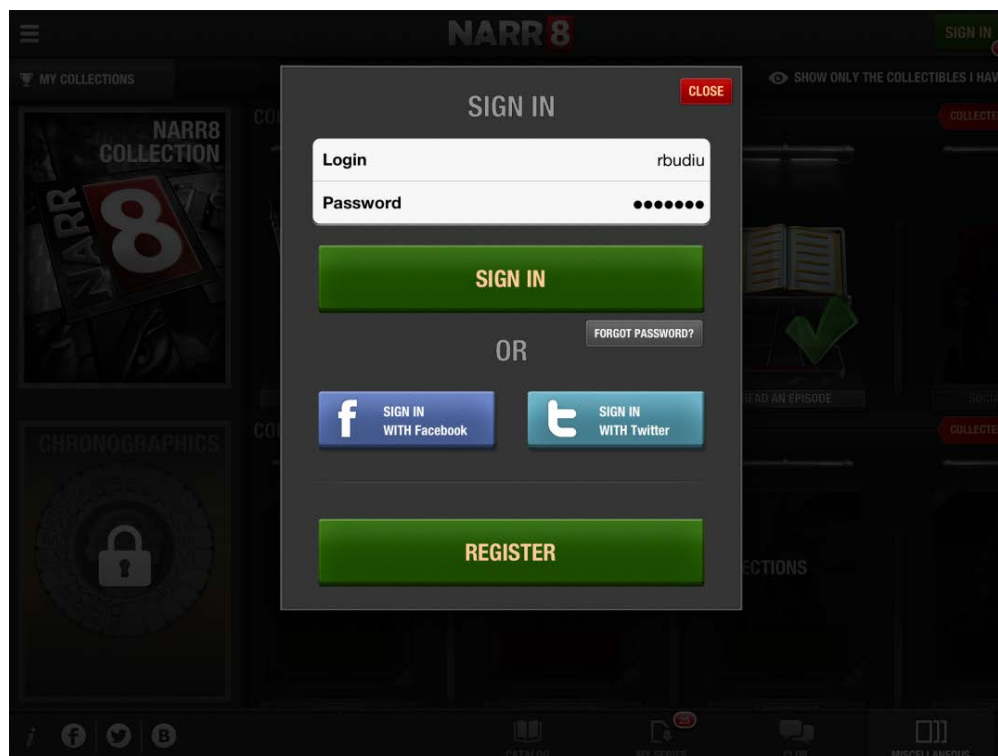
NARR8 for iPad. The first screen requires users to register or login in (but they can skip it by clicking the Close button at the top).
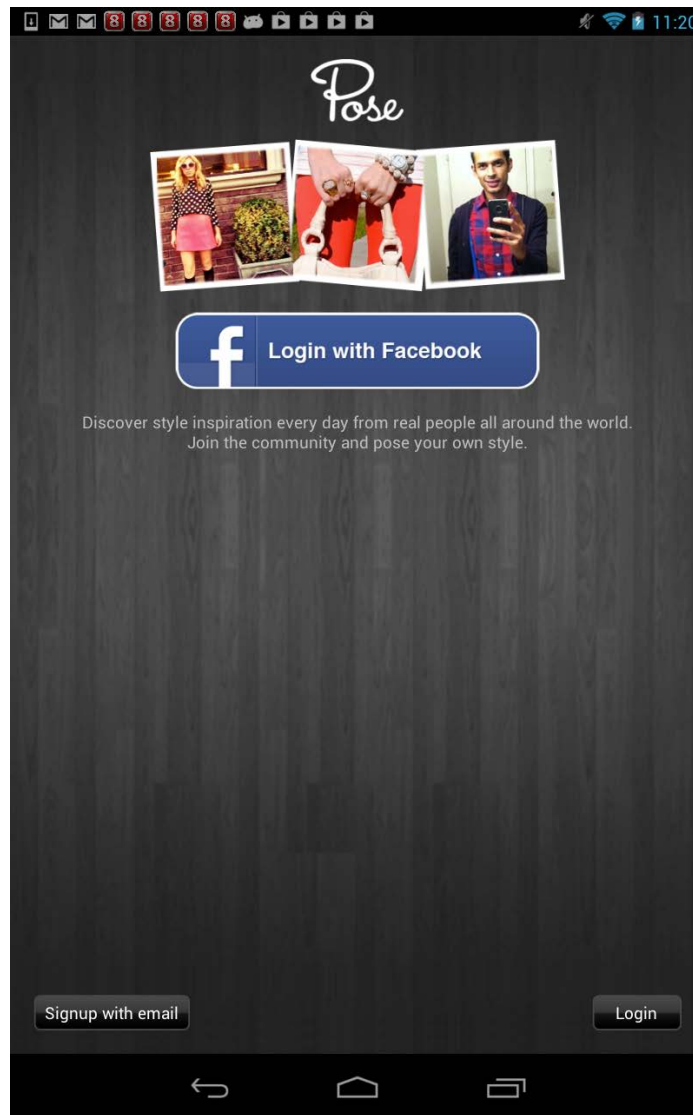
Pose for Android: The first encounter with the app involves a login screen. Note that the Facebook login is the most prominent; whereas the other alternatives (Sign up with email and Login) are small at the bottom of the page, a lot less likely to be noticed.

53. Request registration/login (1) for security purposes (e.g., to protect financial information), (2) if users want to sync their data across devices.

Most apps can function without a login. The true exceptions are banking apps and other types of apps that involve managing an existing account.

You can allow users to login if they wish so (especially if they want to access their data on several devices), but don't force them to do it. And especially don't force them to access certain app features that do not inherently require registration (e.g., saving favorites).

Big Oven requires users to login to add recipes to a list of favorites, to find the nutritional information for a recipe, or to add a recipe to a grocery list. None of these functions need to be tied to an account (all the data can be saved on the local device and associate with that device).
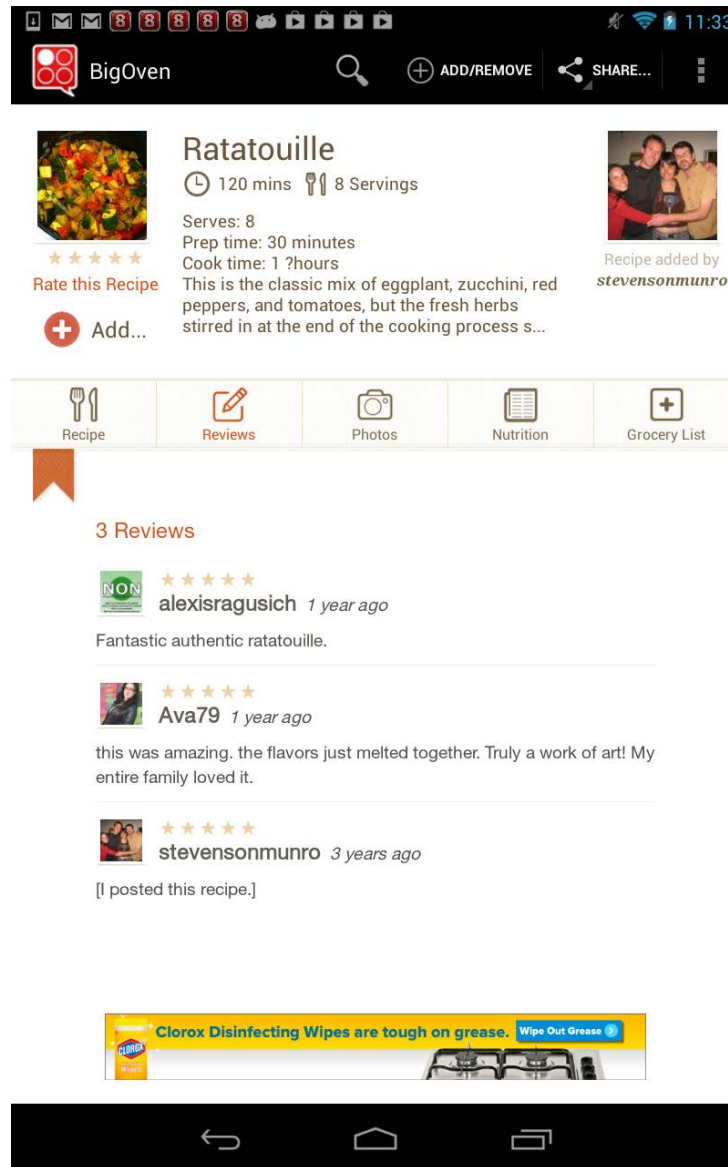
Big Oven for Android. Many of the app features (favorites, nutritional information, shopping list) are made available only to registered members.

Hipmunk, a travel search engine, has an interesting solution for syncing data without requiring a login. They simply provide the user with a unique code word that can be used on a different device to retrieve searches and complete bookings.
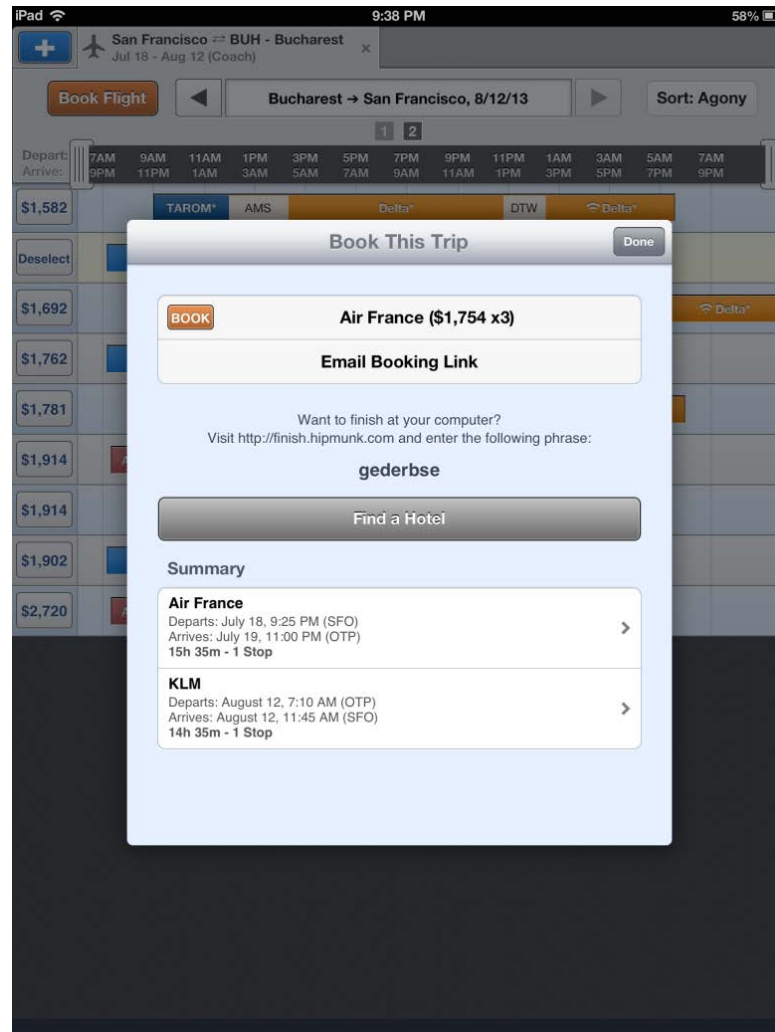
Hipmunk for iPad. Users can finish their booking at their computer without loging in, by typing in a unique code word.

For e-commerce apps always provide an option to checkout as guest. Even people who already have an account may have trouble remembering the password and may prefer to checkout as guest rather than going through the hassle of recovering the password.

54. **Offer people the option to sign in with a Facebook or Google account, but don't make those be the only options available.**

Although some people like to share with another account, the majority is reluctant for privacy reasons or because they are not sure what type of information will be posted to that other account. That is why apps should

always make it possible to sign up for an application-specific account rather than using an existing Facebook/Twitter/Google account.

55. **Give equal priority to registration and sign in fields.**

56. **If users make an error trying to sign in when they don't have an account, take them to the registration form but save the information that they had entered in the sign in form.**

Empty text fields act as user magnets: people often start typing right away: they fill in whatever they think they are supposed to fill in without pausing to (a) understand whether the form applies to them, or (b) read what they are supposed to fill in. Often registration forms are filled out when people mean to sign in or, vice versa, people sign in without having an account.

Costco app for Android: users started to fill in the first two fields of the form, thinking that it was a sign-in form. They realized that it was a registration form only when they were asked to confirm their password. Only then did they parse the page more carefully and discovered the Registered Shoppers accordion. In fact, one of our users made this mistake twice — the second time, after he recovered his password from his email and was trying to log in again.
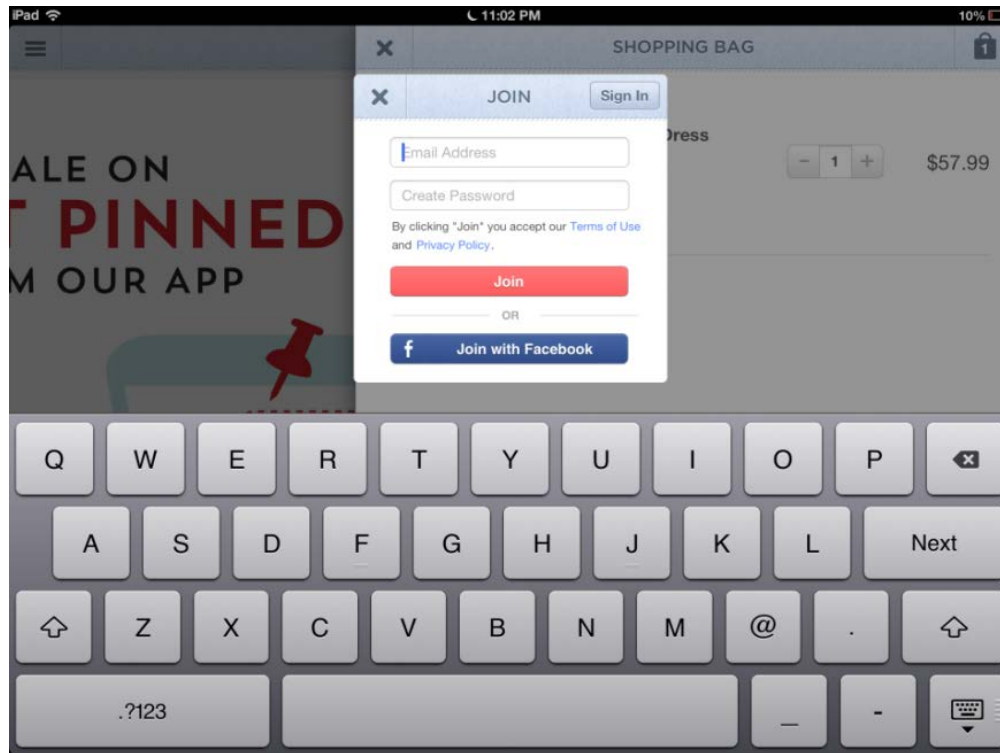
Modcloth for iPad. This app places the Sign In button at the top of the screen, in the a less salient position. The two other Join buttons are more prominent.
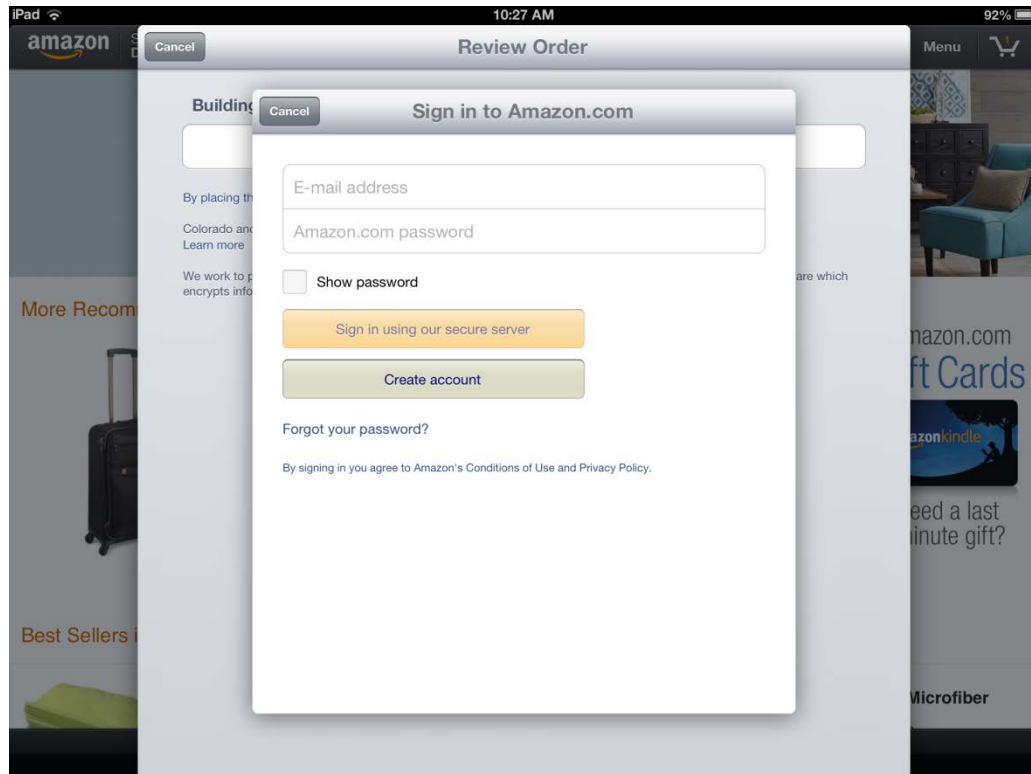
Amazon for iPad. This design is also problematic, because, although the Create account is present and quite big at the bottom of the form, the Sign in is still the more prominent one. More importantly, the attraction of the empty text fields is still there, and users are likely to fill in the email and password fields before they get to the two buttons. If they do so and then press Create an account, the information that they typed in on this page is lost and they have to reenter an email and a password on that page (see below).
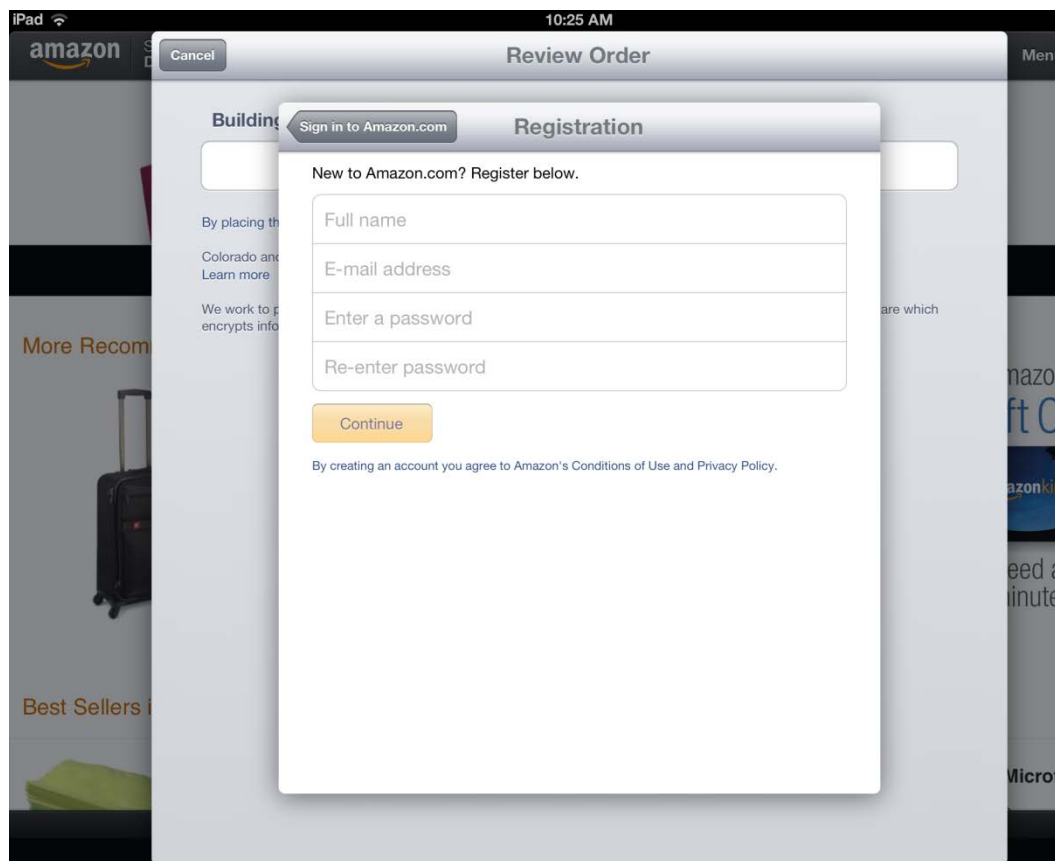
Amazon for iPad. The registration page does not show the information typed inadvertently on the first login screen (see above).
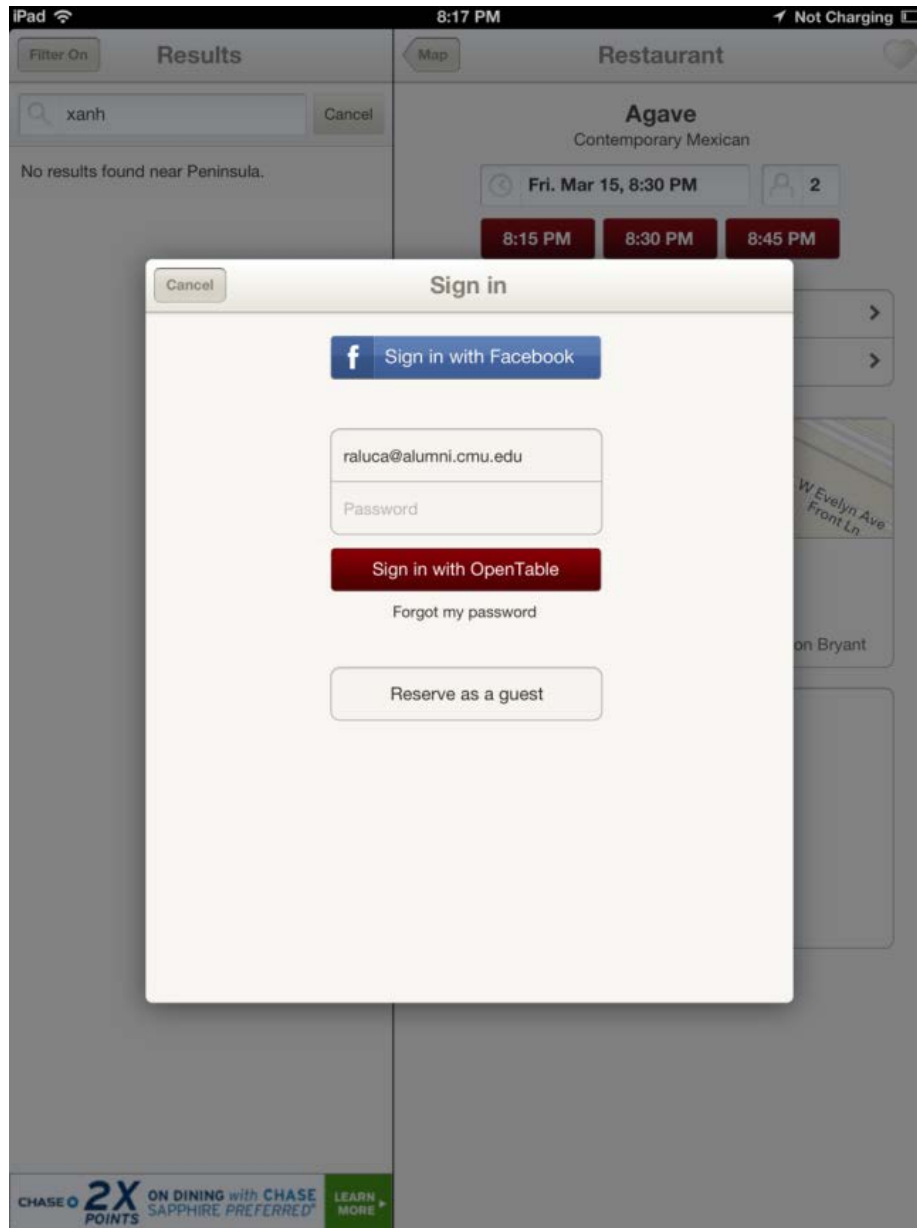
Open Table for iPad. This design includes a Reserve as Guest button, but it's the least salient of the three buttons present on this screen. If the user presses it after filling in the form above it, the email and password are lost.
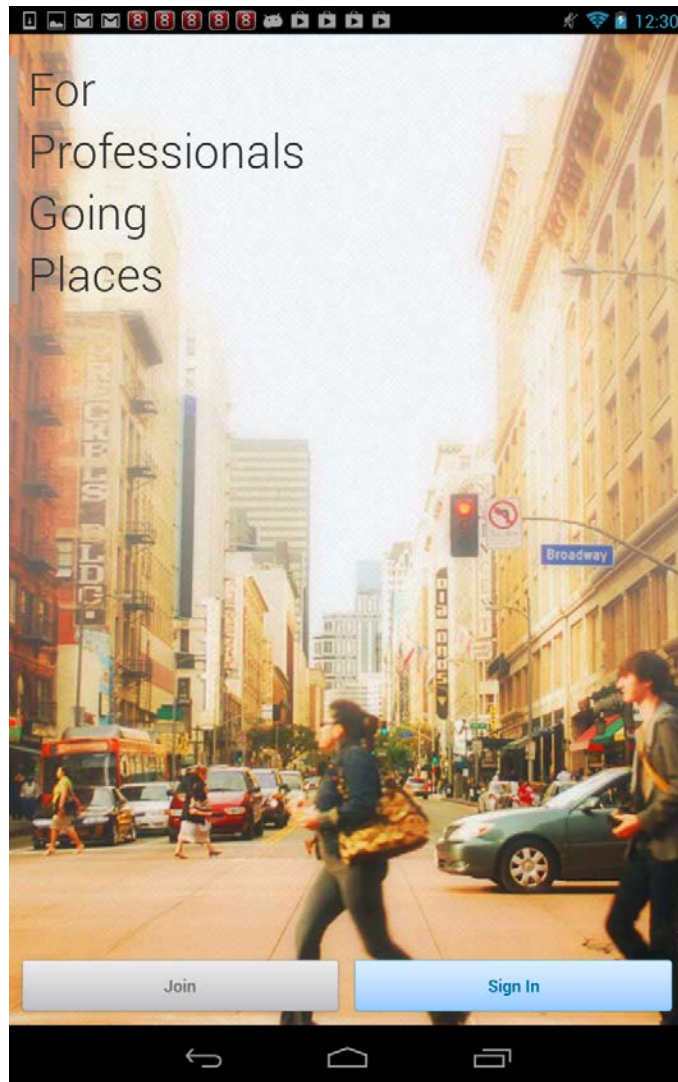
LinkedIn for Android. This design avoids the trap of the empty fields by asking users to disambiguate between registration and login before entering their information. The slight disadvantage is that it introduces an extra tap (for this first step), but in an app, this should only slow down the flow minimally.
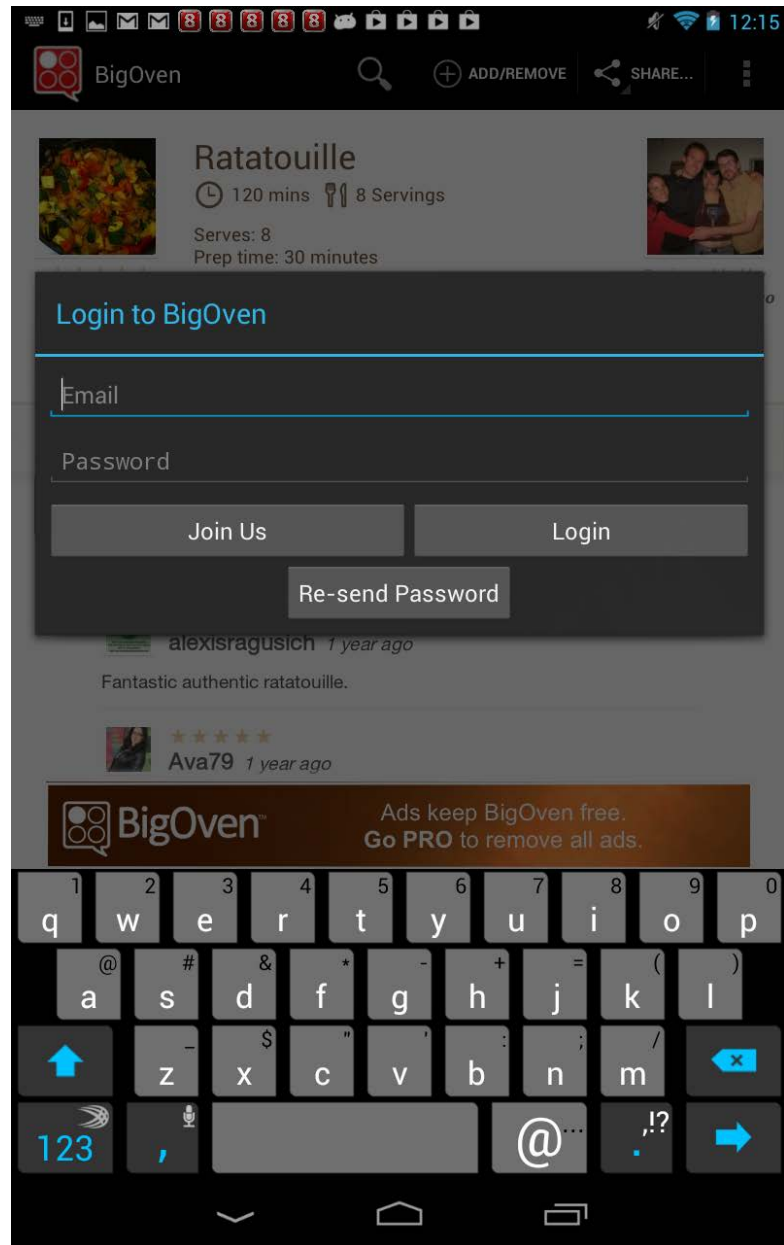
Big Oven for Android. The app correctly places the Join and Login Buttons next to each other, giving them equal priority. Unfortunately, it does not treat correctly the situation when the users fill in the two fields and then press Join Us — the information typed on this page is not used on the registration page.
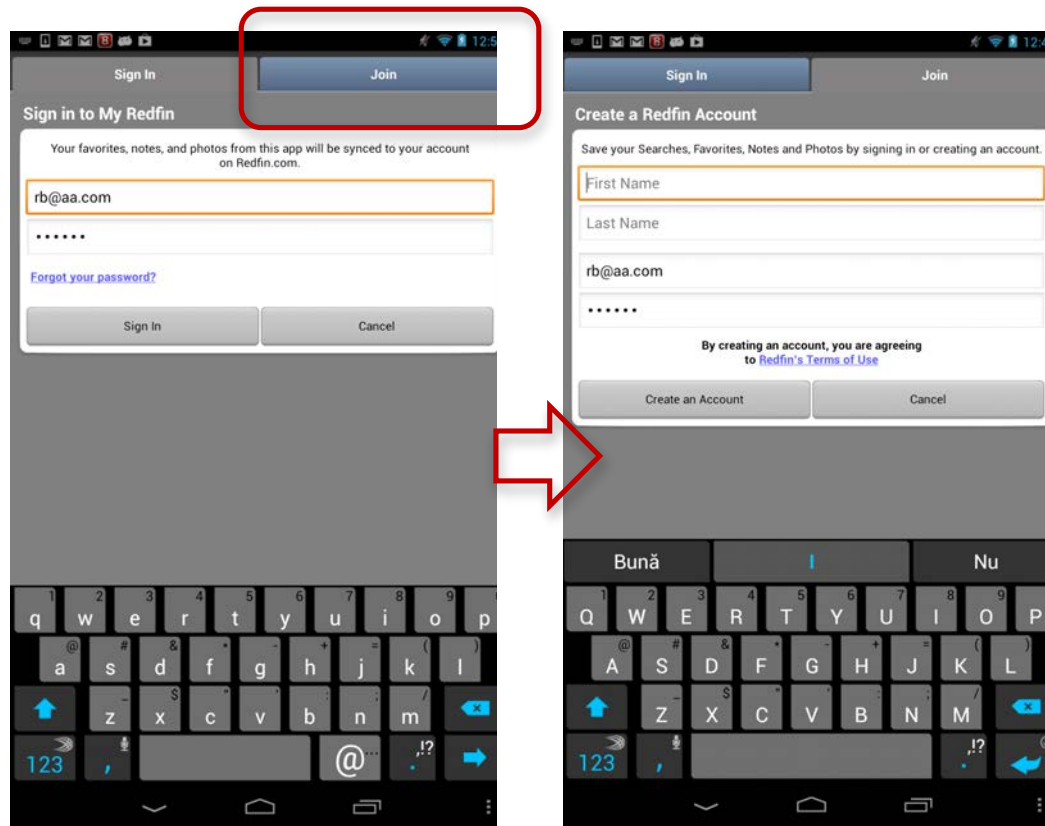
Redfin for Android. If the user is on the Sign In page (left) and fill in the fields but then realize they need to join and press the top Join tab , Redfin saves the email and password values and prepopulates the corresponding fields on the registration form (right). (Note however that making Join and Sign In two separate tabs is not an inspired choice, as people can ignore those options altogether because they are too removed from their focus of attention.)

57. **Avoid taking people out of the app for registering.**

58. **If registration is not fully supported in your app, consider using a browser view within the app to display the full site. Once users finish the registration, take them back to the flow they were in before starting it.**

    Many apps correctly assume that people will not take the trouble to register on a tablet, so don't have any app-optimized pages for registrations. In those situations, they simply send the users to their full site.

    This cost-benefit analysis, combined with the fact that full sites are relatively usable on tablets, makes this solution reasonable. However, when implementing it, do this within the app. Namely, instead of sending the user to Safari, Chrome, or Internet Explorer, have a browser view within the app that will present the full page to the user. Once the registration is completed, take the user back to the flow they were originally in (for instance, if they were purchasing something, take them back to the checkout flow).

If the registration is done in a separate browser app, the user is burdened with the task of recovering the flow — they need to go back to the app, and enter their new credentials. We noticed that when people were taken to the web to register, they often forgot to come back to the app. Most of the time, they just completed (or failed) their task on the full site.

59. Minimize the number of fields in the registration form.

Because registration on a touch screen can be painful, try to make registration forms as short as possible by only asking the minimum amount of information. For e-commerce apps, as people enter information such as address and payment method in their apps, you can ask them if they want that information saved and linked to their account.

60. Remove duplicate fields (email, password).

61. Let people see their password in clear for both registration and login.

Many apps and websites ask users to type their email and password twice, in the attempt to avoid errors. That is unnecessary: in the case of email, you can simply ask people to go over their email address again and make sure it is correct.

With passwords, a simple way to avoid errors is to allow people to see their password in clear. This can be an option next to the password field — if users don't feel comfortable displaying it, they can always have it hidden.
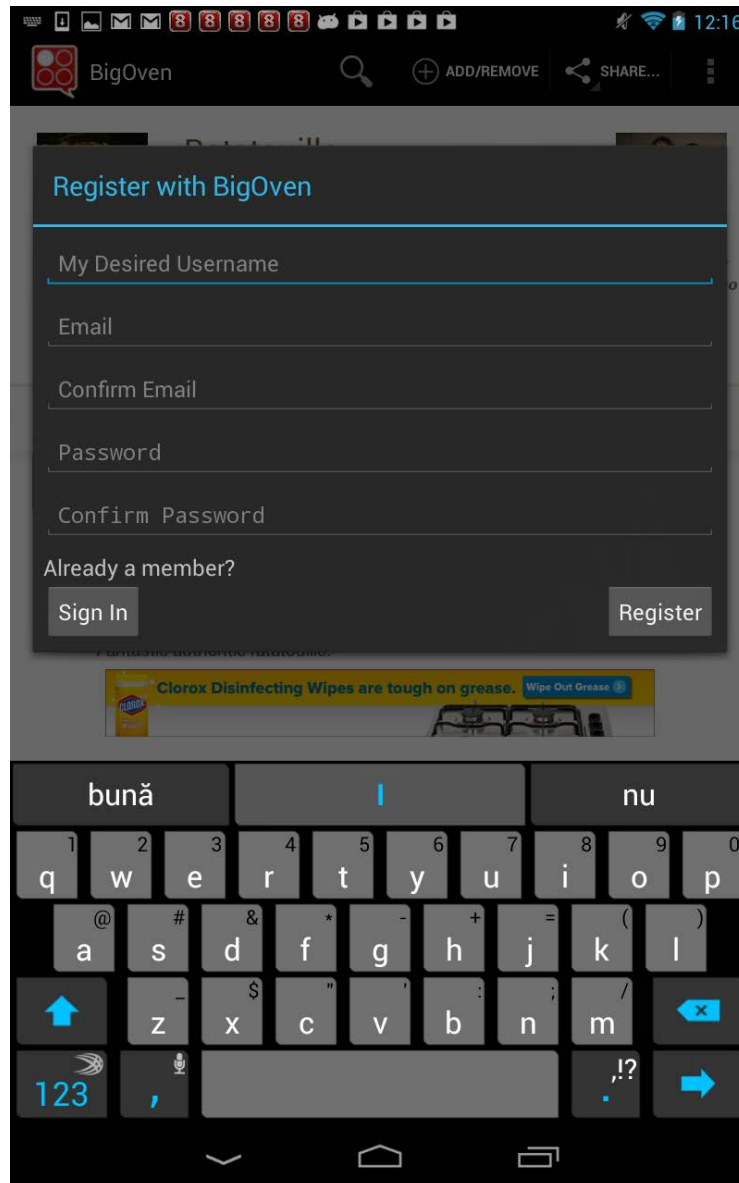
BigOven for Android. The app requests a username, an email and a password (entered twice). It's not necessary to ask users to type their email and password twice. Also the ability to see the password unmasked would help the user make fewer mistakes.
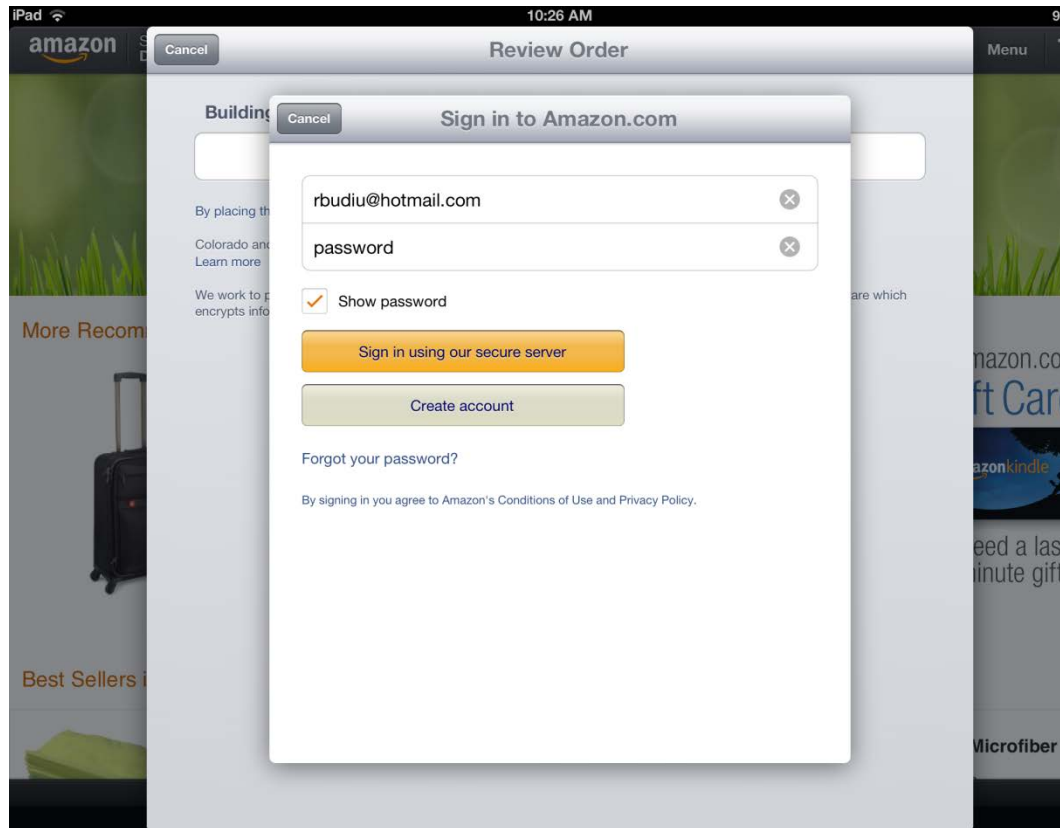
Amazon for iPad. Users can choose to see their password in clear when they log in.

Walmart for Android. Users don't have to enter their email and password twice and they can see their password in clear.

Flow

62. When an app supports several similar tasks, avoid making one of the tasks the default flow.

We saw an example of this phenomenon with sign up and log in: whenever a preference is given to one flow (e.g., log in over sign up), users tend to go with it without realizing that they are on the wrong path. The reason is that the user is so entrenched in his task, that he will simply fit into that task whatever is given to him by the interface.

An example of default flow that causes problems is given by Expedia for Android. The app supports hotel and flight searches; these are fairly similar tasks. Our participants had to find a flight to Helsinki. However, all who attempted this task were trapped by the interface, which defaults to searching for a hotel — they started making selections and realized they were in the wrong flow only when the reached the final button (Search for Hotels).
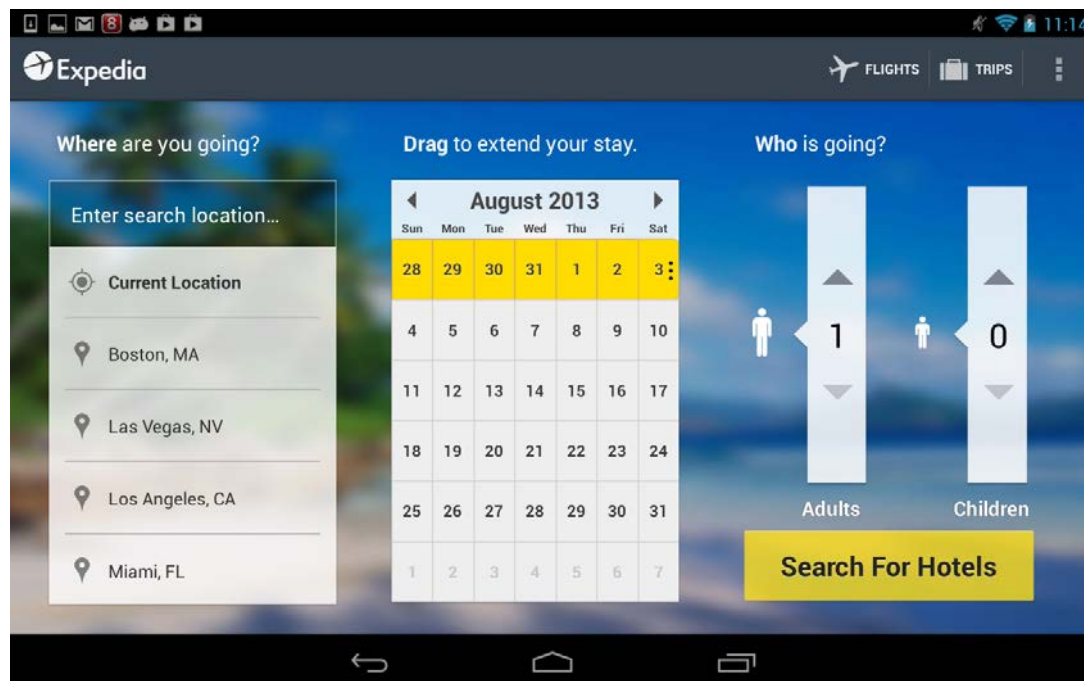
Expedia for Android: Searching for a hotel is the preferred flow. Several of our users started fill in the information although they were searching for a flight.
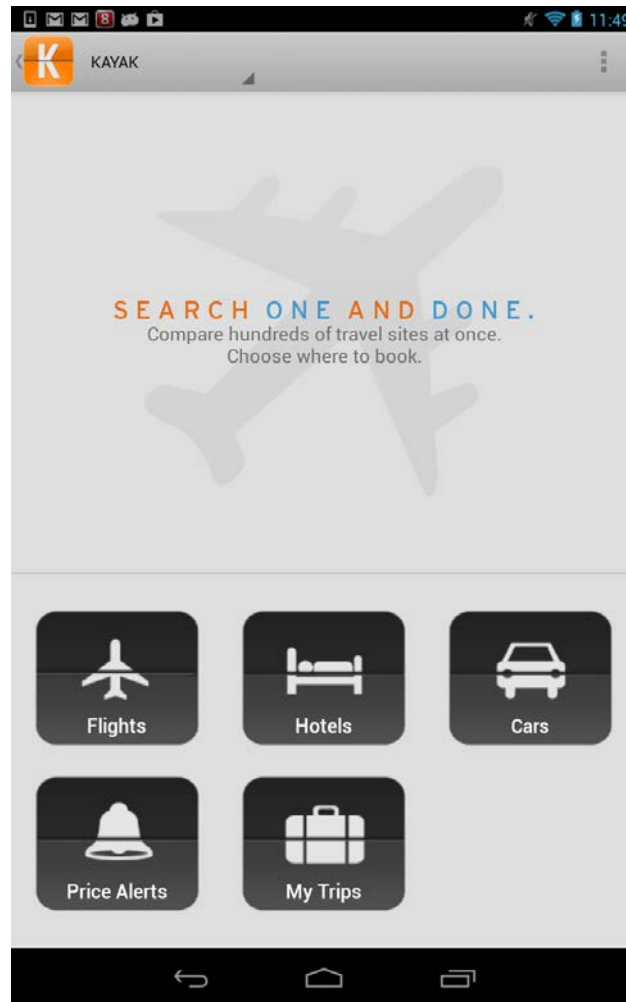
Kayak for Android. Users have to choose a flow before entering any data.

63. **Always make all the necessary steps explicit. Avoid including steps from different flows on the same page.**

Sometimes apps are too clever in their attempt to save page loads and end up confusing the user.

In the case of Expedia for Android, the app decided to combine the screen for choosing a checkout method with the screen for checking out as a guest. As a result, they included two options to log in, and a few steps belonging to the third option, checkout as guest. Note that these options don't have the same visual weight.

One of our participants was trying to make a reservation through Expedia without creating an account. She went on to enter the credit card info, but she did not realize that she also had to enter the traveler's information because the calls to action were not clearly marked. In the end, she clicked the Log In with Expedia button (the only clear call to action on the page) and gave up, thinking that she could only purchase the ticket if she had an account:

"This is pretty frustrating… They should have told me in the beginning that I need an account in order to buy the ticket…"

In fact, she could have bought the ticket as a guest, but because that option was not clearly marked and because it wasn't clear to her what she had to do, she ended up not being able to complete the task.
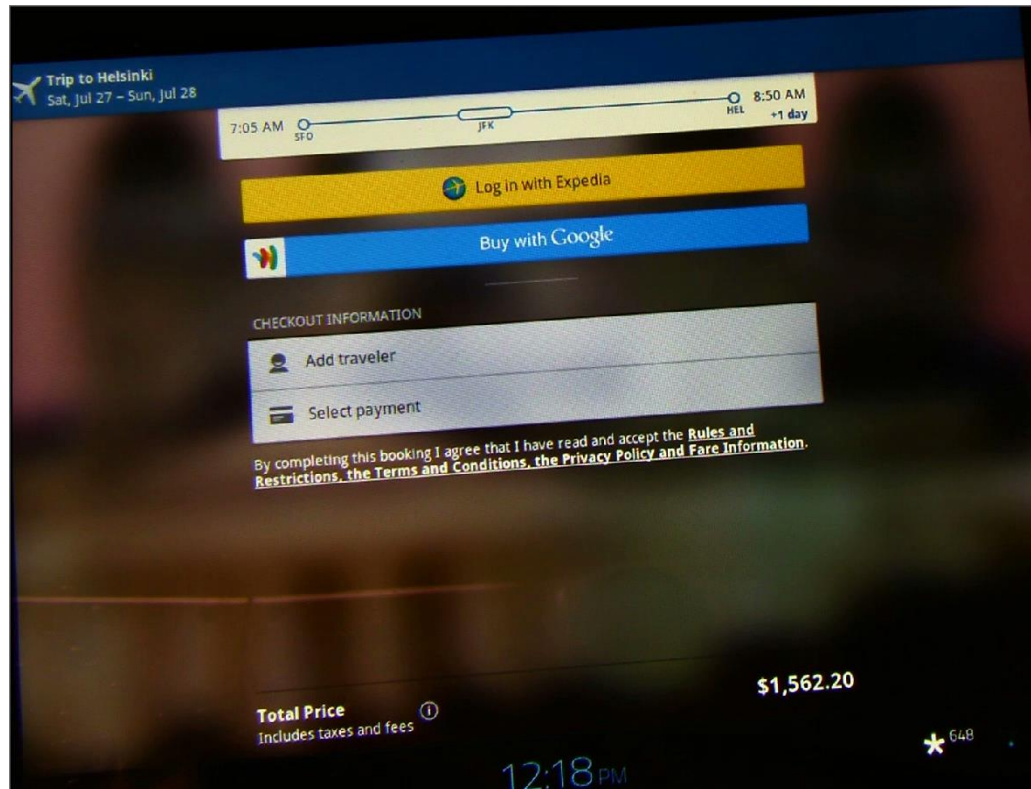
Expedia for Android (screenshot from usability testing video): The two clear calls-to-action were Log in or Buy with Google. Our participant wanted to checkout as a guest; she tried to select the payment type but didn't realize that she also had to add a traveler in order to be able to complete the checkout. The checkout-as-a-guest option was not clearly marked.

64. Use sensible defaults for app options.

Interior design for iPad is an app for building house plans and for decoration. When laying out the plans, users can move and resize the different rooms that they decided to include. However, by default, when resizing the rooms, they could get an irregular shape (i.e., a shape other than rectangle). Most of our participants struggled with that option, as they did not realize that they could have turned it off (and forced all rooms to be rectangles).
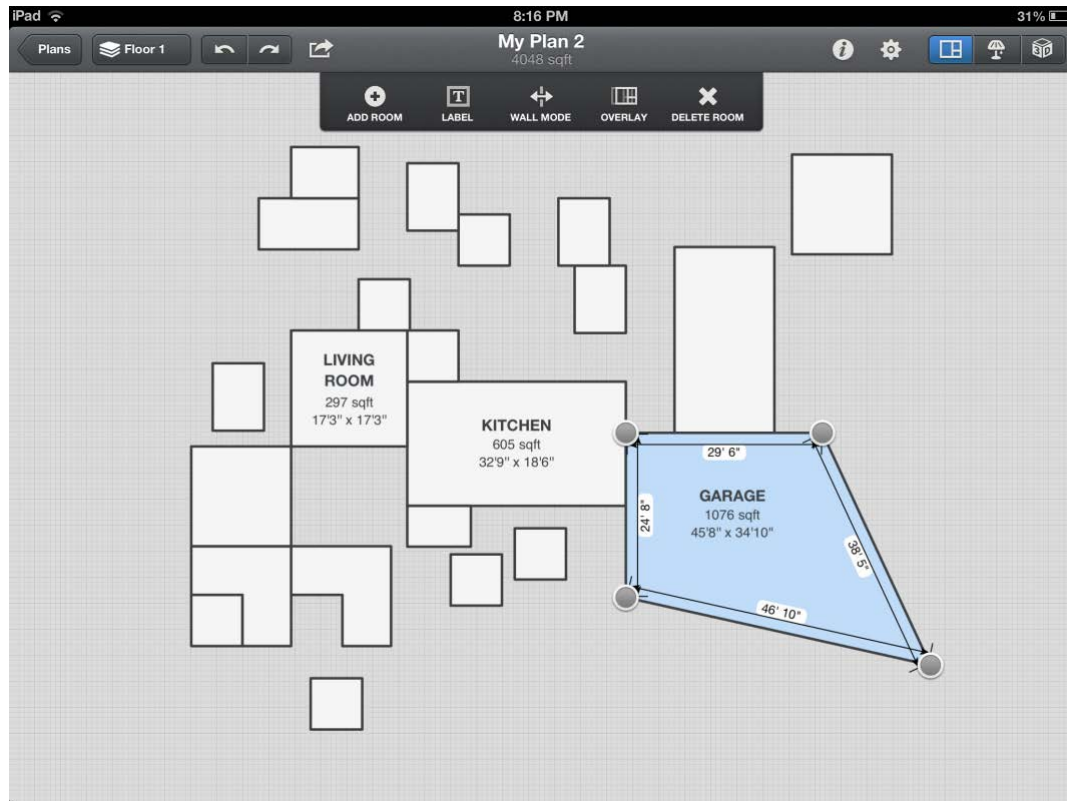
Interior Design for iPad. By default, when users resize a room, the shape can change. Most people want rectangular rooms, and making sure that the rooms stayed rectangular was a big hassle for our users. The app had a "Wall Mode," which, when enabled, enforced that all the rooms were rectangular; however, it was not turned on by default and people did not discover it.

In the case of Booking.com, by default, the prices for different hotels are offered in the local currency rather than in US dollars. Most of our (American) users wished that they could see the prices in US dollars, and, although the app did allow them to switch to USD, some users never found that option. Instead, they thought they should go outside the app and convert the prices to their desired currency.
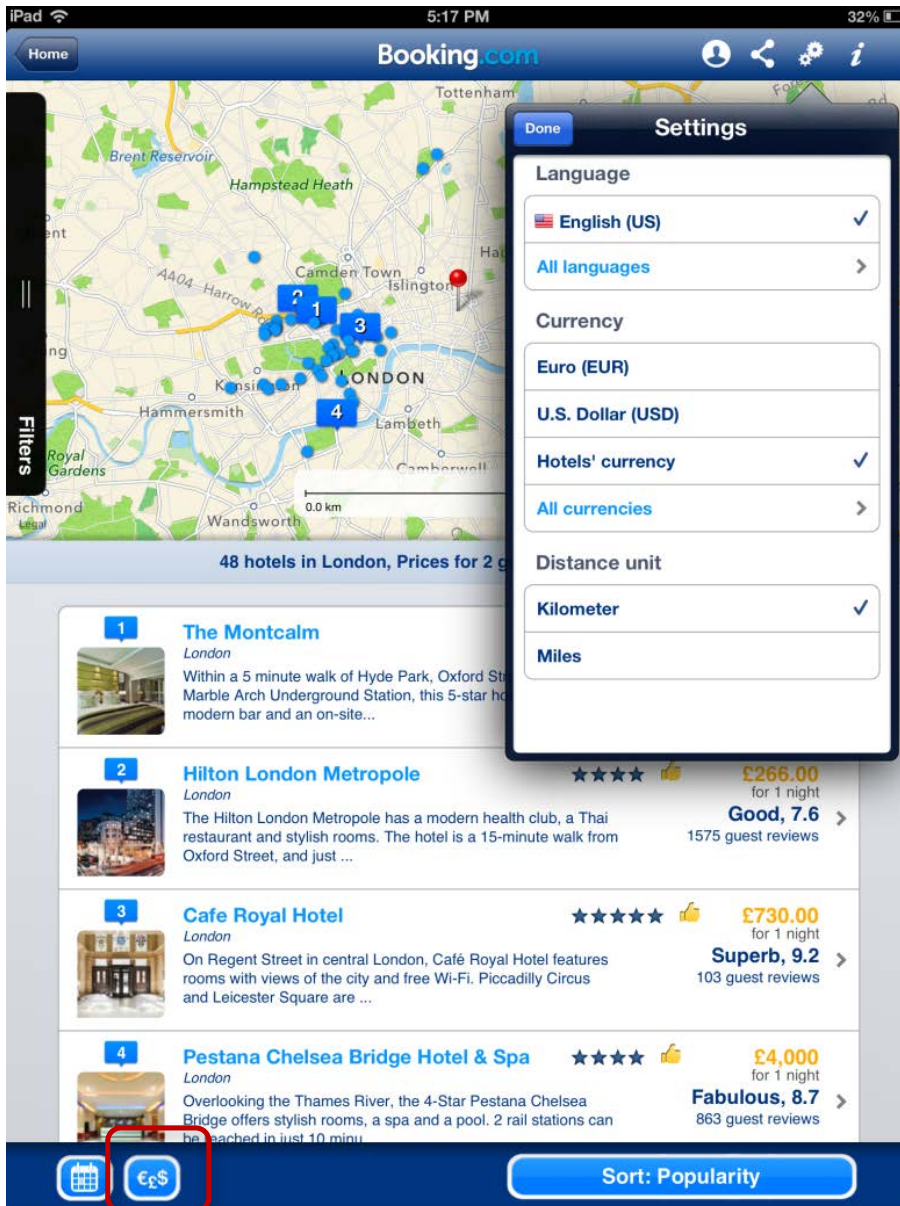
Booking.com on iPad: Users need to go to settings to change currency or they can hit the currency button at the bottom of the screen. Our participants did not realize it was possible to do so.
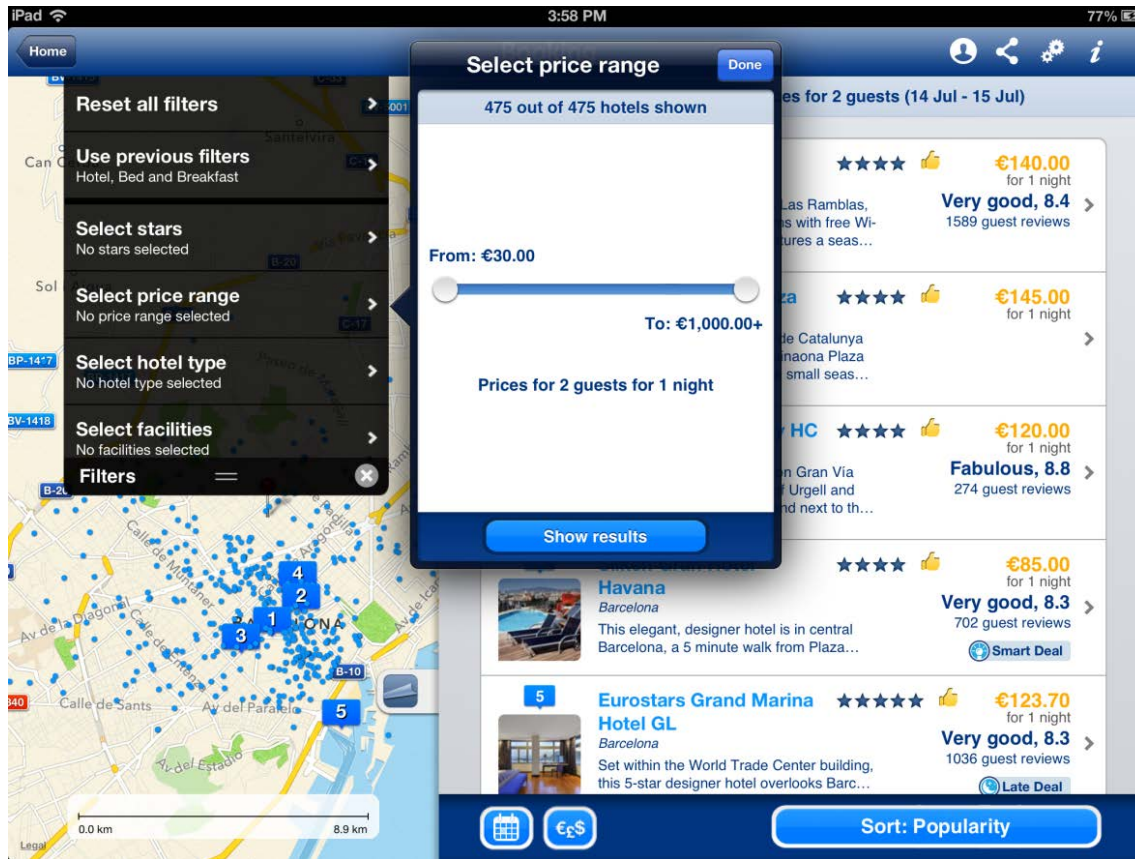
Booking.com: The currency option would have been more visible if it were in the popover that enabled users to set a price limit for their search.

Navigation and Tool Bars

65. Include a home button as a way for the user to start all over and go back to a home base.

Many times when users were lost in the app, we noticed that they wanted to start from scratch with a clean plate. It turned out that apps, in their (legitimate) desire to save state for the user, did not let them do so. Users tried to quit the app and launch it again; some even resorted to killing the app from the list of recently run app, but even in those situations, sometimes the app saved state and they could not start from the beginning.

One of our participants got lost in Reuters' Wider Image and he complained that there wasn't an easy way to go back home. The home screen contained a huge canvas with photo stories. When the participant selected one of them, he could read and see the corresponding photos. Our participant decided to switch tabs and go to Explore, and then wanted to return back to the home screen. None of the tabs were titled home. When he tried "Latest" (the 1st tab), he got back to the story and not to the home screen. Although the app does the right thing by preserving state within tabs, a home button that took the user back to the home screen would have helped him feel in control and gain a sense of orientation in the app.
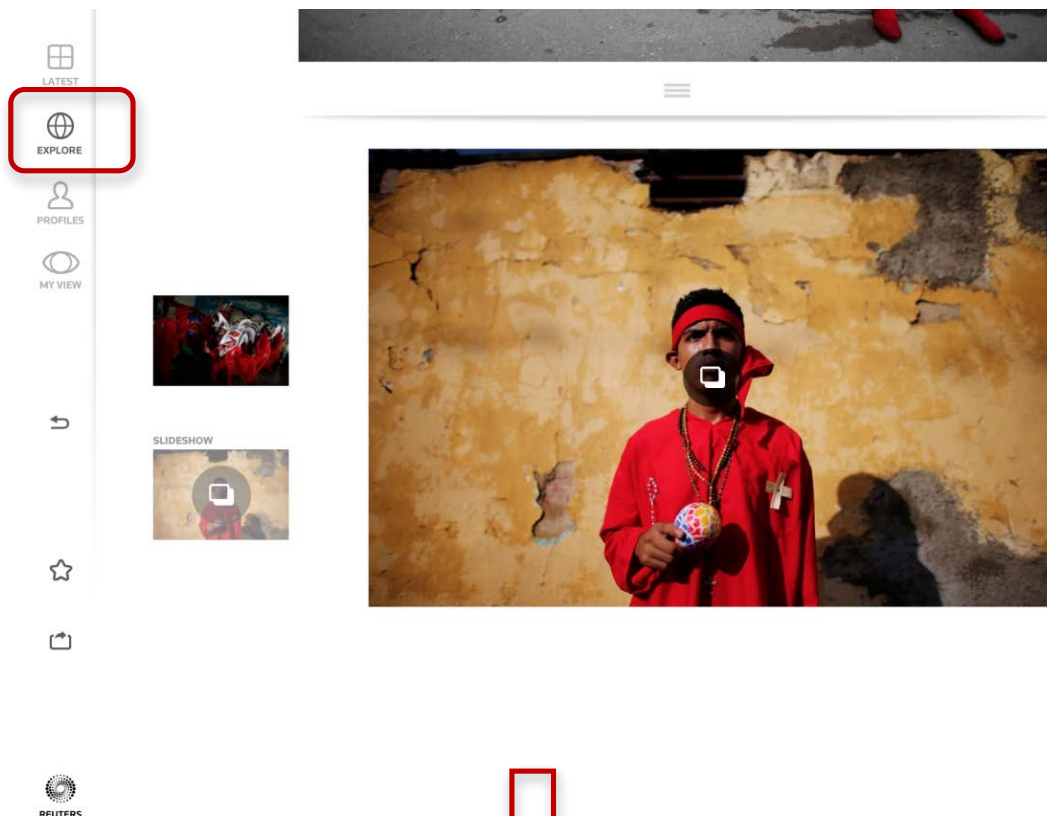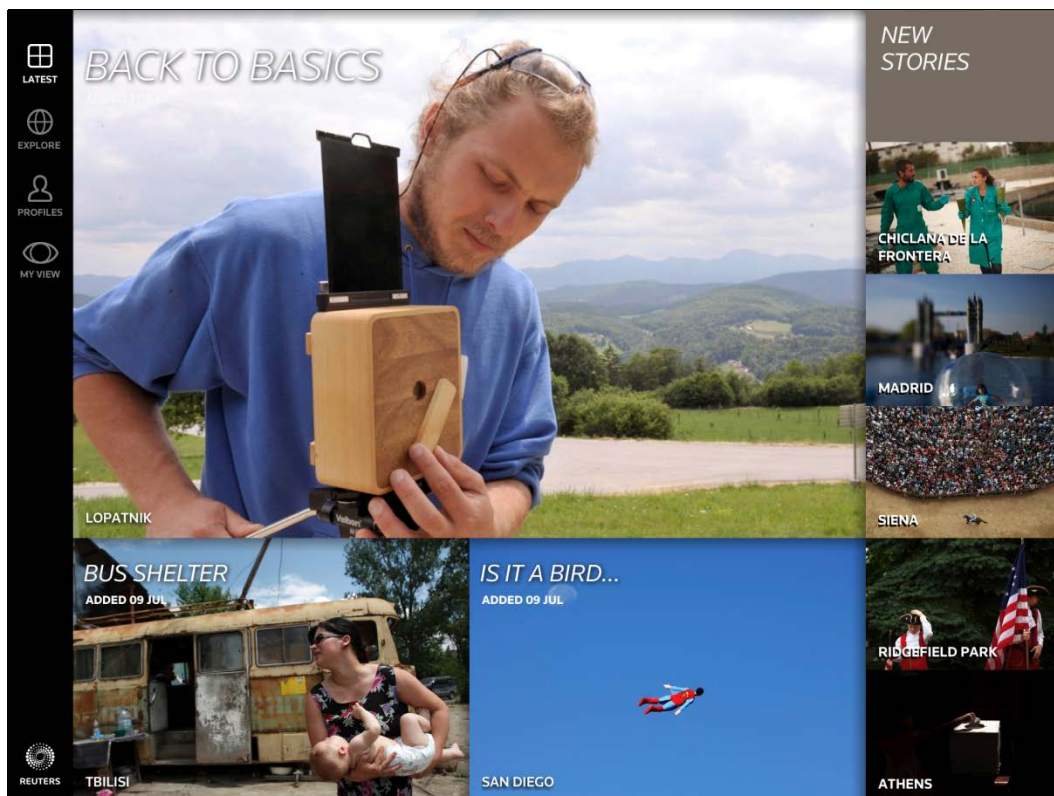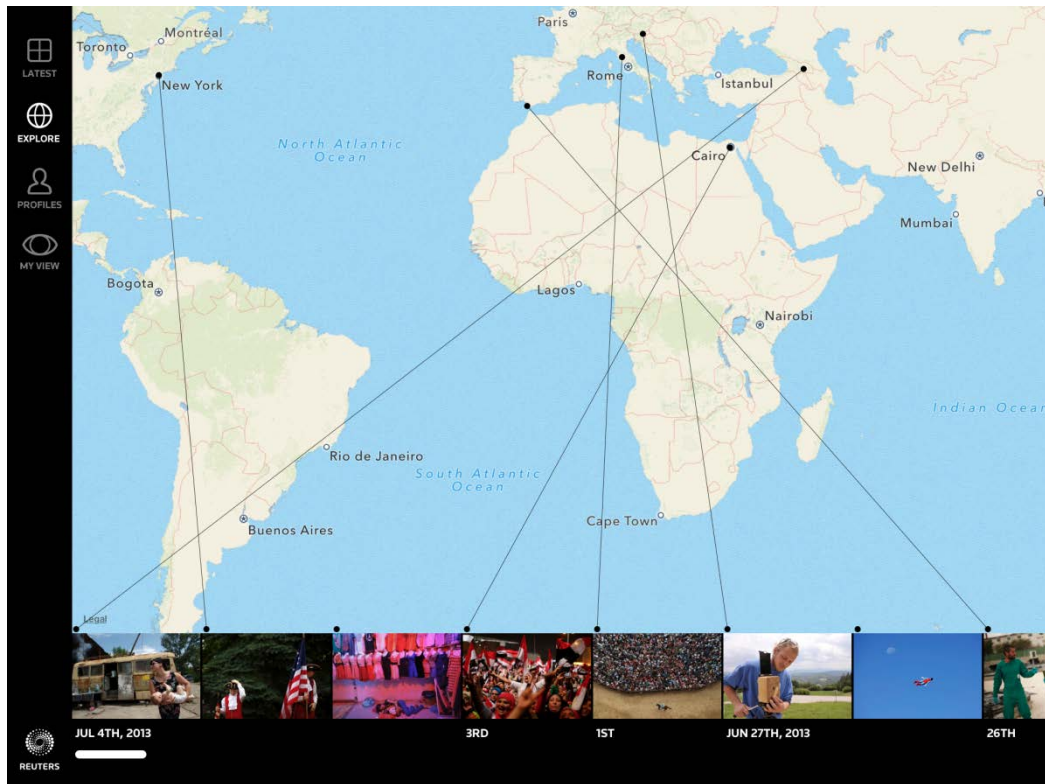
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When using Redfin, some users where confused as they were navigating through the app and wanted a way to start all over. There was no way for them to return to a home base because the app did not have a homepage.

Open Table, an app for making restaurant reservation, also does not have a homepage. As a result, global settings and account information are buttons that appear arbitrarily on some pages (e.g., map), but are not present on others. Since the choice of settings and account info on the map page is pretty arbitrary, it's unlikely for users to expect it there or remember that it's there.
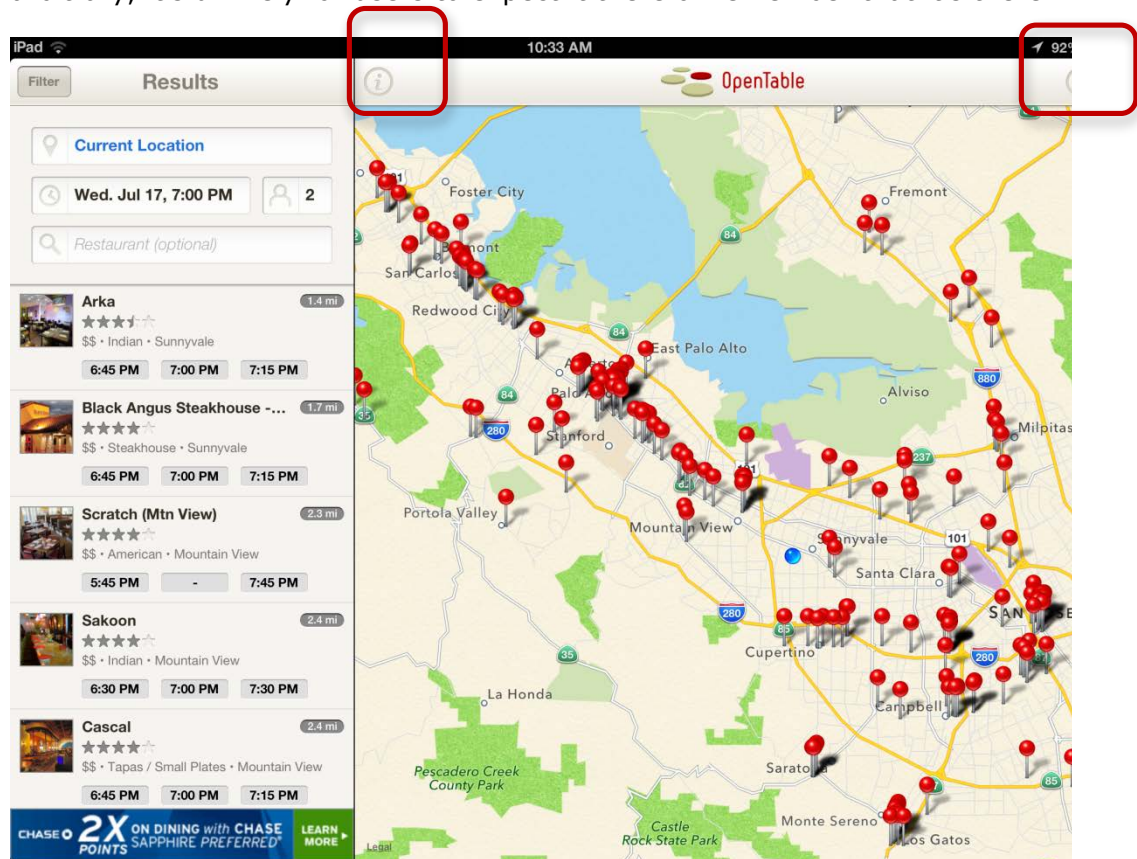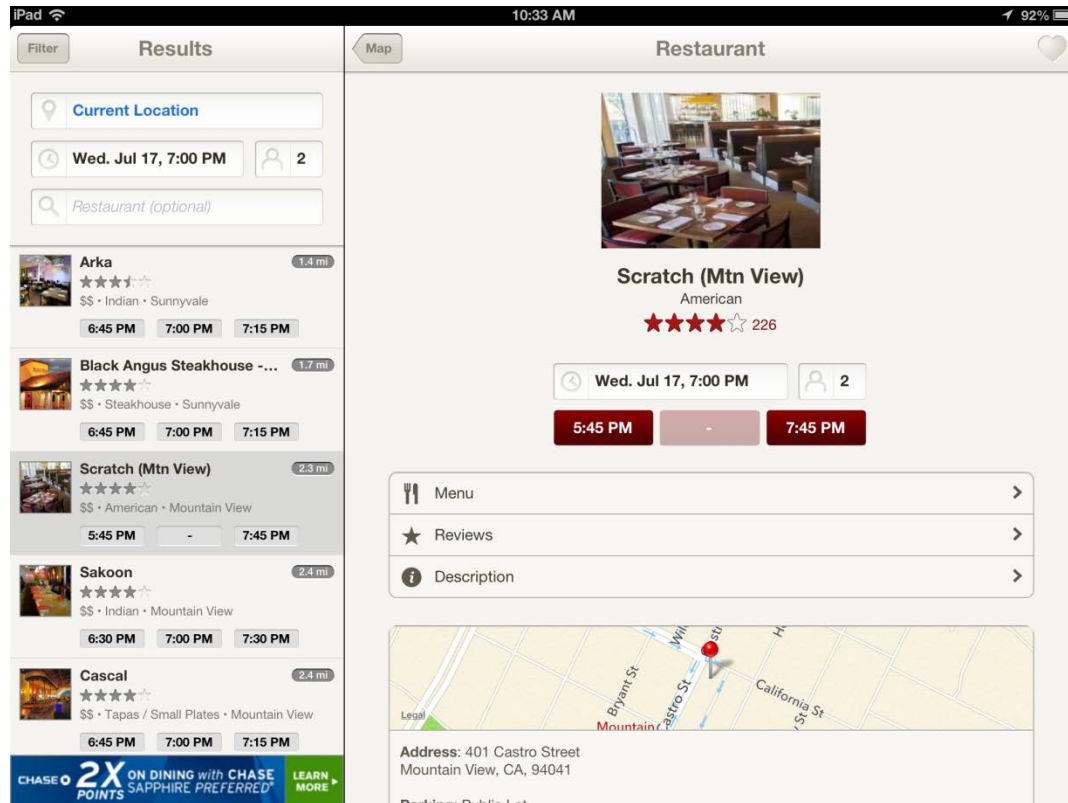
Open Table for iPad. The settings and account info appear on the map page, but not on the restaurant page. There is no homepage to help the user get oriented.

66. **Crucial functionality (essential navigation options, search feature) needs to be visible on the screen.**

Out of sight is out of mind. If it's not present on the screen, people often do not discover that feature, or, if they discovered it once, they're less likely to go back at it again.

Unfortunately, hidden navigation plagues many apps or website, and the motivation beneath it is well justified: saving space and prioritizing content over chrome.[5] Windows 8 exemplifies the prioritization of content over chrome taken to extreme.

In Windows 8, the search function can be exposed by swiping over the right edge of the screen. This is a convention at the operating system level, and many apps obey it. Similarly, navigation and tool bars can be typically found by swiping over the bottom or the top edge of the screen.

Unfortunately, these hidden features caused a lot of trouble in testing. People did not discover them in an app (although they may have used them in a

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[5] By chrome we mean interface elements that help the user access the content they are interested in. Users don't use an app for the chrome; they use it for the content. The chrome is a tool for facilitating the interaction with the app.

different app or at an operating-system level). And even for those who did eventually discover them it wasn't a quick process — only after fumbling around and trying to discover these features in the app, it did occur to them that swiping around the edges may be a good idea.

Luckily, Microsoft eventually realized that hiding the search box and the main controls in apps is not a great idea, and took at least one step in the right direction. In the newest version of Windows 8, some of the Microsoft apps (such as Weather below) have visible search tools.

Weather for Windows 8. The original version of Windows did not include the search tool in the top right corner. This caused users to be completely lost, as they did not realize that they had to swipe around the edges to expose controls and change the default city to a different one. In the current version, the search tool is visible, but people can still expose navigation by swiping over the top and bottom edges (see below).
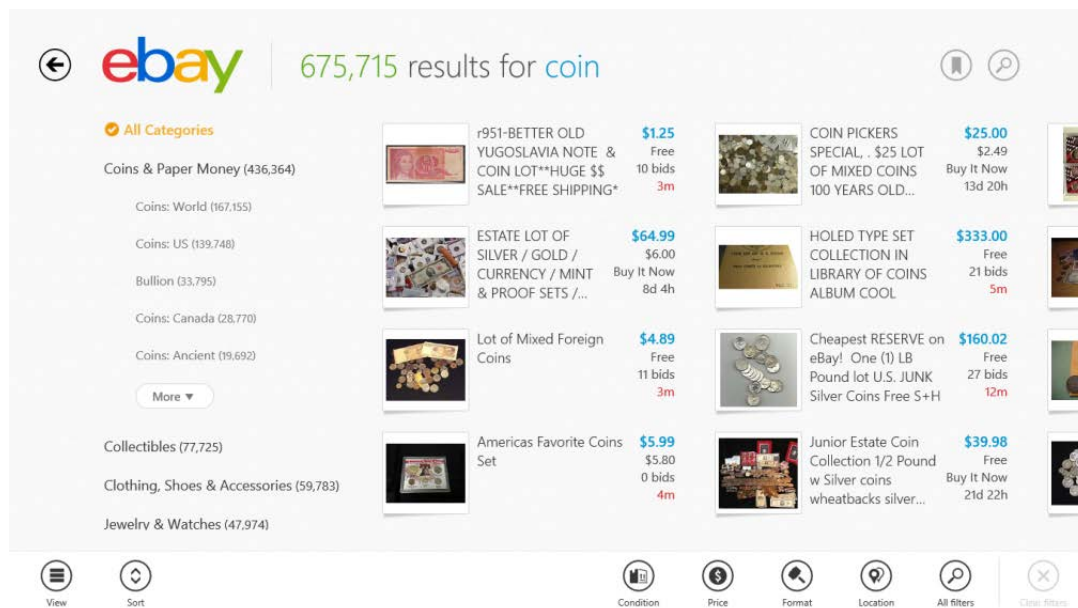
eBay for Windows 8. After experimenting with various visibility settings
for the search and for the filters, eBay settled on the most sensible one:
the search tool is always visible on the screen and the filters are visible by
default (unless the user swipes over the bottom edge; that gesture makes
the filters disappear).
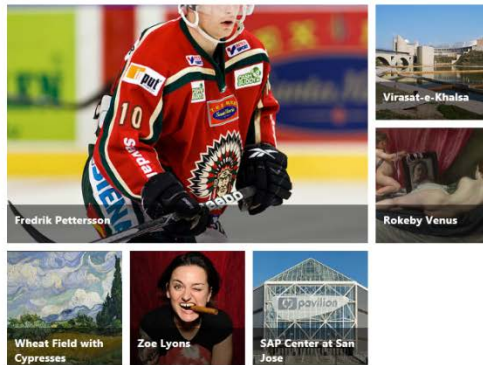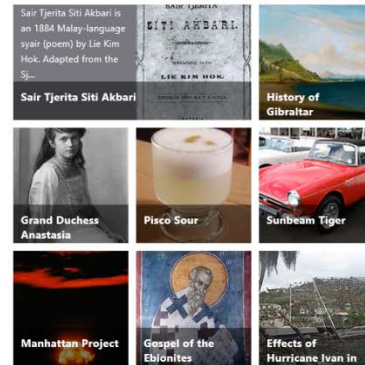
Wikipedia for Windows 8. The search feature is not visible; users must swipe on the right edge to expose it.

Applications on other operating systems also have problems with deciding which functionality to keep visible.

Soundhound is an app that identifies songs. In the iPad version, the most important button of the app (the "What's that song" button) is hidden under a menu instead of being prominent on the homepage.
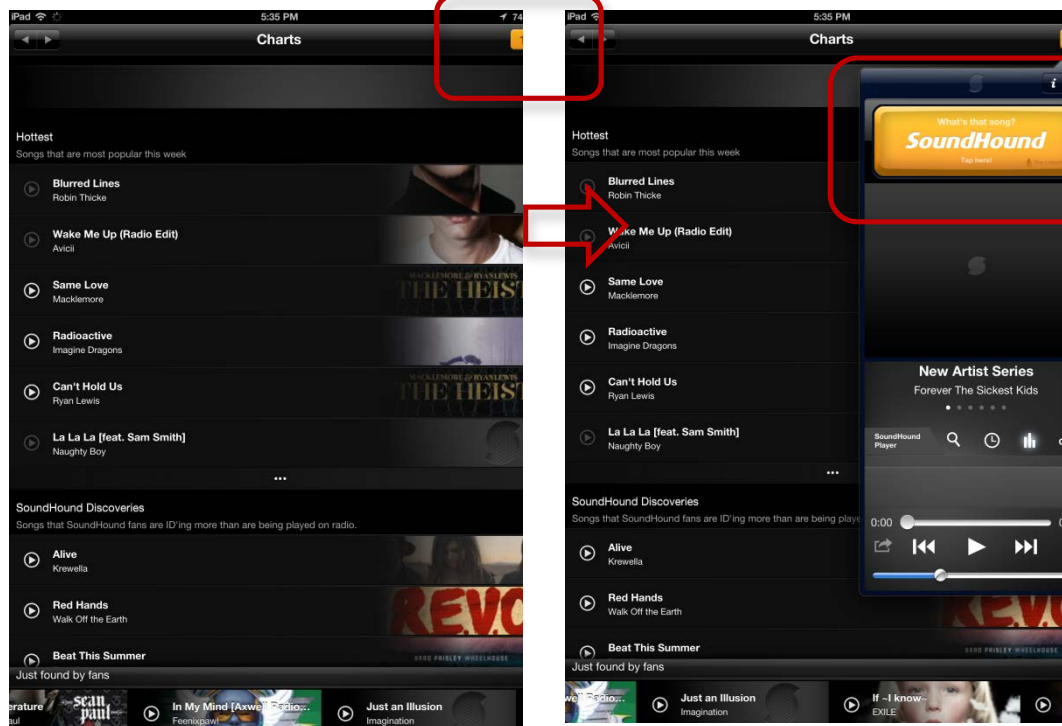
Soundhound for iPad: The What's that song button is hidden under the home popover in the portrait orientation.

BHG Must Have Recipes for Android hides search under a lateral sliding menu that is hard to find. Our participants had a hard time figuring out how to search for recipes in this app; many ended up using the built-in visible navigation, although it did not quite match their needs and required a lot more work.
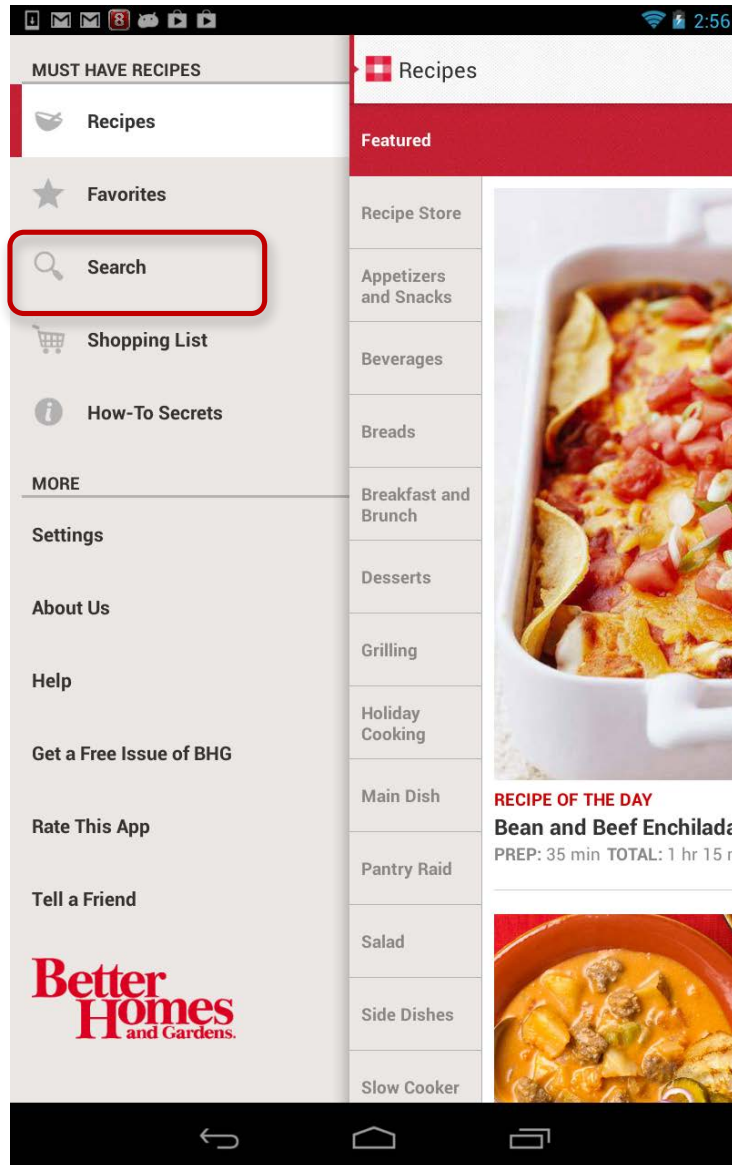
BHG for Android: search is hidden in the lateral sliding menu.

67. Menus need to have good affordance.

If you are hiding options under a menu, you need to provide good visibility and labeling for that menu so that people know what they will find there. Unfortunately, sometimes apps try to minimize the menu label and end up making the menu practically invisible.

An example is the sliding menu, a popular trend nowadays. Its big attraction is that it saves space and may preserve context. However, in the attempt to save as much space as possible, some apps make sliding menus hard to discover.

For instance, BHG Must Have Recipes for Android utilizes a left-hand side sliding menu that is quite easy to miss. The only cue is a tiny arrow in the top left corner of the screen. After struggling for a while with the app and finally discovering the sliding menu, one of our users commented that "it's not intuitive at all that the swipe is there."
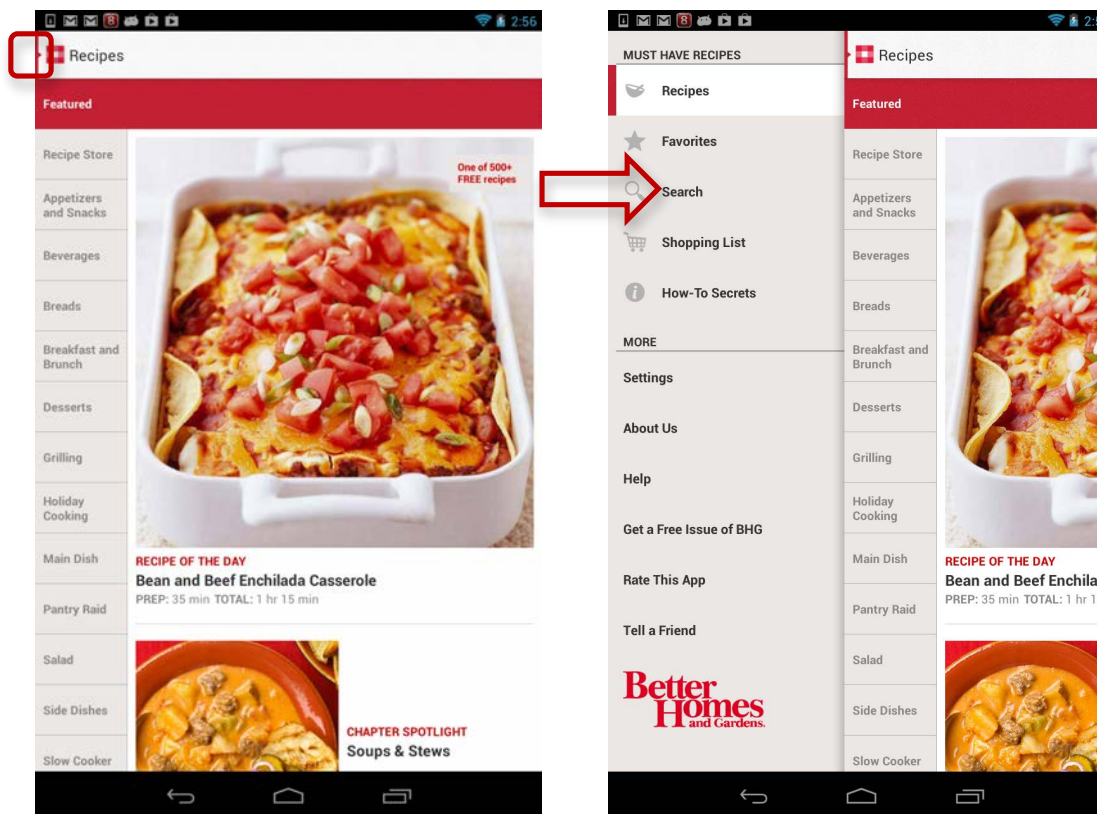
BHG Must Have Recipes for Android: The sliding menu is signaled only by a tiny arrow at the top of the screen.
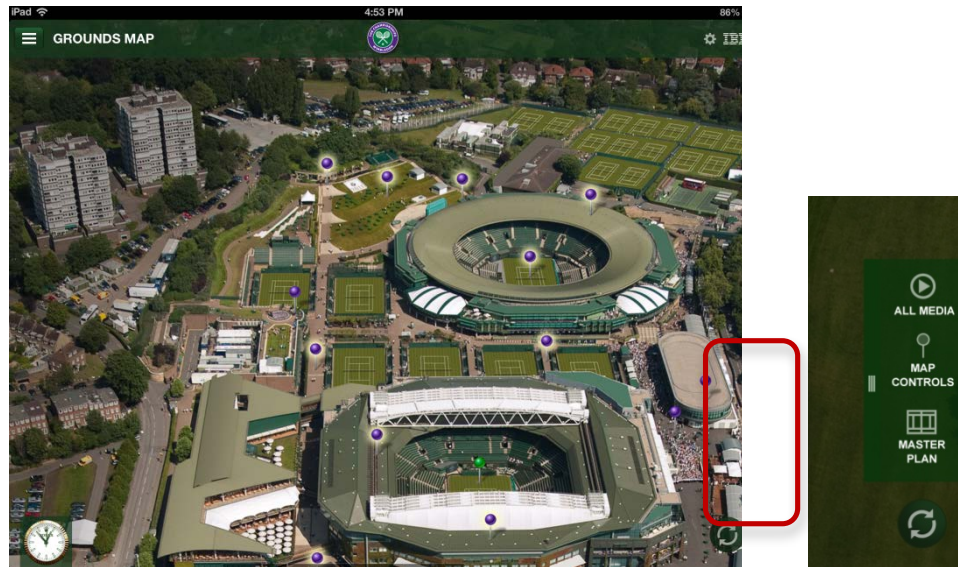
Wimbledon: The sliding menu on the right is practically unnoticeable.

Wimbledon utilizes a sliding menu on the right that blends too well with the map and is very hard to notice.

On Tripadvisor, the filters are a vertical pull-out on the map; the button is far away from the list of results and visually it blends with the map, making it easy to ignore.
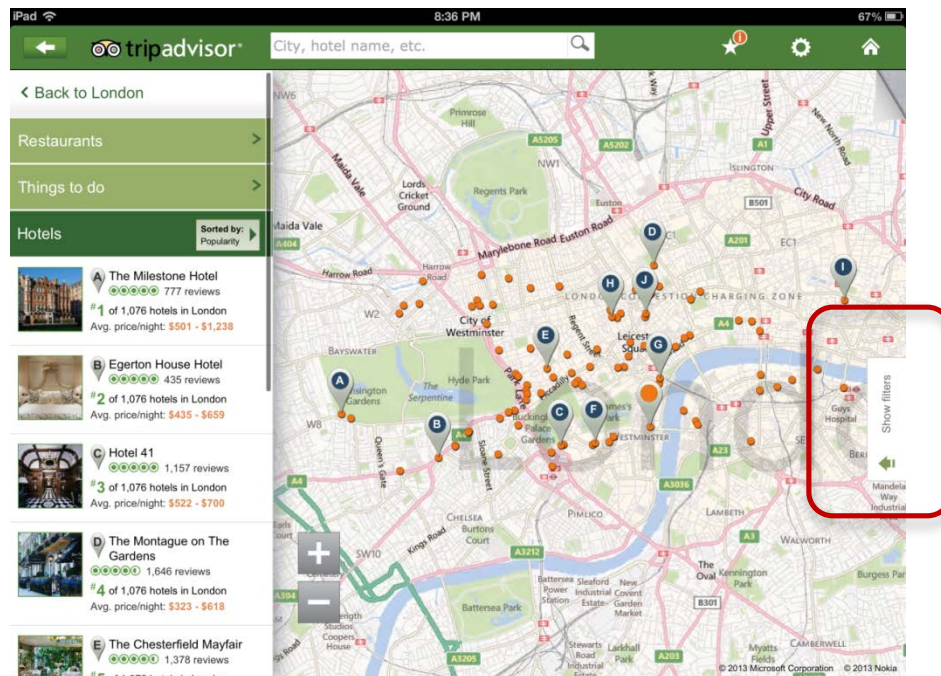
TripAdvisor for iPad: The filter button blends in with the map and can be easily missed.

Booking.com has a similar way of displaying filters, but the visual treatment and the proximity to the search results is better, making the filter menu more likely to be noticed.
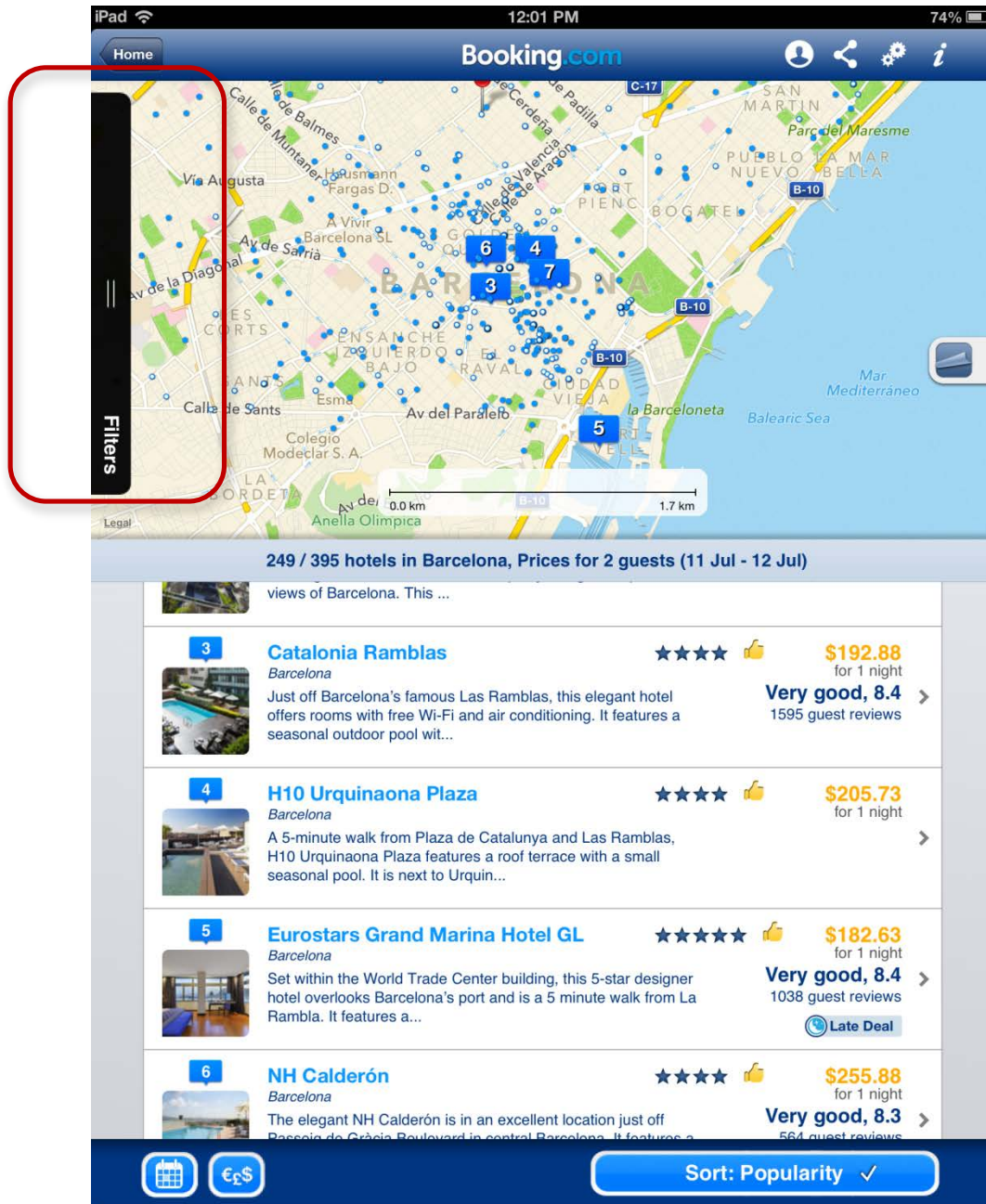
Booking.com for iPad: A similar lateral pull-out black button for filters is more noticeable.

The menu icon has become quite standard and the majority of people recognize it, especially if the site uses good contrast. This menu is sometimes referred to

as the "hamburger icon" among user experience professionals, though we recommend not using this term with users.

La Presse for iPad. A Canadian newspaper uses the standard menu icon in the top left corner.
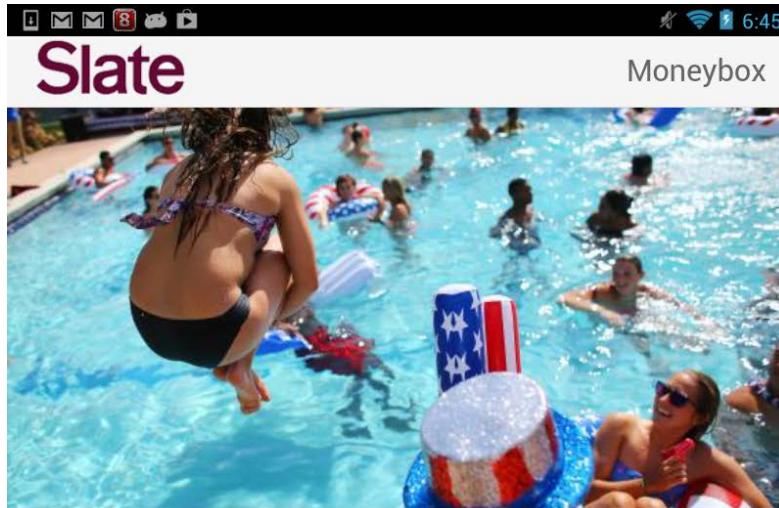
Currents for Android. The gray on white (modified) menu icon is placed in a nonstandard position and is hard to see.

68. The icon for a menu needs to stay the same throughout the app.

The same menu needs to be designated by the same icon on different pages of the app. Otherwise, users will have to learn what triggers the menu on every page.

In iMDb, a sliding menu is accessed through the logo on the homepage and through a menu icon on other pages. This inconsistency is puzzling and puts an unnecessary burden on users' memory.
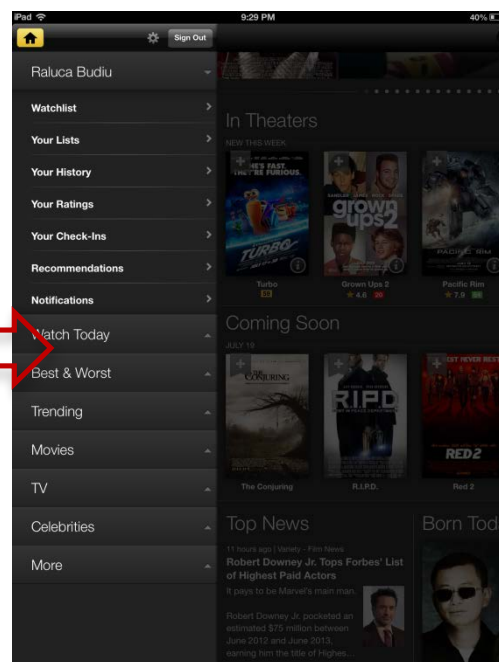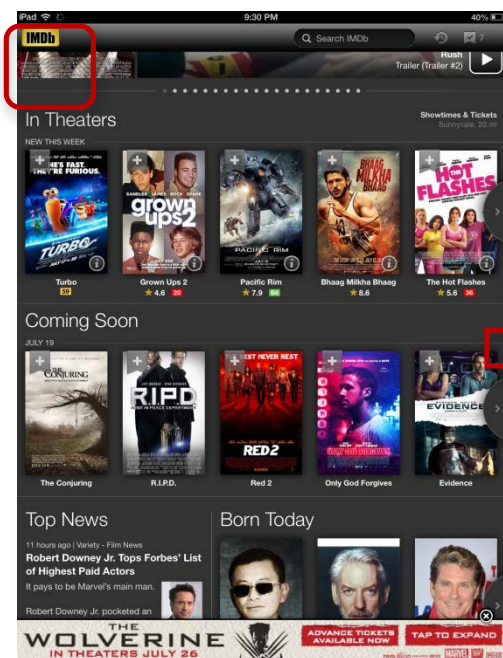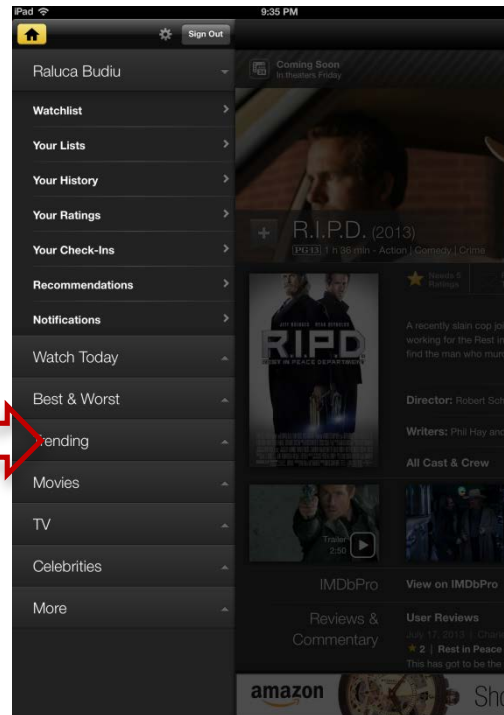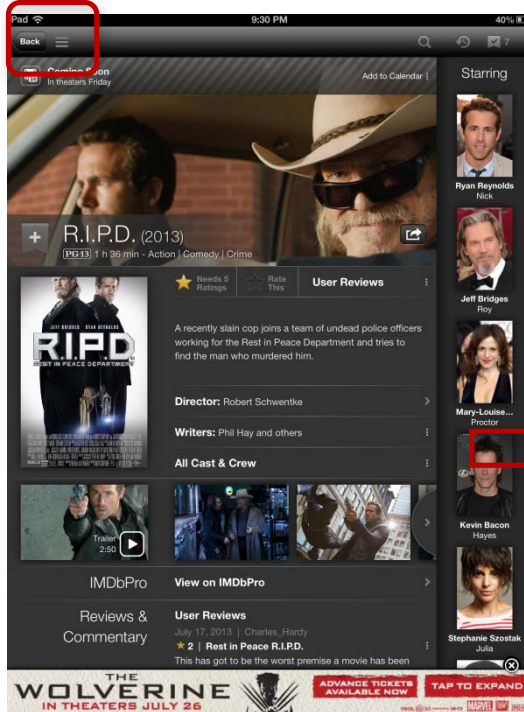
iMDb for iPad. The same menu is accessed either by pressing the menu icon on deep pages or by pressing the logo on the homepage.

HORIZONTAL NAVIGATION AND SWIPING

69. When using horizontal (deck of cards) navigation styles, make sure that you give users cues so that they know how they can interact with your app.

A popular alternative to vertical scrolling is the deck of cards model in which people swipe horizontally to go to a different "card" (or section of the app). Horizontal swiping has become quite standard; however, most often users need cues in order to figure it out.

The cues can be arrows at the bottom of the screen, or fragments of the next page peeking out at the sides.

LinkedIn structures the profile information in multiple cards; unfortunately, although the cues for horizontal swiping are there, they are quite subtle and easy to miss.
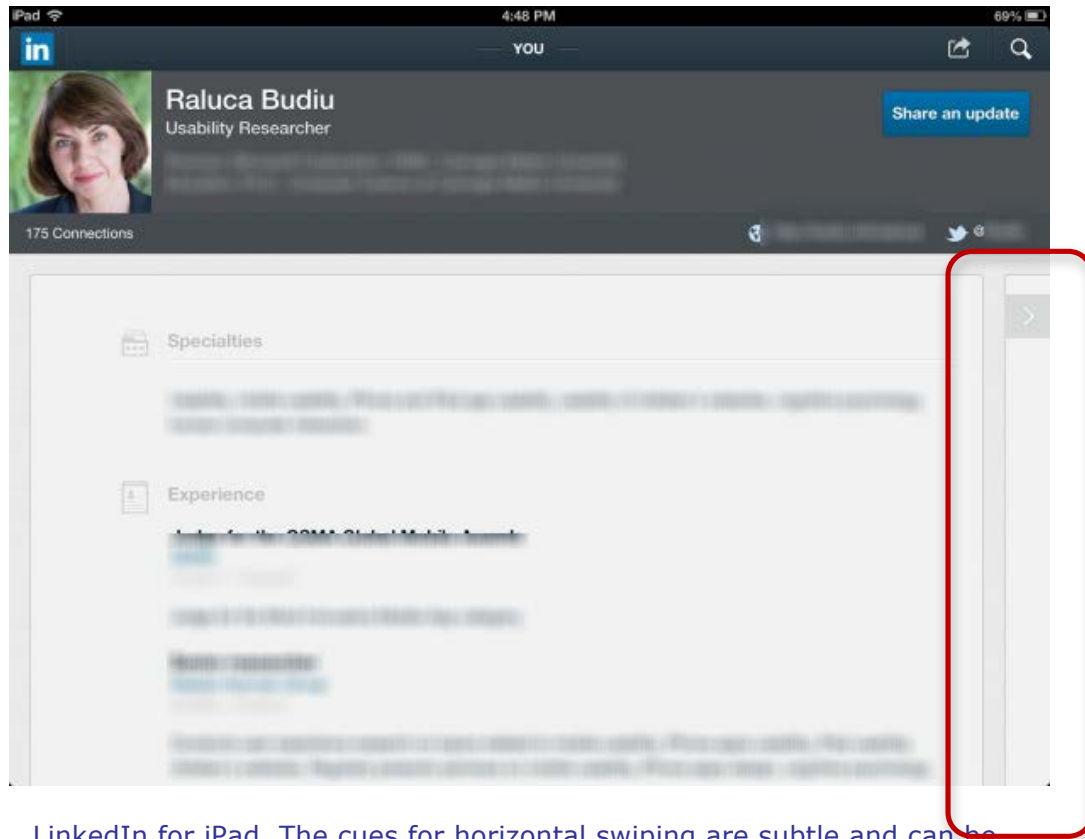
LinkedIn for iPad. The cues for horizontal swiping are subtle and can be easily missed by users.
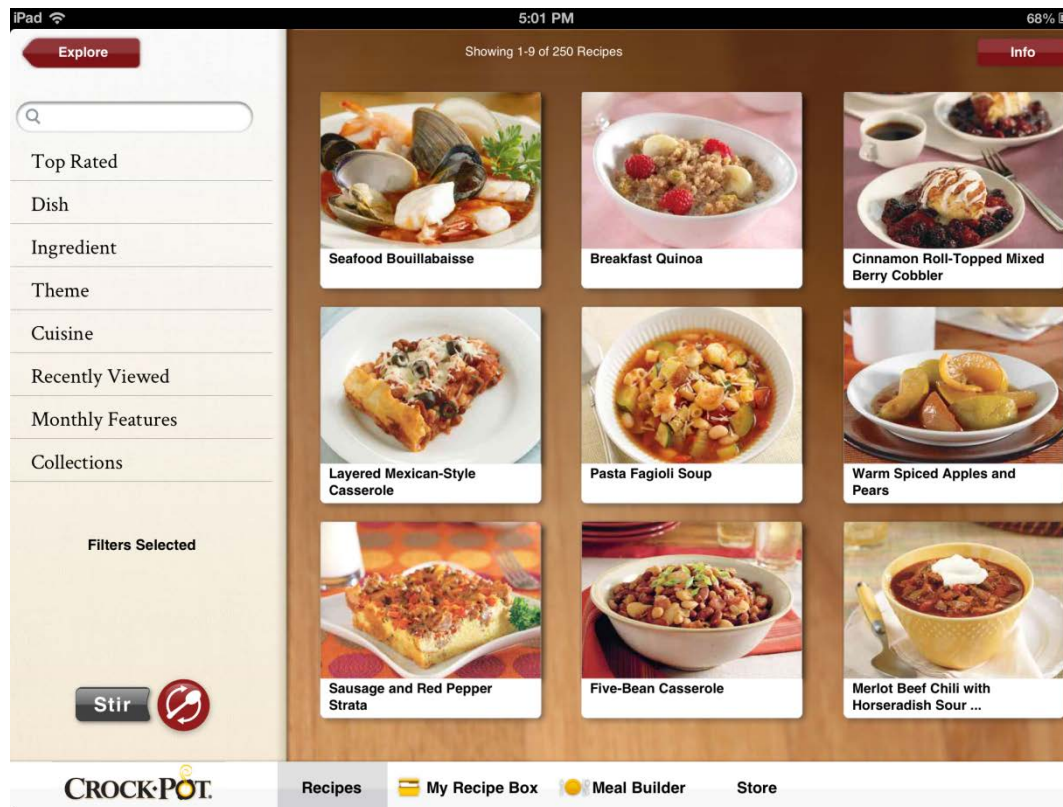
Crockpot for iPad: Users can swipe horizontally to get more recipes; however, there are no cues to suggest that gesture to the user.
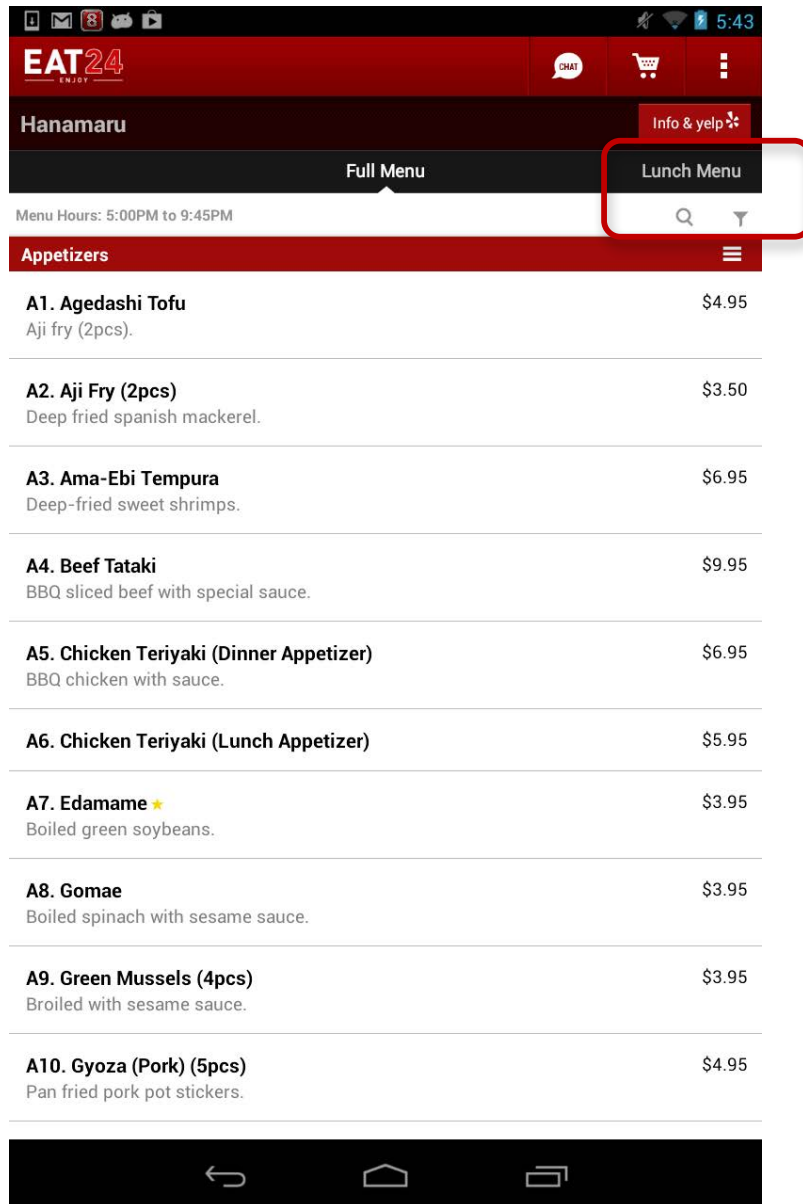
Eat24 for Android. You can swipe horizontally to see the lunch menu, but the cues are very subtle (there is a Lunch Menu label at the top).

Windows 8 has made the horizontal swipe an integral part of its user-interface style. The swipe is well signaled in many (but not all apps), by showing a fragment of the content that is "on the other side" of the tablet edge.

Skyscanner for Windows 8. The illusion of horizontal continuity invites the user to swipe for more.

Amazon for Windows 8. Unfortunately, the app does not give good cues for horizontal swiping on its homepage; it's not clear that there is more content to the right.

70. Avoid using several navigation styles (horizontal, vertical) within the same app. If several navigation styles must be used, be consistent in how you assign them to different types of content.

Most people learn one style of interaction with an app and expect to stick with it as they use the app. Different navigation methods on different pages disorient the users and increase the memory load.

When magazine apps for iPad first came out, they tended to use a variety of navigation methods, sometimes different in different orientation. More recent apps have settled (mostly) on two ways to navigate throughout the magazine: vertically within article and horizontally for moving to the next article.

Although this dual style of navigation is a little more complex, as long as it's consistently deployed, people can do well with it.

The New Yorker for iPad. Horizontal swiping moves from one article to the next. Vertical scrolling moves within an article.

However, other news applications push the navigation variability a little too far. For instance, Currents for Android, a news aggregator, requires several different styles of navigation: (1) horizontal swiping for moving from one source to another (although not all "cards" in this horizontal stack are really sources — some are simply coverpages such as Business or Lifestyle for a new set of sources); (2) vertical scrolling for seeing the article headlines within one source; (3) horizontal swiping for reading the article page by page and for navigating to the next article.
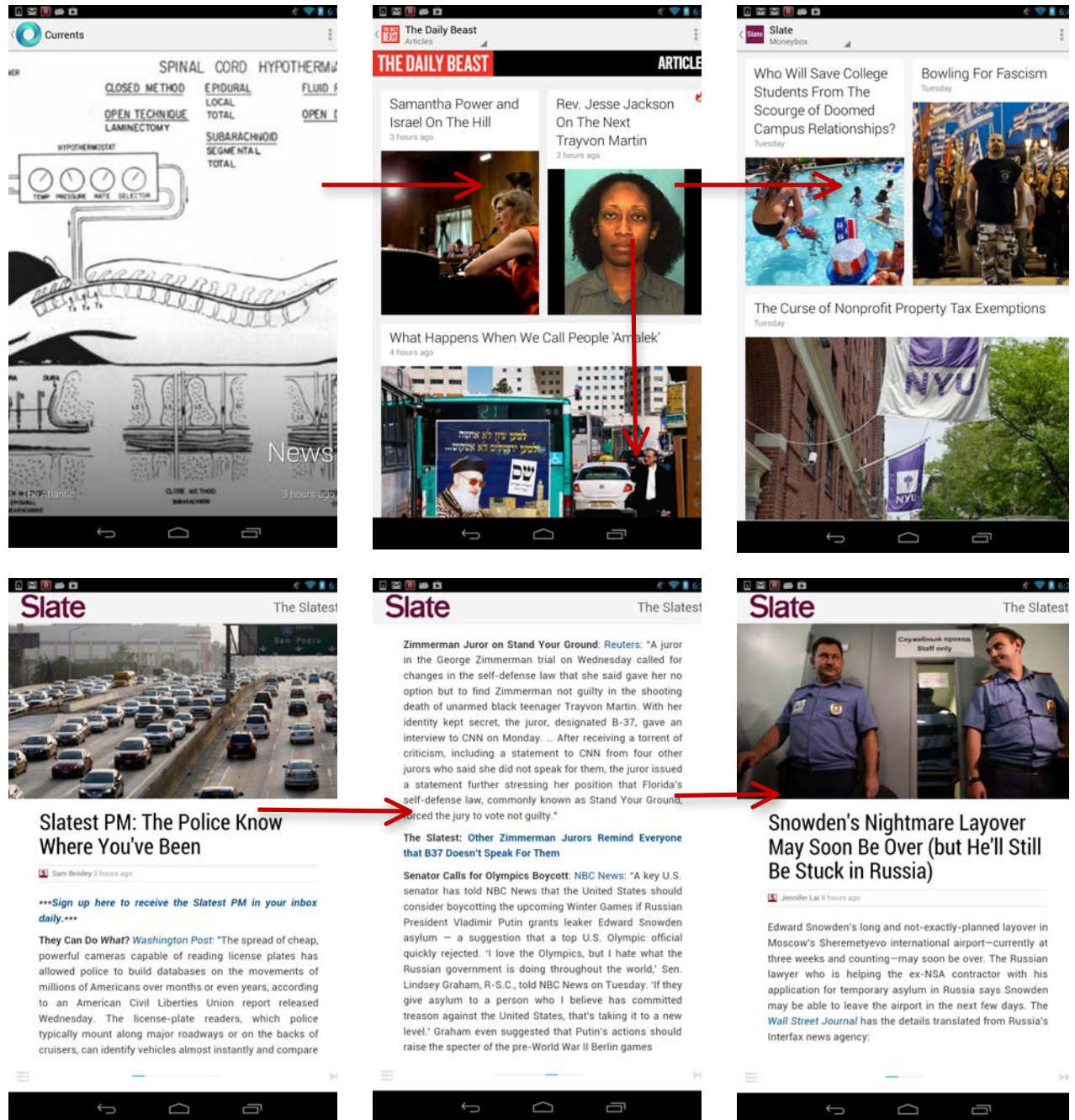
Currents for Android. Horizontal or vertical navigation is required, depending on the context. Users must use horizontal swiping to get from one source to another or to read the pages of the same article or to read the next article; they should scroll vertically if they want to see all the headlines on a page. At least on the article pages the arrows in the lower right point the user to the correct way to navigate (although they could benefit from a stronger contrast with the white background).

71. Do not use an infinite canvas for navigation.

The infinite canvas is appealing visually, but has the disadvantage of being terrible to use. Users have no natural landmarks (beginning or end) and have to remember the items on the canvas in order to realize whether they've already seen the content presented to them or not. When the infinite canvas can be moved in both directions (horizontally and vertically), the confusion is amplified even more.
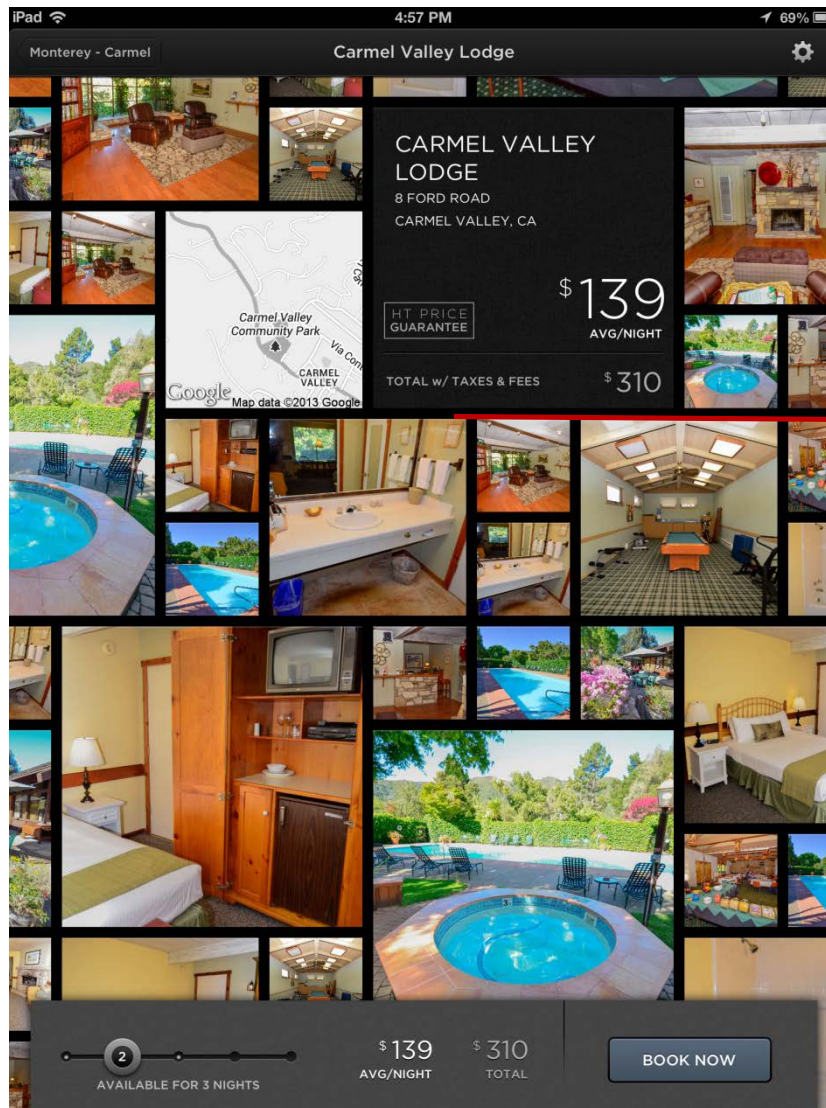
Hotel Tonight for iPad. The hotel pictures and information are organized in an infinite canvas that can be scrolled horizontally and vertically. Users have to remember if they have seen the pictures before.

72. Do not change navigation styles depending on the orientation.

Magazine apps used to vary navigation styles a lot depending on orientation: horizontal swipe for landscape and vertical plus horizontal for portrait. We are happy to report that the problem has been largely remedied, and we now find a lot more consistency between orientations.

Remember that users don't expect to learn a new interface when they change orientations. They assume that the same behavior that they've learned so far is going to hold valid.

Shopstyle by Popsugar uses different navigation styles depending on orientation: horizontal swiping is used in landscape mode and vertical scrolling in portrait mode. At the minimum, this causes users a wasted gesture each time they turn their tablet. (At the worst, people repeat the expected command to no avail and assume that the app doesn't have any more to show them.)
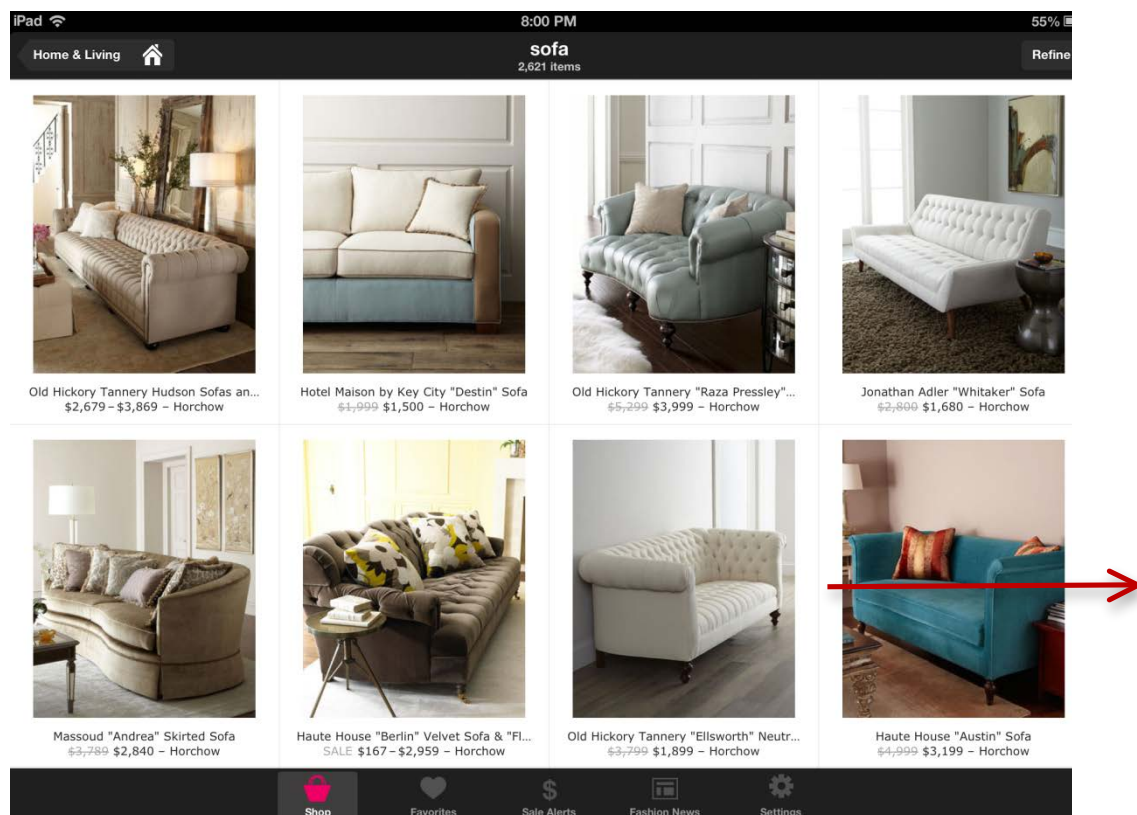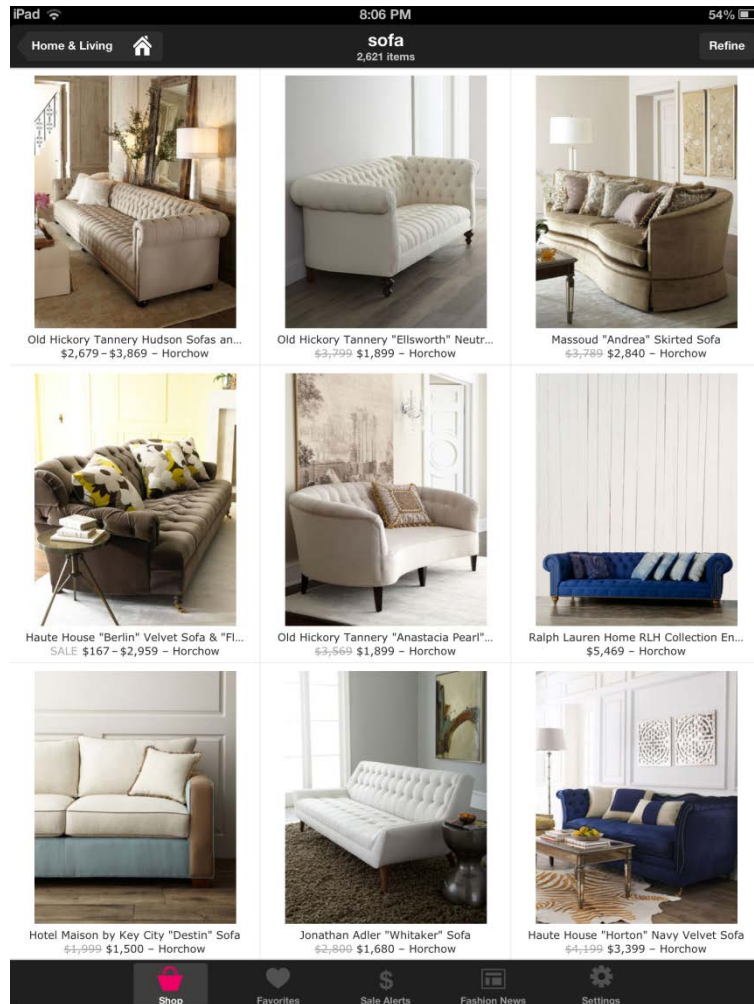
Shopstyle uses horizontal swiping in landscape mode and vertical scrolling in portrait mode.

THE BACK BUTTON

On a large tablet touch screen, accidents are bound to happen: people will eventually touch something by mistake and be puzzled by the new page. When the first iPad apps first came out, many were plagued by the absence of a Back button. We pointed out that problem, and we are happy to report that most apps nowadays comply with our recommendation to include a Back button. Unfortunately, some confusion still exists with respect to the meaning of the Back button.

The Back button is often interpreted in one of two ways: (1) undo; (2) up in a hierarchy. Most of the problems in today's (mostly iOS) interfaces stem from implementing back as up instead of as undo.

Back as up will take the user up in the interface, on a page that is at the immediate higher level in the page hierarchy. Back as undo will take the user back to the previous page that they were on.

73. (iOS and Windows 8) Include a Back as undo button in your iOS app. (Note: Android has a global Back button that eliminates the need for a separate Back button in the interface).

We still include this guideline for apps like the Habitat magazine (below), which are still not convinced of the need for a back button.

The Habitat magazine by the Australian Conservation Foundation. This app has no back button at all. If a user accesses an article from the table of contents, the only way to go back to the table of contents is the article carousel at the bottom of the page.

74. (Android) Do not include a separate Back button if the operating system provides one.

It seems hard to believe that an app would waste screen space with a Back button instead of using a perfectly good one provided by the operating system. Often, examples like the one below stem from trying to reuse the same design for both Android and iOS platforms.

L'Occitane for Android. The global back button at the bottom of the screen takes the user outside the app on any page. To go back, one must use the soft Back button in the top left corner.

75. (iOS) Make sure that you include a Back button on your homepage.

76. (Android) On the homepage, the global Back button should take the user back to the previous page and not outside the app.

As a result of implementing Back as up, most apps do not have a Back button on the homepage. That is simply wrong. The homepage can (most often) be accessed through a logo or a Home button from elsewhere within the app. With the current implementation of Back as up, all history is lost once people reach the homepage.

Android escapes some of the problems with the Back button because of the virtual Back button that is provided by the operating system. However, even with Android, the implementation of the Back button on an app's homepage is often incorrect, as it typically takes the user outside of the app instead of taking them to the previously visited page.
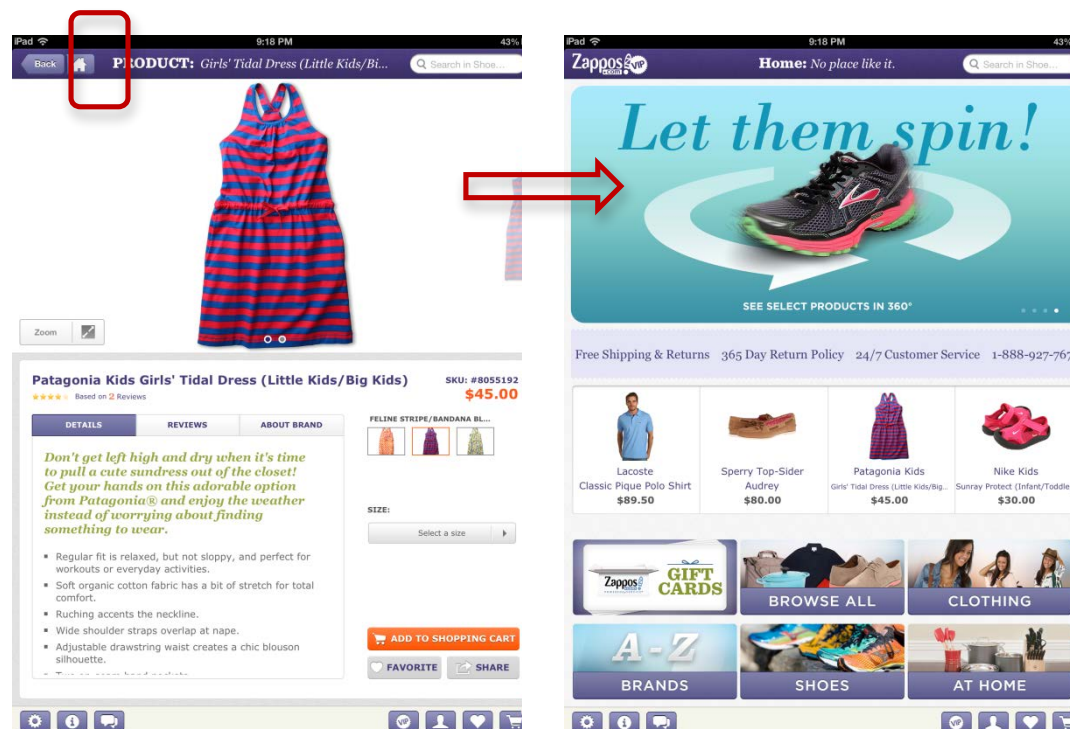
Zappos for iPad. A Back button is provided on all pages, but not on the homepage. Hitting Home from a product page takes the user on the homepage, where they now have no ability to return to the product page.
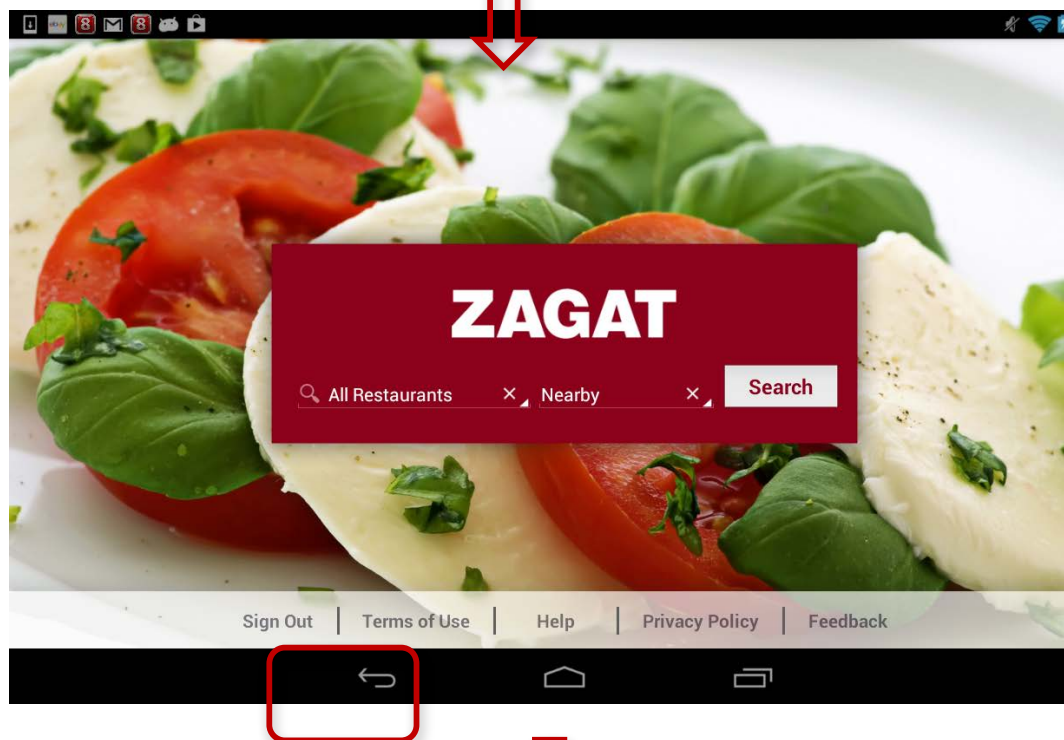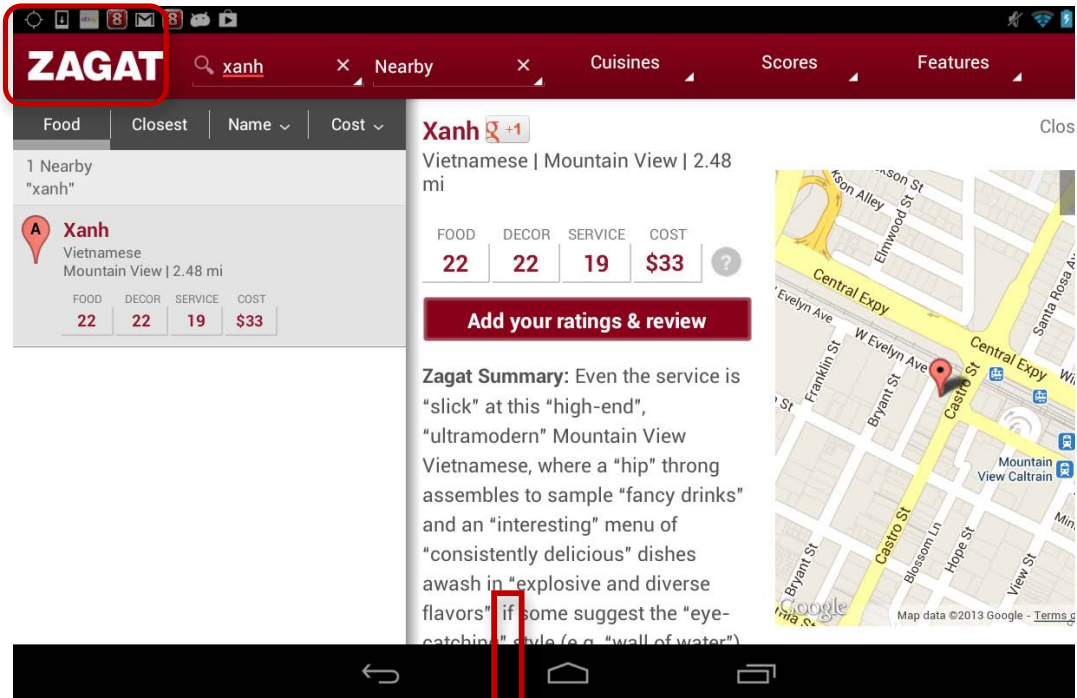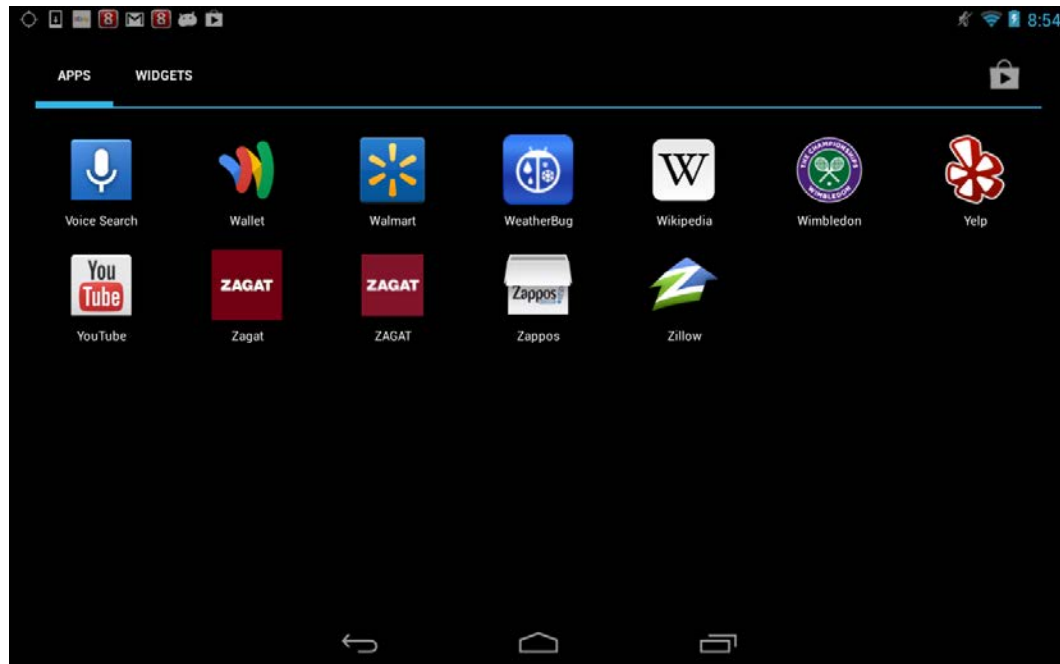
Zagat for Android. If the user runs a search, but then accidentally hits the logo, they, get to the homepage. Hitting the Back button on the homepage takes the user outside the app. The user has lost their original search and must run it again.

Two years ago, Bing was the only app that had a Back button on the homepage. Today, it's still the only one that we know of.

Bing for iPad. The app has a back button on the homepage.

77. **When there are multiple frames on the same page, avoid implementing Back at the frame level.**

78. **When there are multiple frames on the same page, avoid having multiple Back buttons — one for each frame.**

When the screen is divided into multiple frames or panes, one question that arises is: what is the meaning of Back? Some apps have addressed that issue by picking a "main" frame and implementing Back within it.

Both these solutions can be confusing. Keeping track of multiple back buttons and multiple histories is no easy task for the user. When people press Back, they usually mean to revert the result of the last action they just did.

If solving this problem sound complicated, reconsider the frames that you have on the screen. It may be that your division of the screen is too complex and you need to reconsider the flow.

An example comes from iMDb for iPad. One of the problems with the app is that they display search results in a small popover, and keep the background fixed. The Back button acts at the level of the main frame only. So, if users run a search, select a search result and then want to go back to the search, they cannot use the back button, because the back button will only take the user to the page previously shown in the main frame.

INFO@NNGROUP.COM   Navigation and Tool Bars
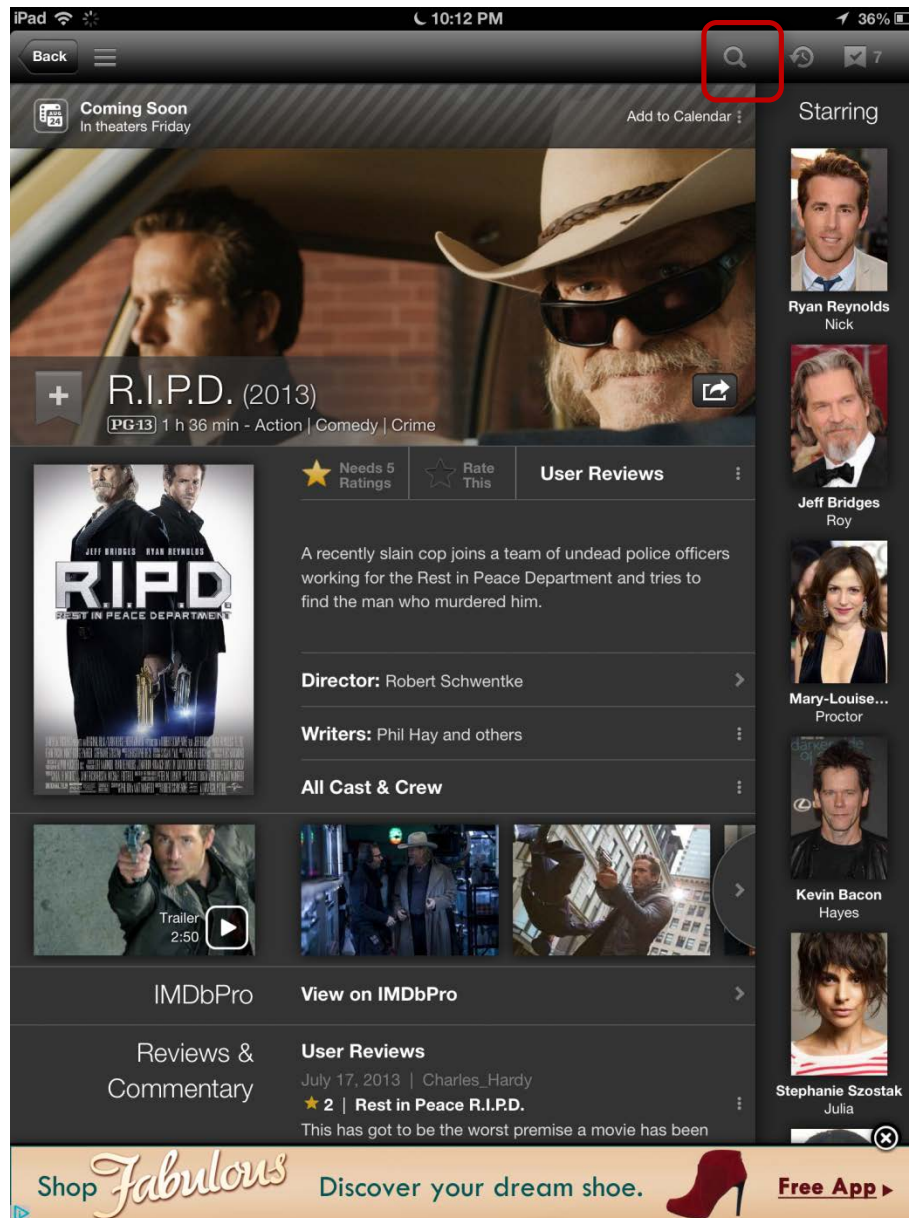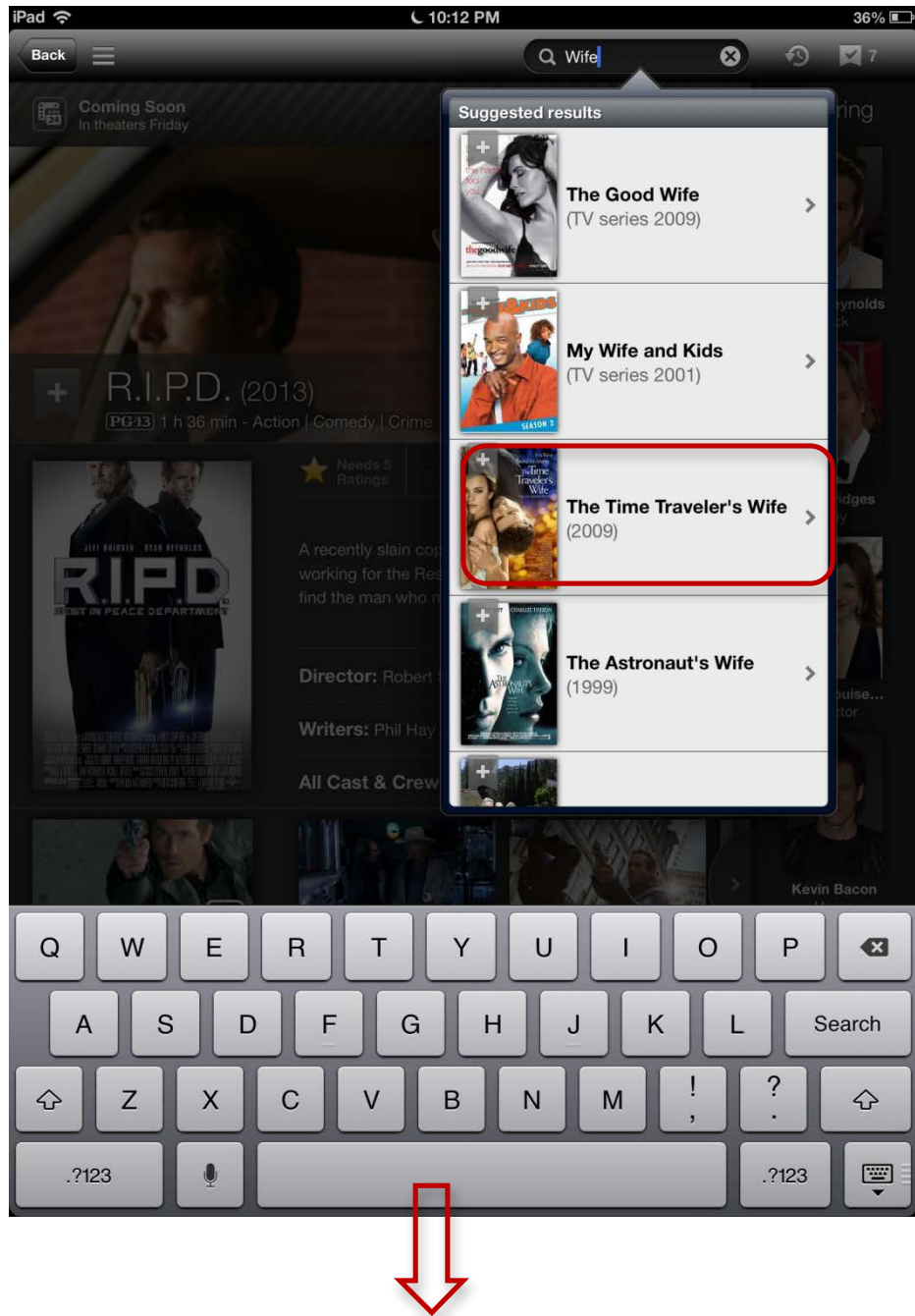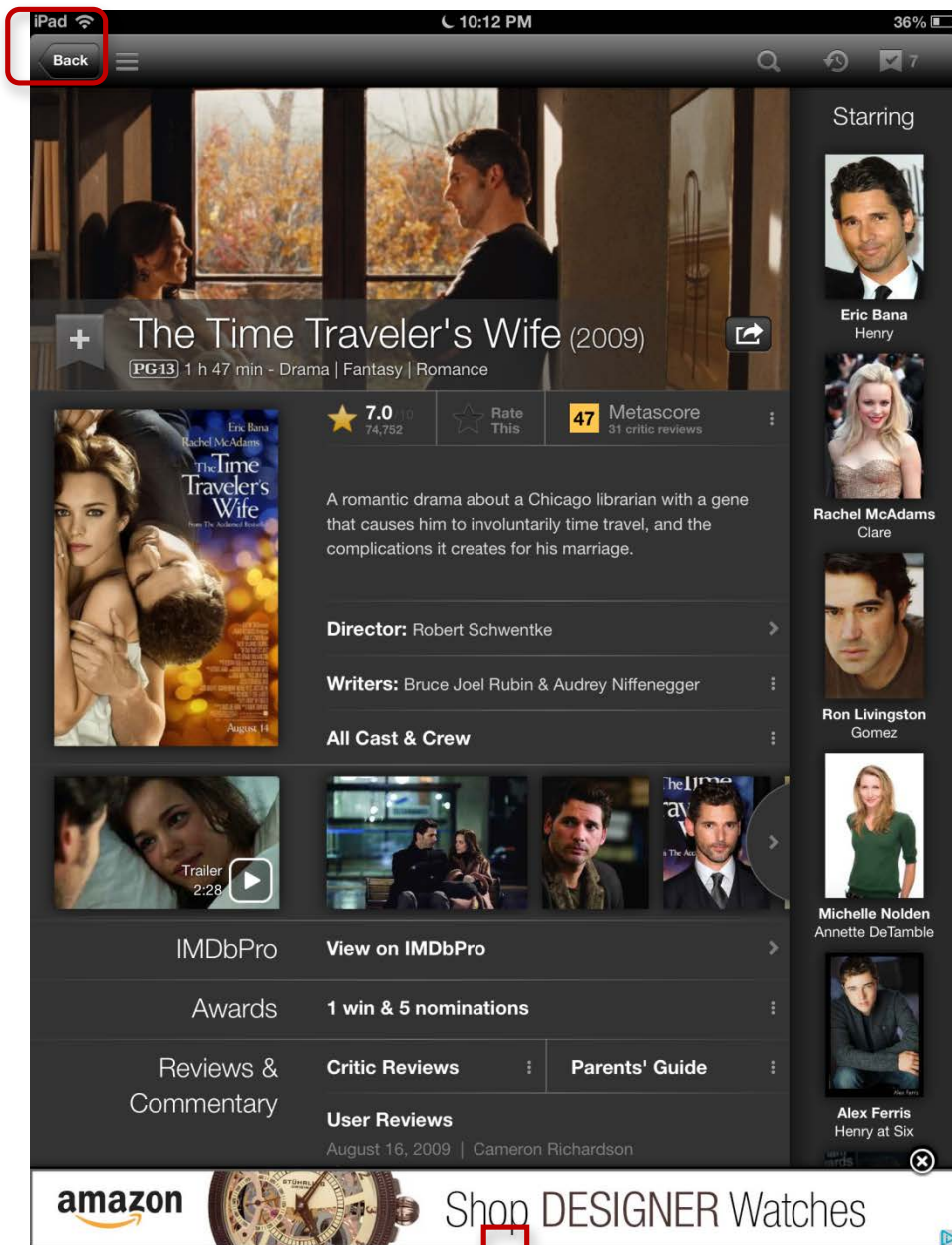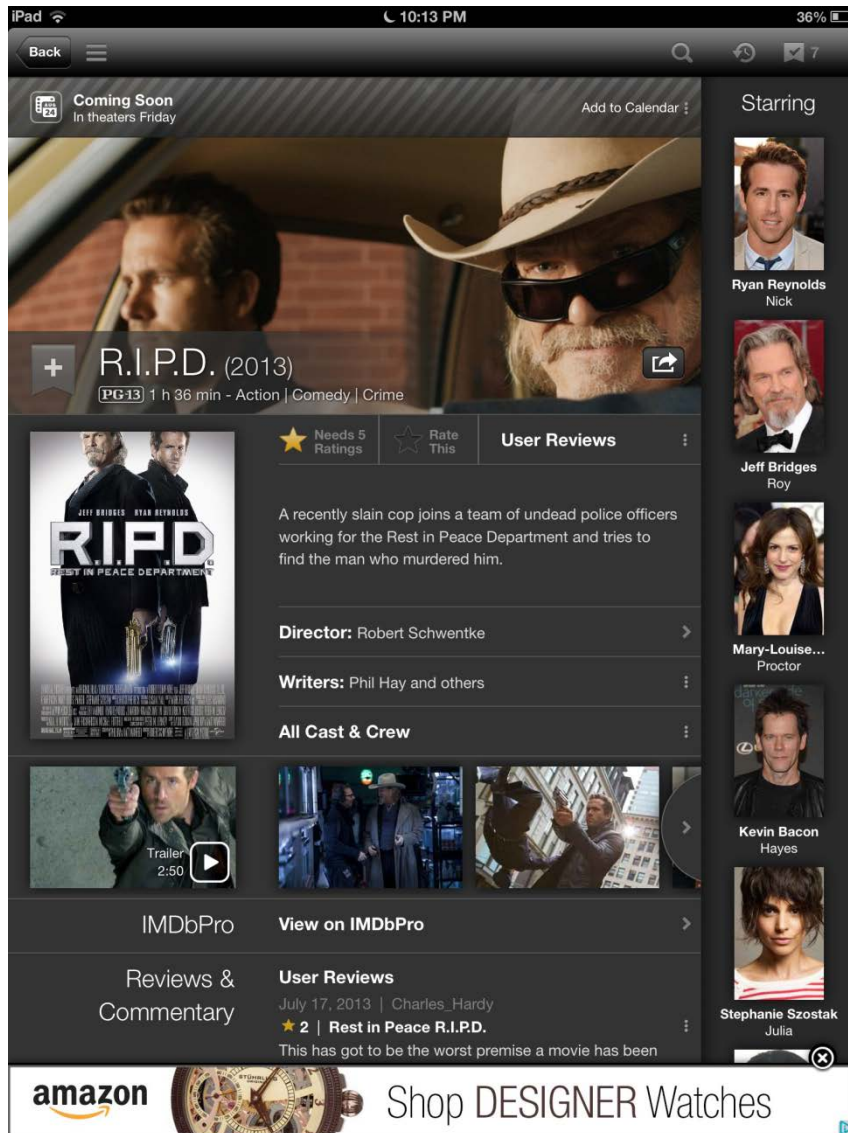
iMDb for iPad. When the user searches for a movie, the search results appear within a small popover. If the user picks a result and then hits back, she expects to go back to the list of search results, but instead she will navigate to the previous page in the main frame. (The search results do get preserved if the user tries to hit the search button again).

79. Avoid multiple Back buttons.

Trip Advisor has two back buttons, next to each other. The difference between the two buttons is unclear — the arrow is a true, persistent Back button, and the button underneath sometimes is Back, sometimes can be a different button. When it's a Back button, the functionality is identical to that of the arrow above.

Even if the two buttons did the same thing always, it'd still be wrong to have two because it makes users ask themselves: why are there two buttons and what's the difference between them? Which is the right one to use?
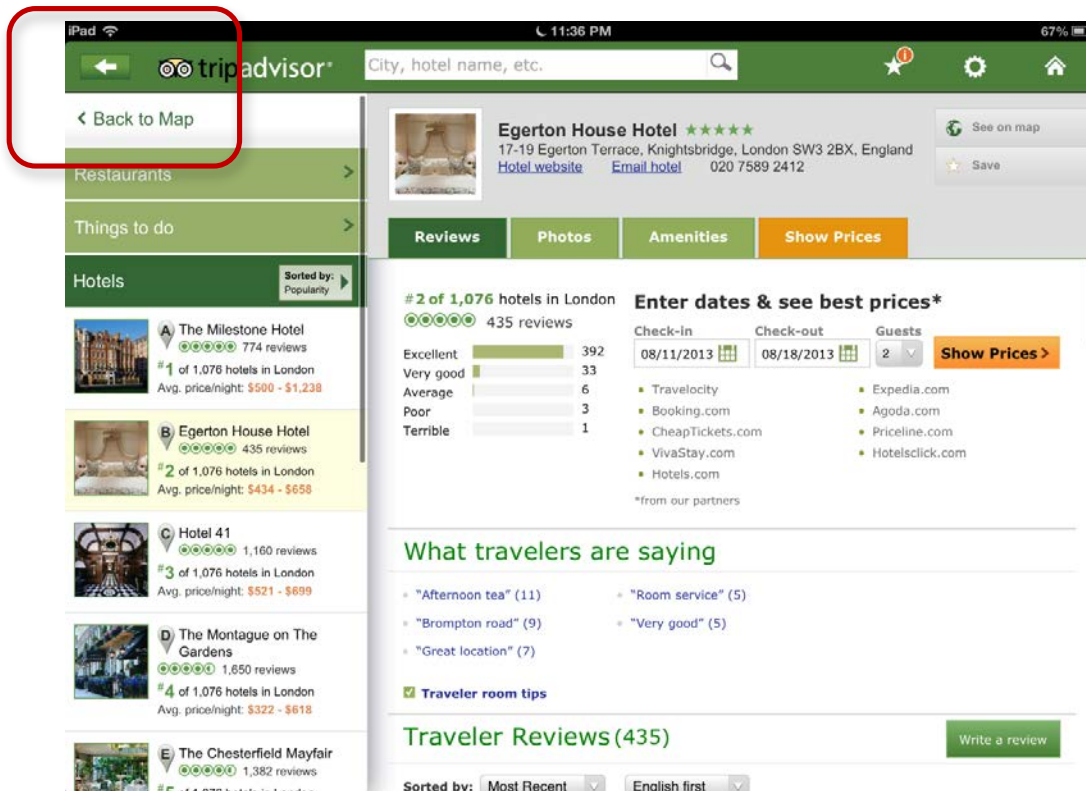
TripAdvisor for iPad: The two back buttons were identical in functionality. The one labeled "Back to Map" was not present on every page (and the name would vary to indicate to the user where they would be taken back).

80. Place the back button in the top left corner.

In their attempt to fit a back button into their visual design, some apps end up placing it in nonstandard locations on the screen. These locations are unexpected for users and it takes them more time to find them.

One of our participants who was using Reuters The Wider Image for the iPad got lost in the app, and it took him some time to discover the back button. The reason was that the back button was not placed in the upper left corner (as expected), but rather, it was embedded somewhere in the middle of a vertical tab bar. (It didn't help that the back button worked only within the Latest section; when the user changed tabs to a different section, the back button disappeared).

When a vertical tab bar is used instead of the more typical horizontal one at the bottom of the screen, navigational buttons such as Back must be placed in nonstandard positions and necessitate more work for the user.
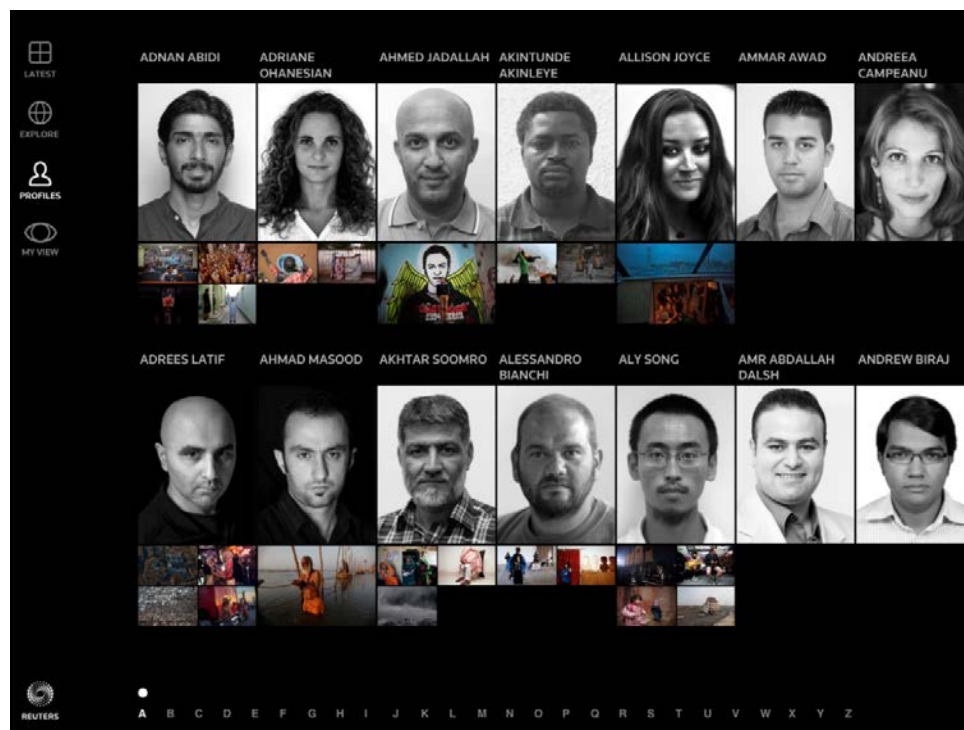
Reuters The Wider Image: The back button appears in the Explore section (positioned in the middle of the left tab bar — see the image above) but is not present in the other sections (e.g., the Profiles section in the image below).

Feedback and Reversibility

81. Whenever users press a target to take an action, give feedback to the user about the result of the action.

One of the basic principles of usable design is give feedback about the state of the system, so that users know what happened and what they're can do next.

The feedback doesn't need to consist of a message — visual cues (e.g., a change of color in a button) can also signal that the action has been accomplished.

Sometimes the feedback is there, but it may be ambiguous. In Panna, when users add a recipe to their favorites, they get a lightbox with the name and the picture of the recipe, and a link to share the recipe. It's not clear whether the recipe has been added to the list of favorites or not.
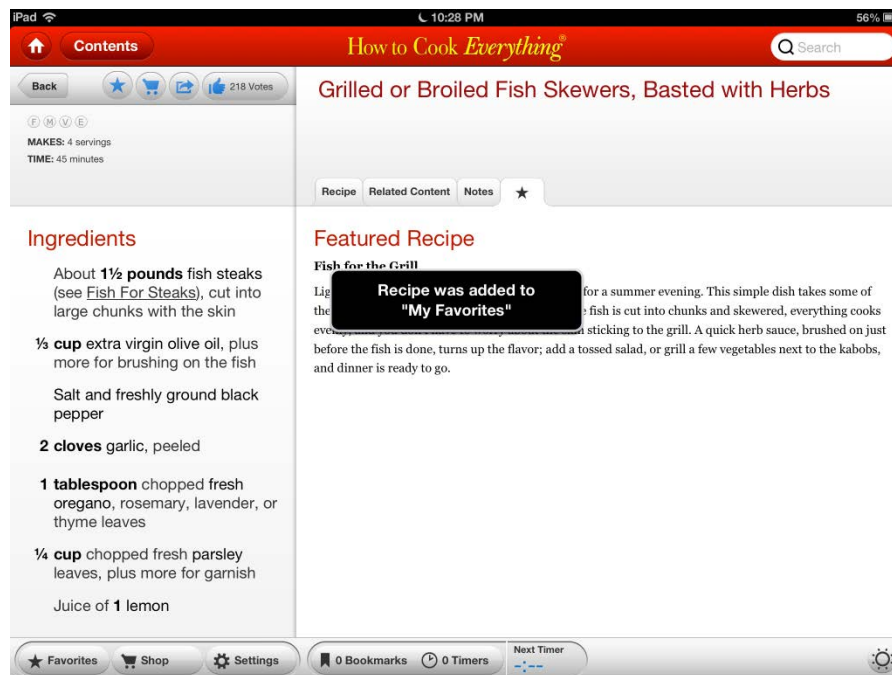
How to cook everything for iPad. A short message informs the user that the recipe has been added to the list of favorites.
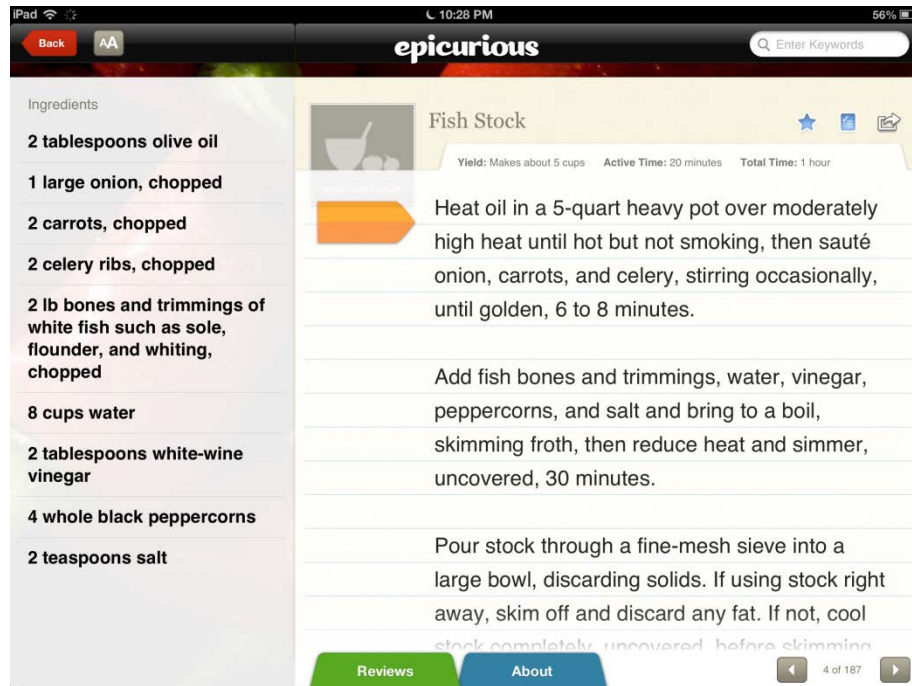
Epicurious for iPad. The star button gets becomes blue after the user has tapped it, to signal that the recipe has been added to favorites.
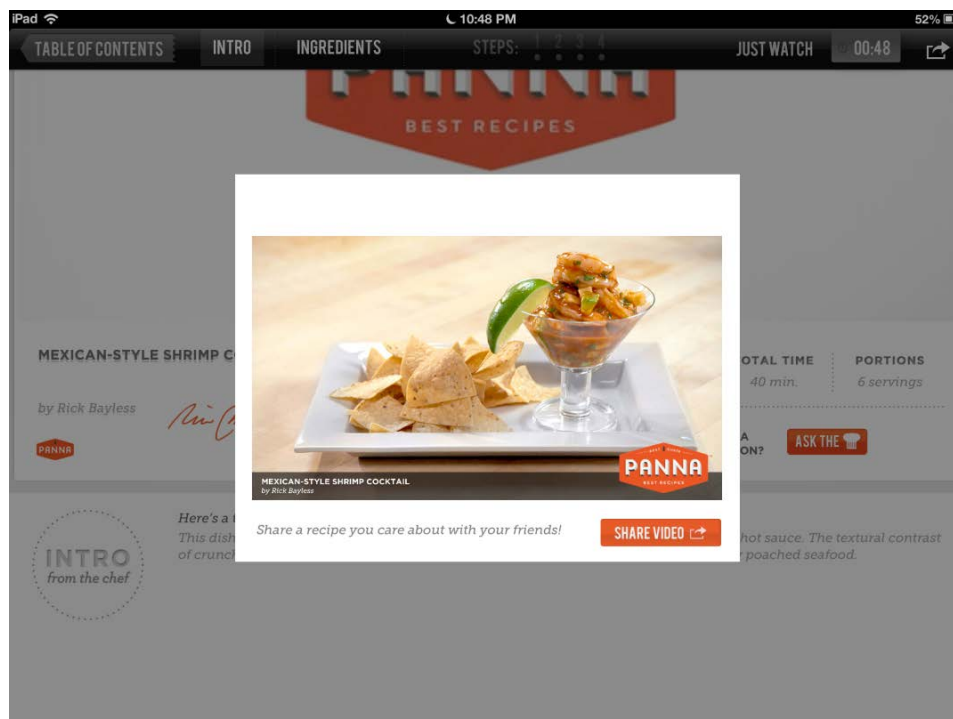
Panna for iPad. The light box that prompts the user to share the recipe appears when that recipe is added to the list of favorites; it's not clear if

the recipe was successfully added to favorites or not.

82. **Always let users revert to the prior state.**

Most often, this means having a back button. But it can also mean undoing whatever they've done.

For instance, in Trapit, one of our users made a story tile bigger than the others, and then tried for a while to get it back to its original size to no avail. The only way to do so is by selecting another story, which becomes bigger instead. The bigger size is meant to indicate which story is the one being attended to; however, the user cannot revert to the original "none-selected" state. One of our users spent a few minutes trying to figure out how to revert the tiles to their original state.
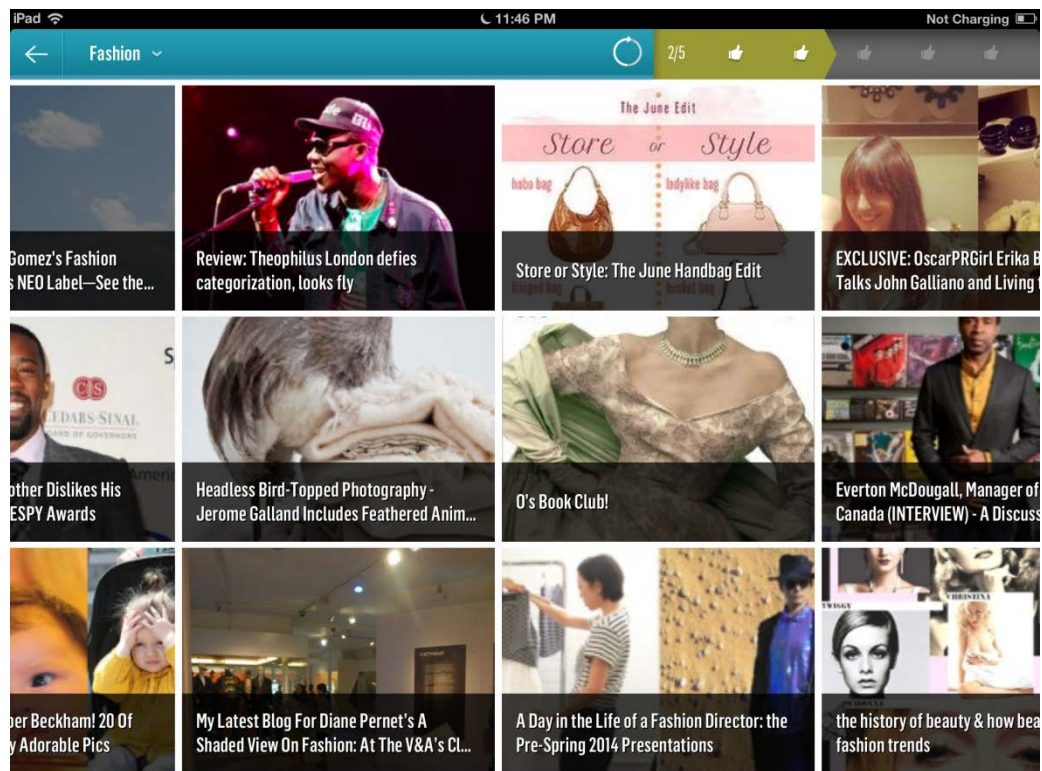
Trapit for iPad: When the app is first started, all stories are presented in equal-size tiles (above). If the user taps on a story, its tiles becomes bigger (below) and the only way to get its previous size back is to tap on a different story. In general, it's likely to cause usability problems when the only way to change object A is to do something to object B instead, because users will have focused their attention on object A.

INFO@NNGROUP.COM   Feedback and Reversibility
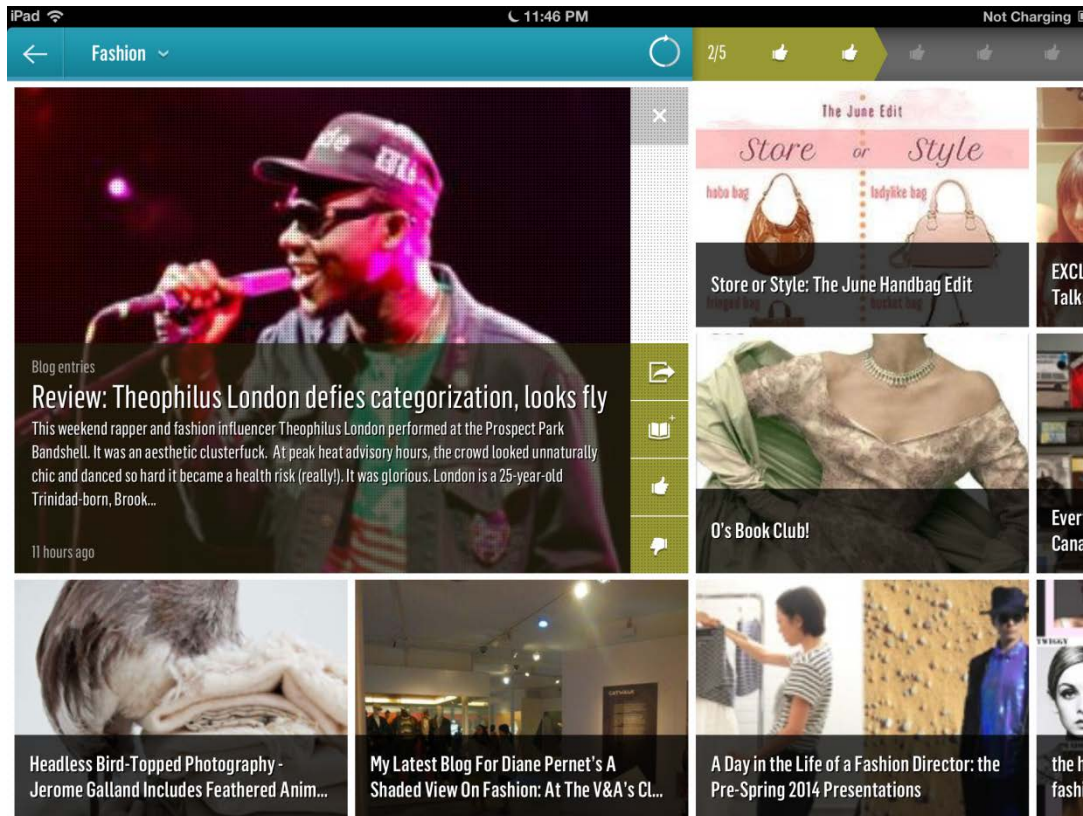
Search

To quote one of our users:

> "A search feature is the best thing in the world."

83. A search box needs to be present in any app that contains a significant amount of content.

NARR8 on Android (a comic reader) does not have a search box, making it really difficult to find specific content. Most of the users who were asked to look for a particular comic gave up because they couldn't find the search box; some never attempted to browse in order to locate the content they were looking for.
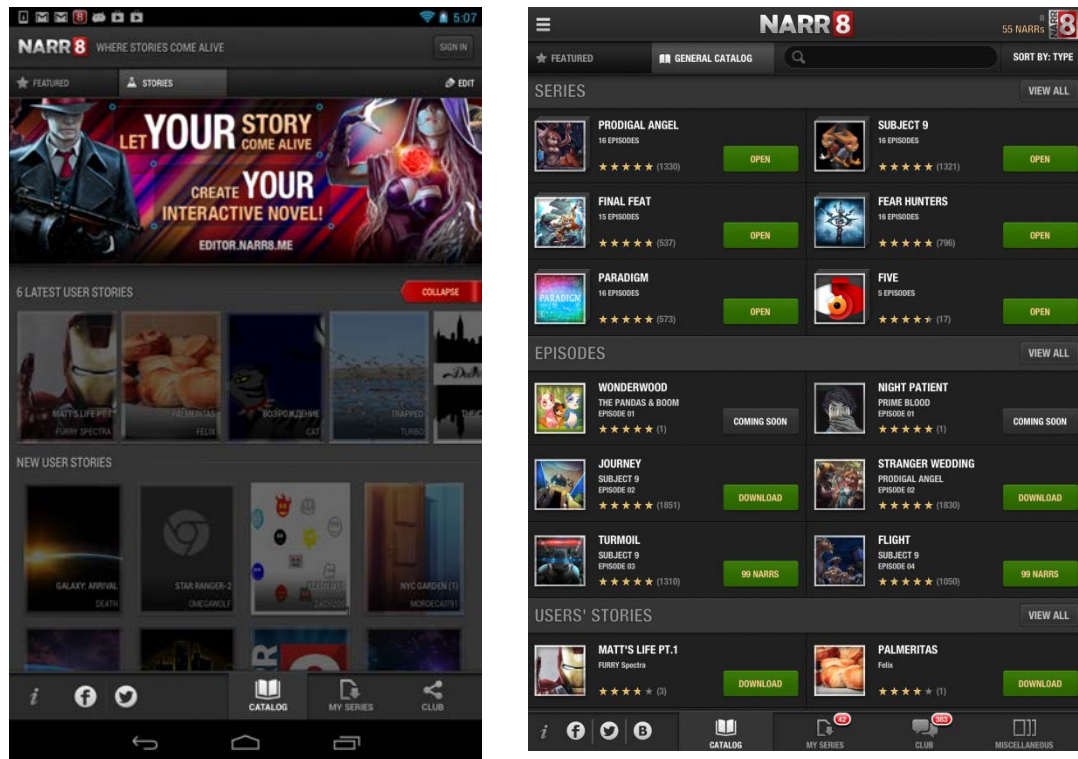
NARR8: The Android version (left) does not have a search feature. The iPad version (right) has a search box under the General Catalog tab.

84. Never hide the search feature under a menu.

We said before that crucial functionality needs to be visible. This is another instance of that more general guideline. The search feature needs to be easily accessible in any app with a significant amount of content. It's never recommended to hide the search box; put it in a prominent place and make it easy to find.

85. Search icons are harder to notice than search boxes.

The desktop has trained people to look for search boxes; however, on mobile, search boxes take up precious screen real estate and many apps try to save space by replacing them with a search tool. Unfortunately, users have a harder time discovering the search feature in the absence of a search box. Whenever possible, try to keep the search box on the screen to ensure that people are going to discover it easily.
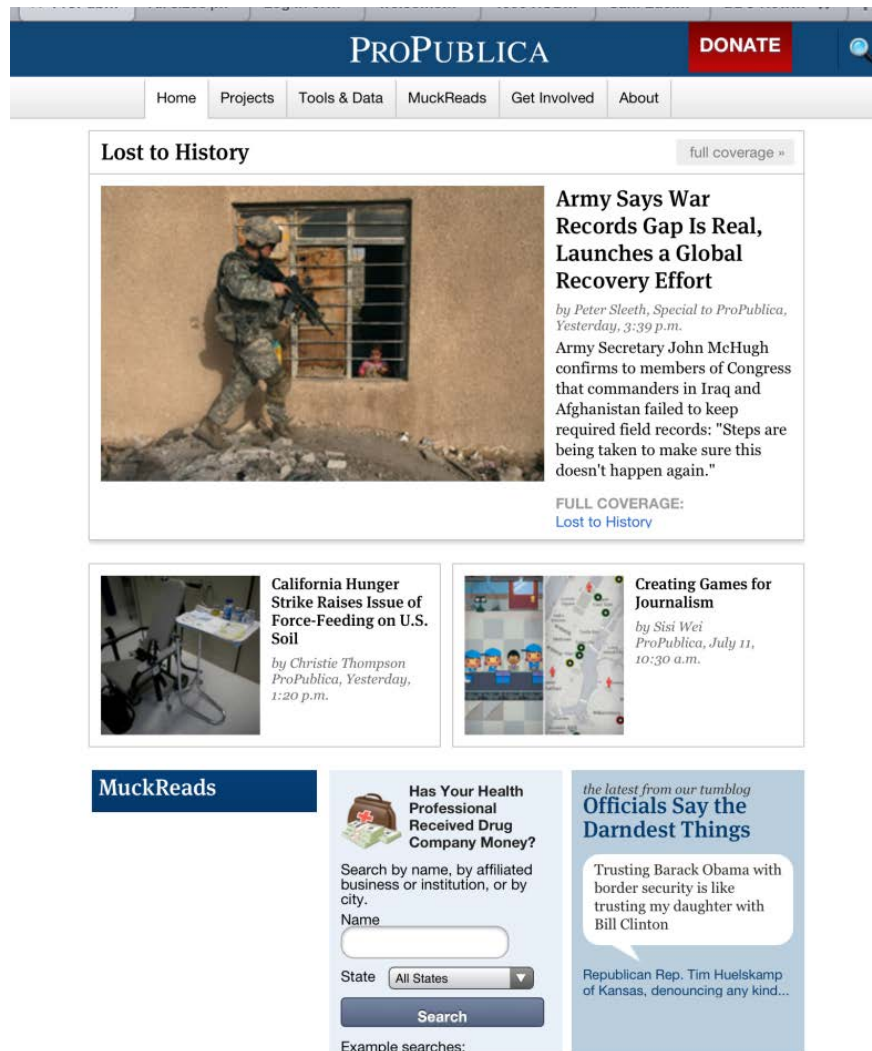
Propublica.org is a responsive design site. On smaller screen sizes the search box is replaced with a search tool. Unfortunately, the search tool is blue on blue background and was less discoverable than a search box for many of our users.

86. Preserve the search query or the search parameters so that people can adjust them and refine their searches. For filters, let people easily access filters that they have selected in the past.

Often users modify searches that they've done in the past, or, for filters, use the same parameters that they've used before.

Refin keeps the parameters of the last search so people can start from there when they initiate a new one.
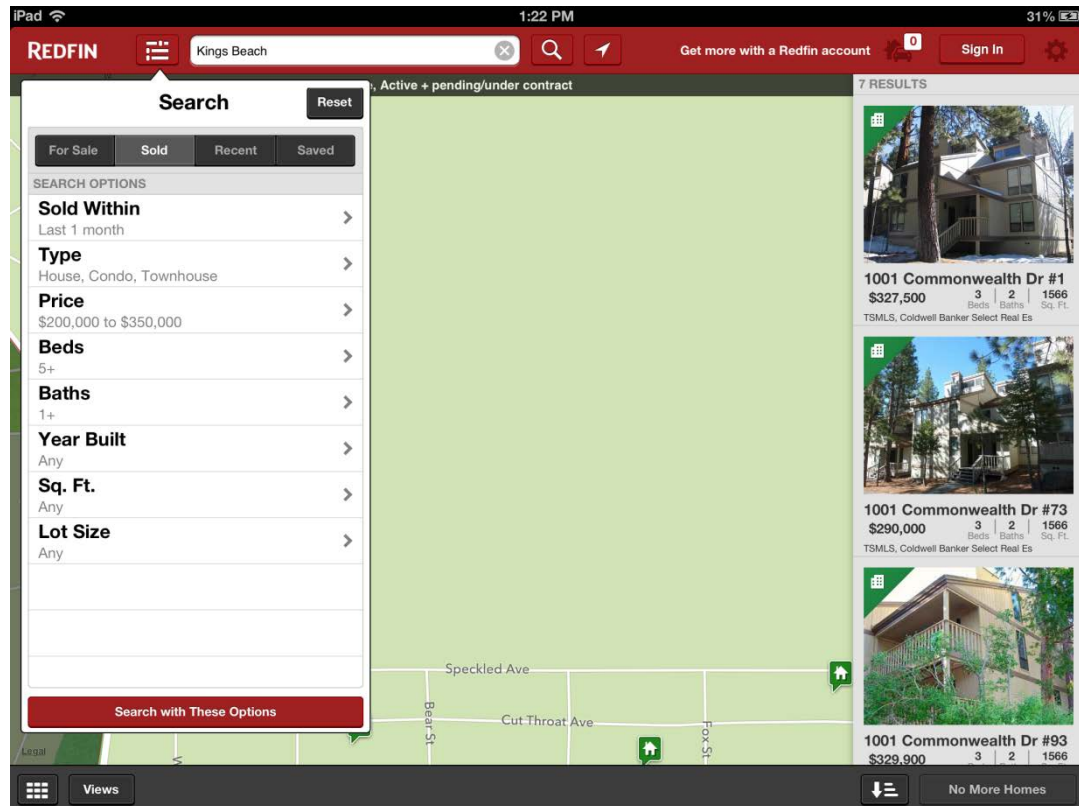
Redfin for iPad: The parameters of the last search are preserved, so people can easily modify them if needed (without having to reenter those filters that stay the same).
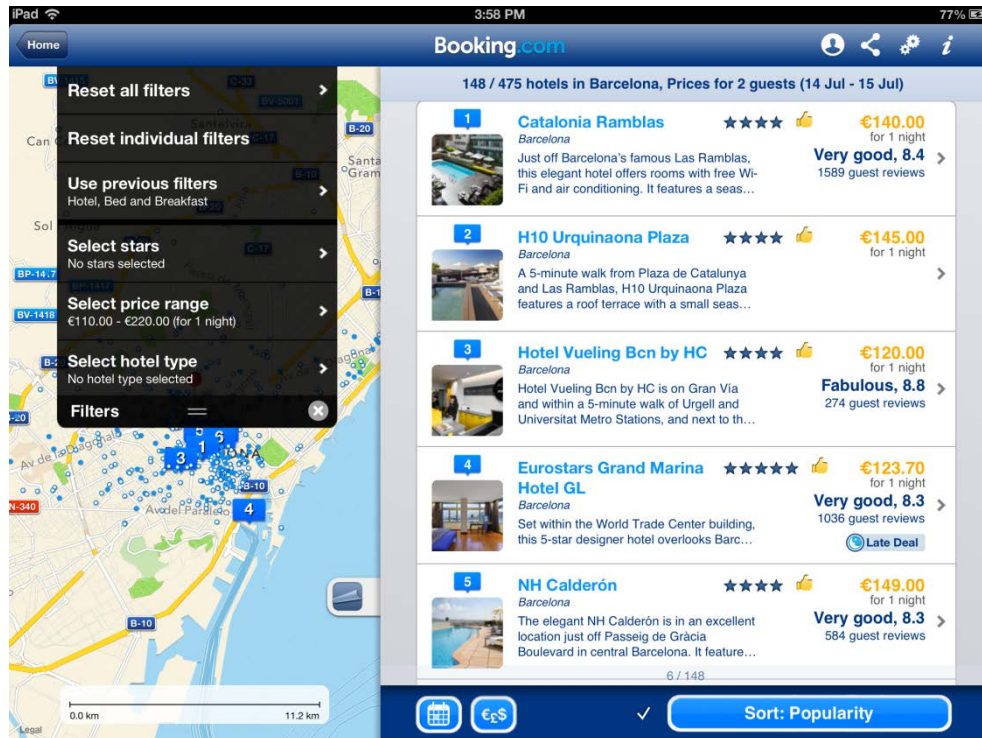
Booking.com for iPad: Users have the option to use previously set filters for a new search.
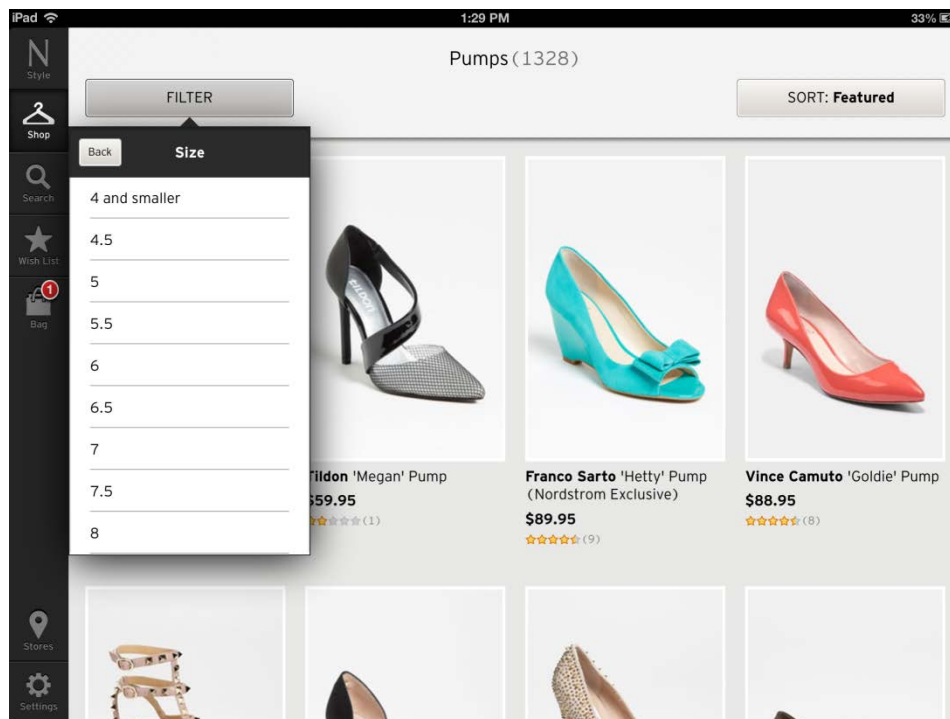
Nordstrom for iPad: Although the previous search was a shoe search, the

app does not prioritize the filter values that were selected in the past (e.g., for size).

87. Show search results in a way that helps the user differentiate them from search suggestions.

Sometimes apps can be too eager to display the search results. The user may be still typing and the search results are displayed below the search box. Because the user expects a change of page when the results are loaded, they may not pay attention to the results below and wait for them to appear.

One of our users was searching for a restaurant in Open Table; he repeatedly pressed the search icon hoping to get the results and only later realized that the text below was in fact the result and not a search suggestion. It would have been better to display results in a more complete format (e.g., with thumbnails, ratings, etc.) that signals to the user that the search has been completed and they can tap on the results.
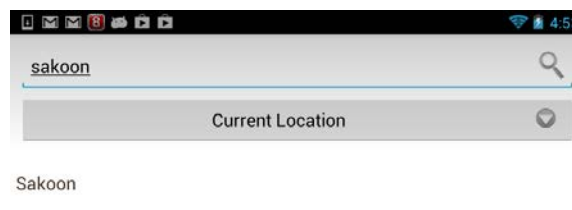
Open Table for Android: When users search for a restaurant name, the results appear right away. Our users found the results, but some commented that it took them a while to realize that these were not suggestions but actual results.

Lists

Long lists can be hard to scroll through on a smaller screen. That is why it's always better to use the full screen for displaying a long list, as opposed to displaying the list in a small window or frame.

Any type of controls that help users identify elements in the list is going to be useful — whether this would be a field where they could type some of the letters of the item they are looking for, or just some letters that users can pick to jump to the right region of an alphabetically ordered list.

88. **Do not display long lists in popovers or small frames. Use the whole screen for long lists.**
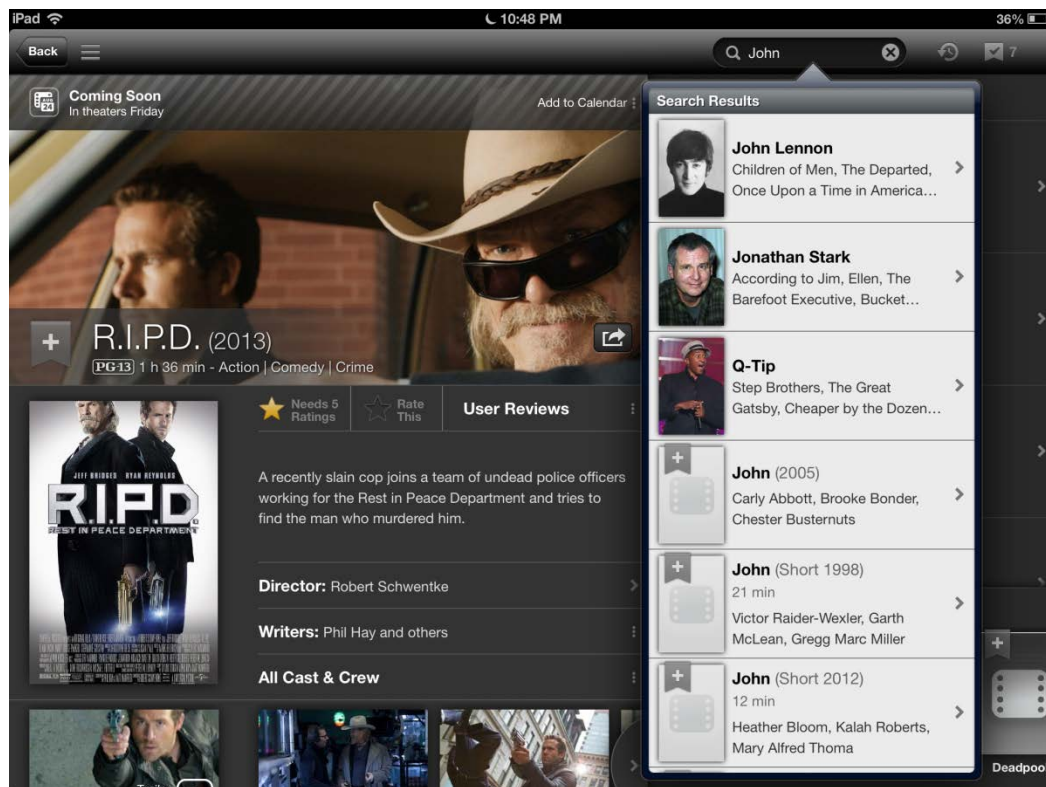
iMDb: The search results are displayed in a small popover; the screen space is underutilized. When the keyboard is displayed, that popover is truncated even more (see below).
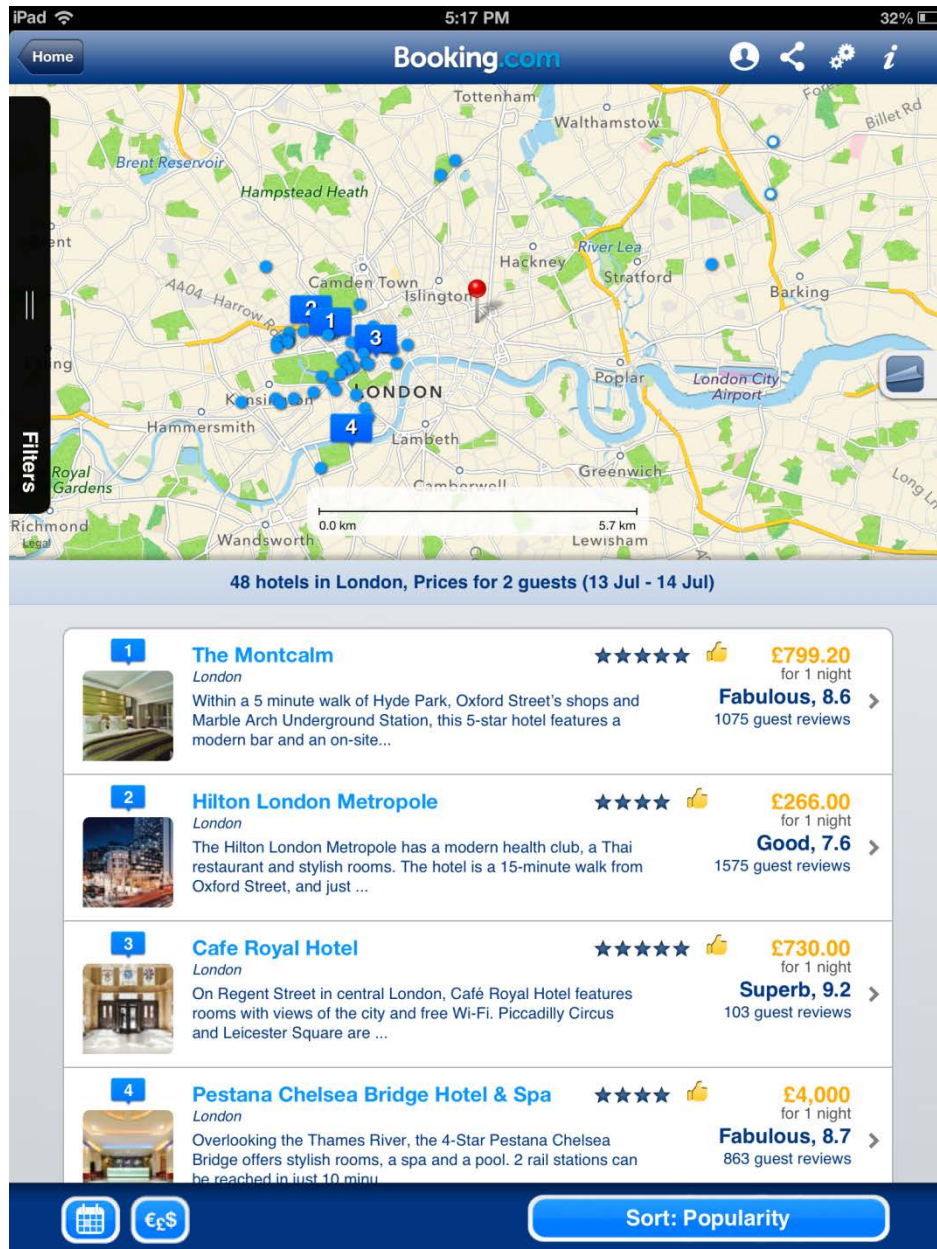
Booking.com. Dividing the screen into maps and hotels make only 4 hotels visible at one time. Users have to scroll through many more.
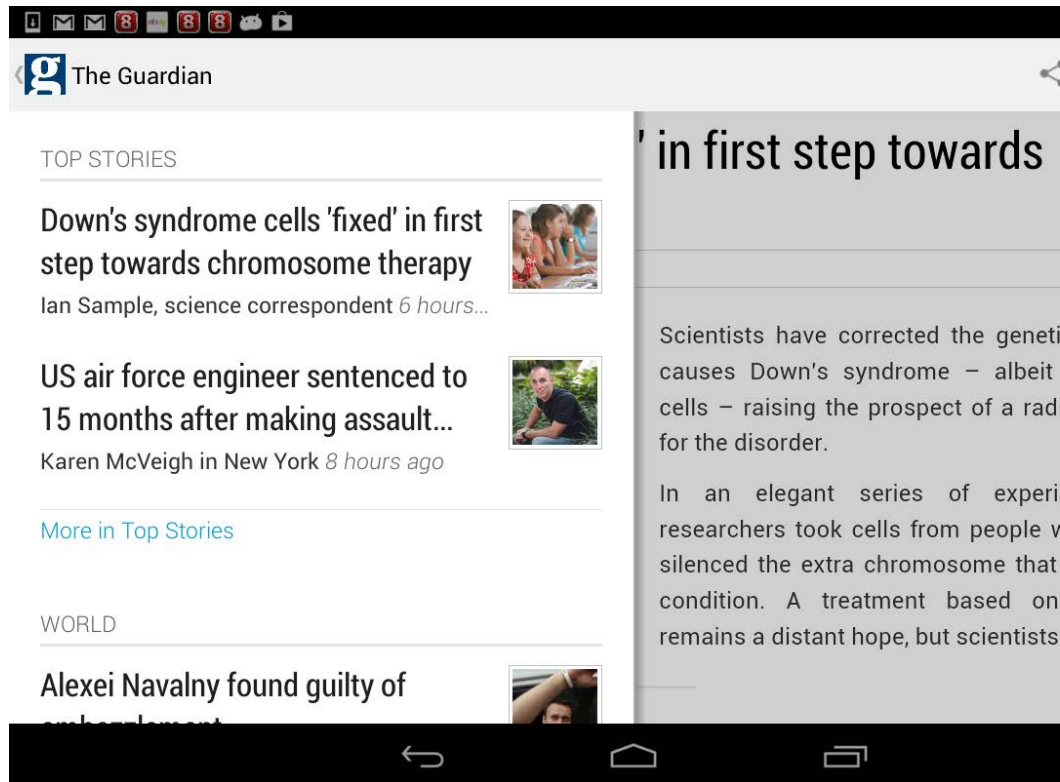
Currents for Android. The list of headlines is displayed in half the screen, covering the article page. Users can see about 3 article titles per page.

89. **If a list is sorted alphabetically, let users jump to any letter in the alphabet to see items starting with that letter.**

This can be done either by having a search field where users can type the 1st few letters of the name or by having links to the letters.
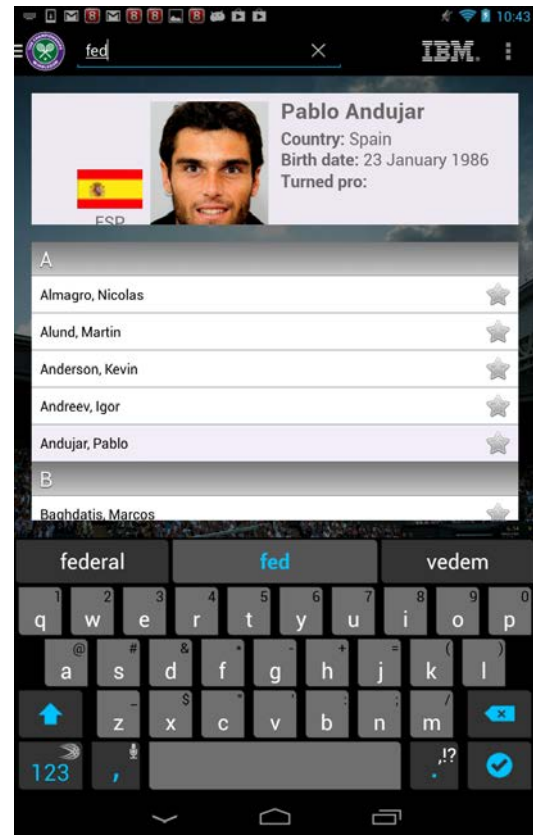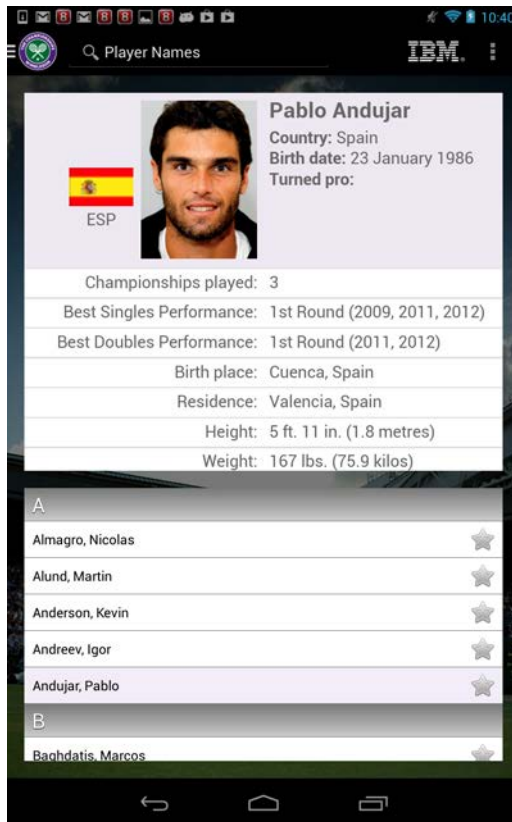
Wimbledon for Android: Users cannot jump to a letter in the list of names; they must scroll to find the player of choice. If they use the search feature, there are no auto-suggestions for the names starting with that string.
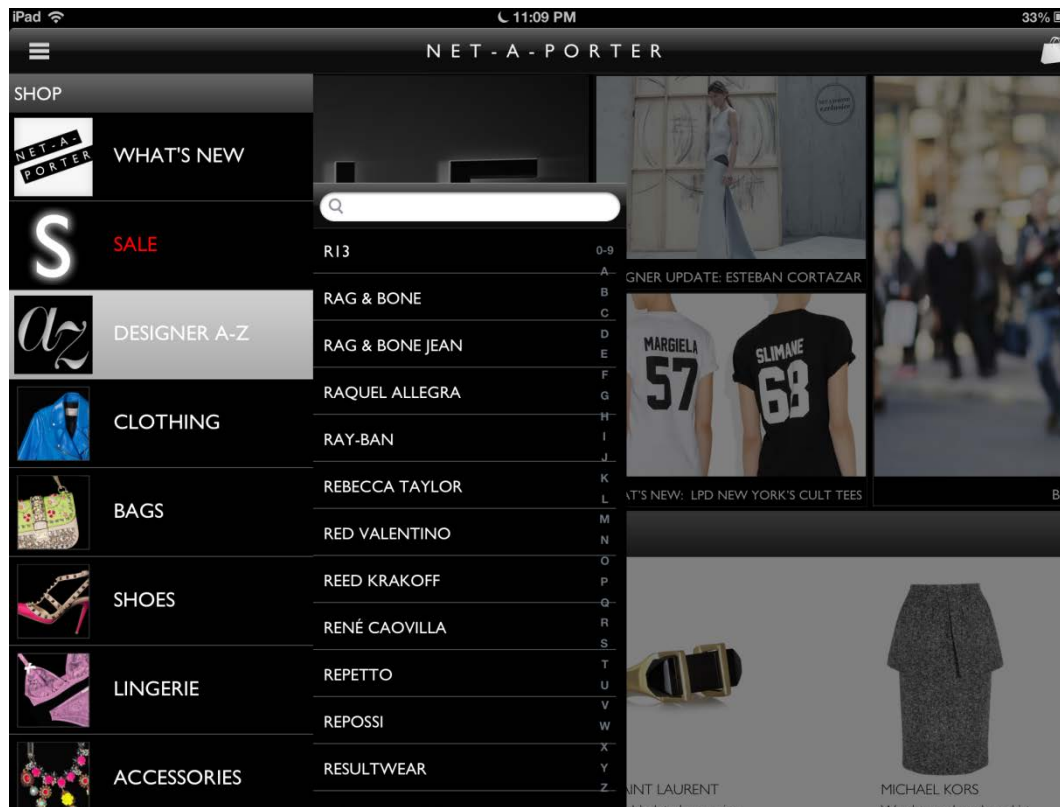
Net-a-porter for iPad. Users can select a letter to jump to the brands starting with that letter, or they can type the first few letters of the brand. (Note, however, that using a popover for the brand list is suboptimal even with these helpful controls.).

Split Views, Popovers, Frames, Content Tabs

With the larger tablet screens, multiple frames and windows came around. Apps started to fragment the screen into multiple regions, to preserve context and display pieces of related information. Unfortunately, many apps abuse the partitioning of the screens into regions, and make the user experience suboptimal by forcing the users to scroll more in any of these regions.

90. **Do not segment the screen into smaller windows unless the user needs to look at all the windows at the same time in order to complete the task.**

91. **Decide if you can display a piece of content in a window based on how much scrolling the user would need to do to get to see all the content in the window. Scrolling 1-2 times is ok; more than that can easily become tedious.**

    Ask yourself: Does the user really need to see all this information on the screen at the same time? If the answer is no, or even if the answer is "maybe, in order to keep track of where they're coming from", you can safely discard some of those windows. (Context, if really needed, can be shown in more space-economical ways — for instance by using breadcrumbs).

    In Reuters The Wider Image, for each photo essay there is a "cover page" that remains visible at all times. The story is displayed in a partition of the screen. One of the participants commented:

    "That [partitioning] is silly — it doesn't make any sense!"

Reuters The Wider Image: The photo essay has a cover page; in order to read the story users have to tap (or pull up) the little gray button at the bottom of the screen.

Reuters The Wider Image: A fragment of the article cover page remains visible on the screen at all time, as users have to scroll through the actual article in the lower part of the screen.
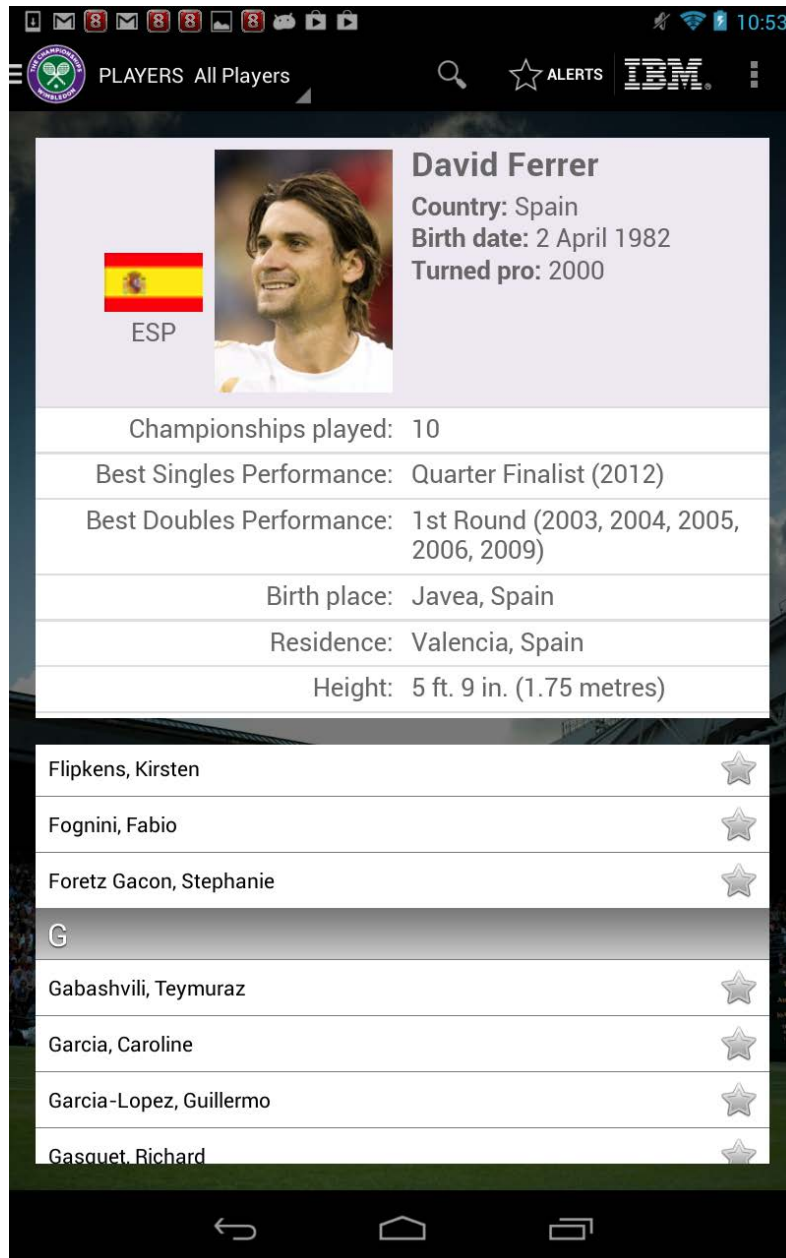
Wimbledon for Android: The list of players is shown in the bottom half of the page, while the top half shows the details of the last seen player. The page-split is unnecessary and makes the users scroll more to see the player list.
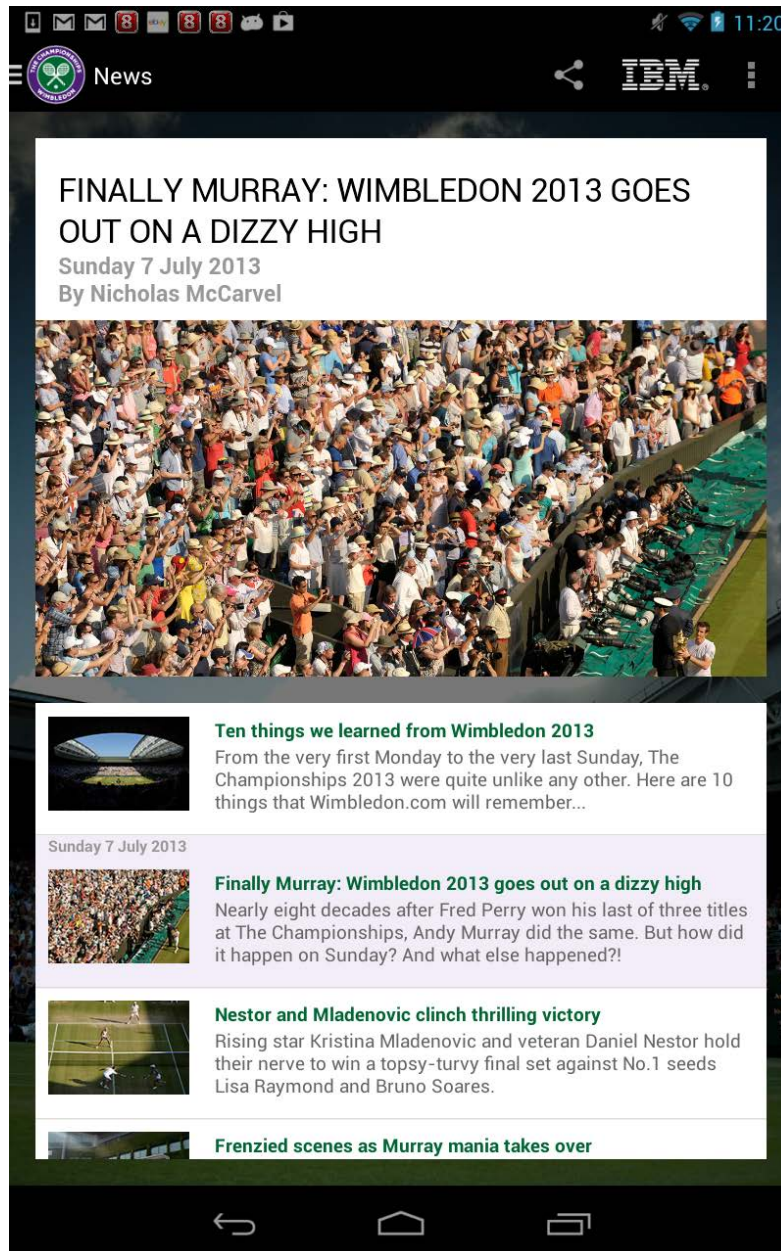
Wimbledon for Android. Half the screen is taken by the news headlines and half the screen by the article selected in the list of news. The user doesn't see much of the article displayed at the top (in fact, he sees less than the content displayed in the actual headline, which also includes a summary), and has to scroll in the small window to read the entire article. It would have been better to take the user to a separate page where the article could occupy the whole screen.
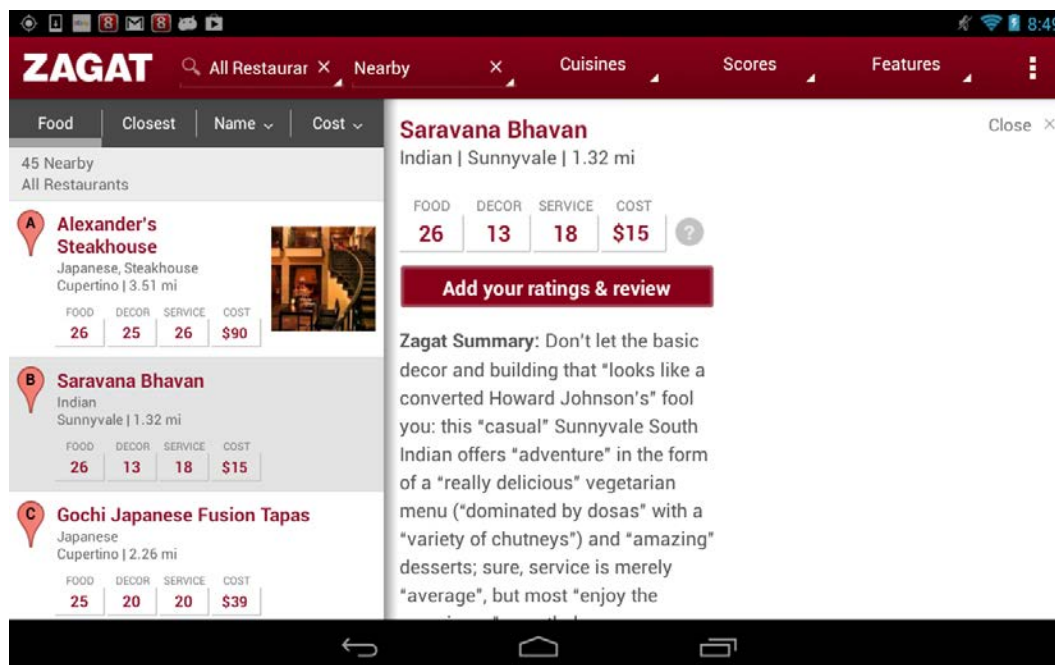
Zagat for Android. The restaurant information is displayed in a small column, on the side of the screen.
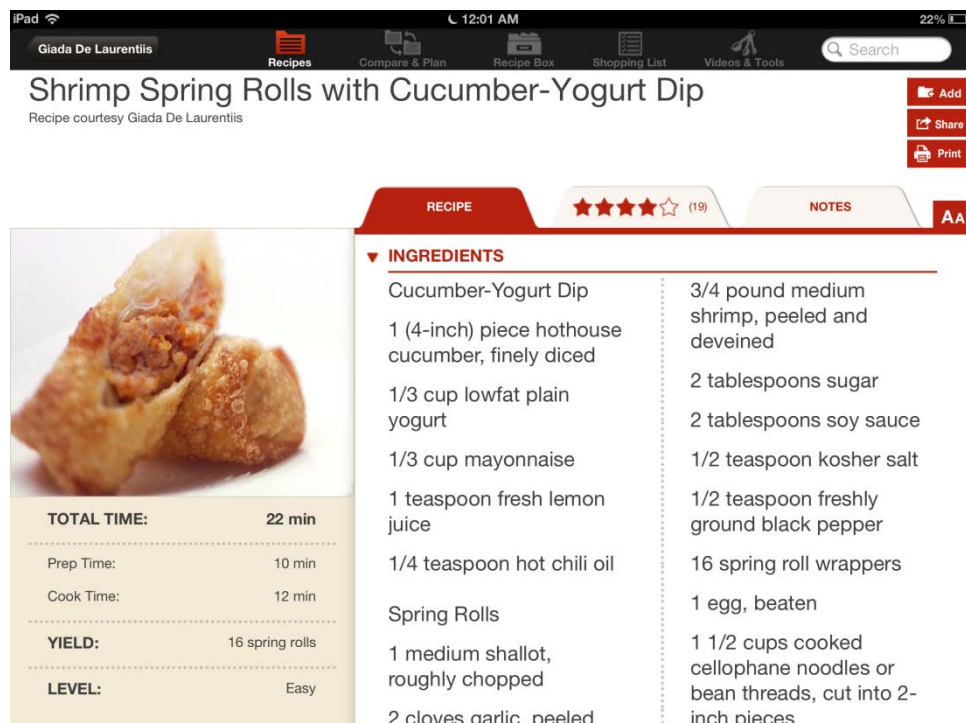
Food Network for iPad. The recipe is displayed in a window, while other content remains visible at all times on the screen. The end result and the time to prepare the recipe, the yield, and the difficulty level are all useful

information, but do not need to be present on the screen while cooking. The recipe needs to get the prime stage and the maximum amount of space.
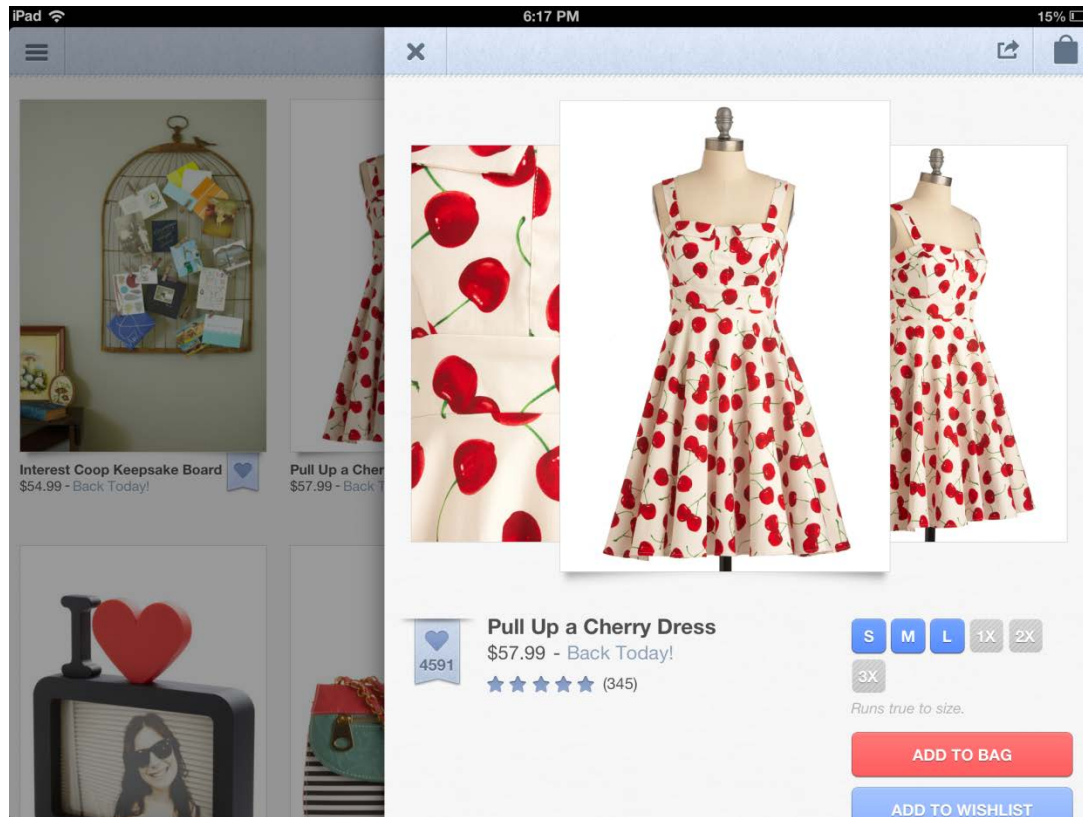
Modcloth for iPad. The product information is displayed on only half the screen. Users have to scroll down to read the product information and the review. The space would have been beter utilized if the product page occupied the whole screen and users could go back to the list of products by pressing a Back button.

92. **Avoid truncating or decreasing the font of the text in a frame in order to fit more content in that frame.**

If you need to make text small to fit more in the window, then consider not using a window and displaying the text on the whole screen.

How to Cook Everything for iPad. The list of favorite recipes is displayed in a small popover; the font of the recipe titles is made smaller so that the popover can fit more info.

93. **Do not split content into multiple tabs if the pieces of content are interrelated. Consider a split view or a popover instead.**

Many recipe apps follow the practice of structuring recipes into ingredients and steps. One of the advantage is that, as users follow through the steps, they can easily access the list of ingredients to check on quantities, and then go back to the step description.

Let's take a look at a recipe in BHG Must Have Recipes for Android; in this app, the ingredients and the recipe steps are presented in different tabs. A user who encounters an instruction such as "add the brown sugar" may need to switch tabs and go back to the list of ingredients to check how much sugar she needs to add. Once she located the sugar, she must memorize the quantity and then go back to the steps tab and find her place in the list of steps.

Brown Sugar Icebox Cookies

INGREDIENTS   STEPS

1.   In a large mixing bowl beat the 1/2 cup shortening and the butter with an electric mixer on medium to high speed for 30 seconds. Add the brown sugar, baking soda, and salt. Beat until combined, scraping sides of bowl occasionally. Beat in egg and vanilla until combined. Beat in as much of the flour as you can with the mixer. Using a wooden spoon, stir in any remaining flour and the 3/4 cup ground nuts. Divide dough in half.

2.   On waxed paper, shape each portion of dough into a 10-inch-long log. Lift and smooth the waxed paper to help shape the logs. If desired, roll logs in the 2/3 cup finely chopped nuts. Wrap each log in plastic wrap. Chill about 4 hours or until firm enough to slice.

3.   Preheat oven to 375 degrees F. Cut logs into 1/4-inch-thick slices. Place slices 1 inch apart on an ungreased cookie sheet. Bake for 10 to 12 minutes or until edges are firm. Transfer to a wire rack set over waxed paper and let cool.

4.   If desired, in a small saucepan combine chocolate pieces and the 1 tablespoon shortening. Heat and stir over low heat until smooth. Cool slightly. Transfer chocolate mixture to a small resealable plastic bag; seal bag. Snip off a tiny piece of one corner of the bag. Drizzle melted chocolate over cookies. Let stand until set.

Nutrition Facts

65 cal., 4 g fat, total, 1 g sat. fat, 7 mg chol., 33 mg sodium, 7 g carb., 1 g pro.

My Notes: tap to enter a note

BHG Must Have Recipes for Android: The ingredients and the recipe steps are split into two tabs; users must commute between tabs to cook the recipe. Note also that the big picture in the Ingredients tab takes up a lot of space.

Epicurious for iPad:The ingredients and the steps are shown on the screen at the same time in landscape mode. This is a good use of a split screen.

Gestures

Using gestures instead of visible interface controls can free up space for content, but, unfortunately it has its risks. First and foremost, gestures are not easily discoverable and most of them have no natural affordances — it can be quite hard for users to remember to do a certain gesture. Another big problem with gestures is that, when many are used at the same time, people mix them up and forget what each is supposed to do. And last but not least — gestures can be difficult to produce and replicate reliably. For instance, not many iPad users use multi-finger gestures that are native to the device — sometimes because they don't know or remember them, but also because they involve more motor dexterity.

Windows 8 is again one example of gestures deployed not very successfully. In our testing people had trouble remembering to swipe over the tablet edges in order to expose controls. It's easy to understand why — the swiping over the edges had no cues to remind people about it; in other words, it had zero affordances.

GESTURE AMBIGUITY

94. **Do not assign multiple meanings to the same gesture depending on where the gesture is deployed on the page.**

95. **Avoid swipe (or other gesture) ambiguity.**

    In our previous reports on the usability of iPad apps, we noted the phenomenon of swipe ambiguity, which occurs when users can swipe on different parts of the page with different results. Windows 8 provides plenty of examples of swipe ambiguity.
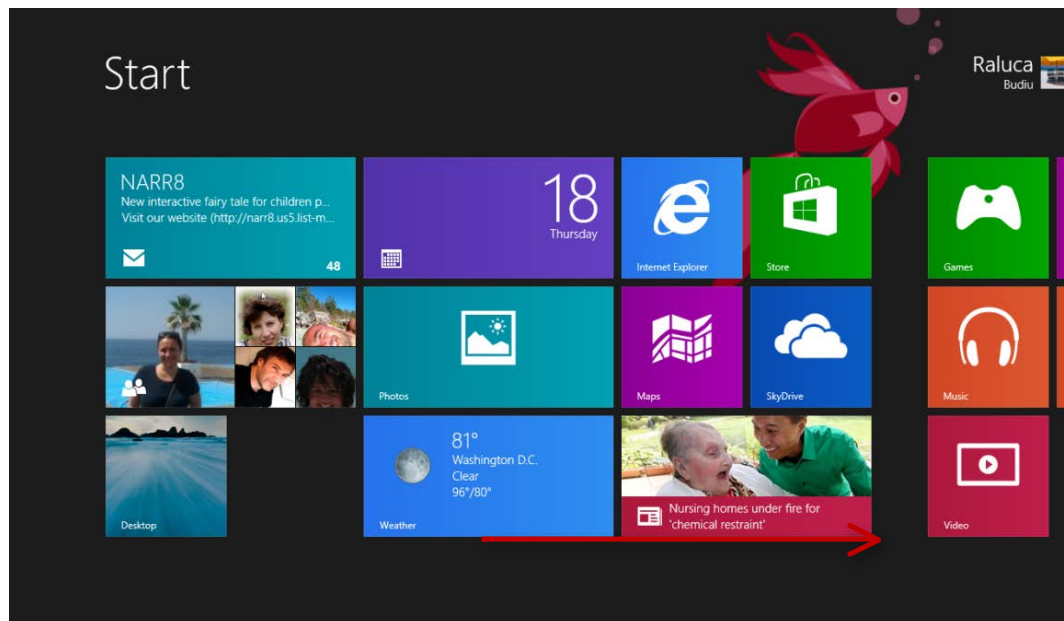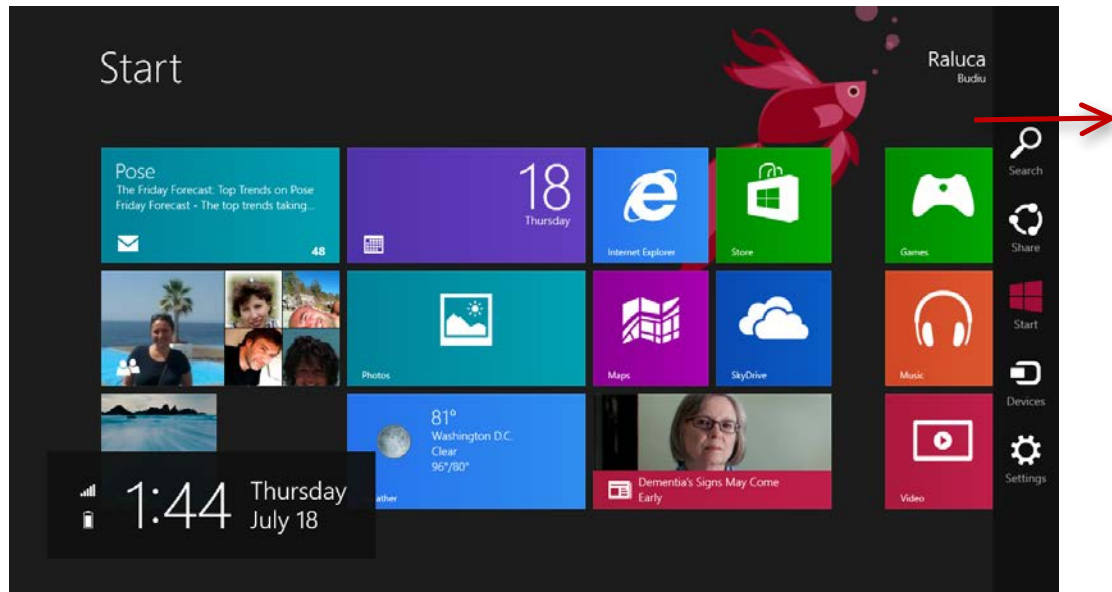
Windows 8 homescreen. Swiping horizontally advances the homescreen and exposes other tiles (first screenshot); swiping horizontally across the screen edge exposes the charms (second screenshot). Thus, the swipe has two different meanings depending on where it is performed.

The problem with swipe ambiguity is that it requires people to pay more attention to how they carry out a gesture. In the case of Windows 8, once people become aware of the two types of swipes, they eventually learn to pay attention to how they perform the gesture. But sometimes people may not even be aware of swipe ambiguity.

The most typical example is when carousels are combined with deck-of-cards page navigation. Consider, for instance, a magazine app that has a carousel as an interactive feature on one page. Readers are used to swiping anywhere on the page to go to the next article; but on this particular page (with the carousel), they have to be careful where they swipe to avoid changing the carousel and to trigger a page turn. We've seen users in this situation being surprised that the page did not turn and not understanding that it was because their swipe was moving the carousel instead.
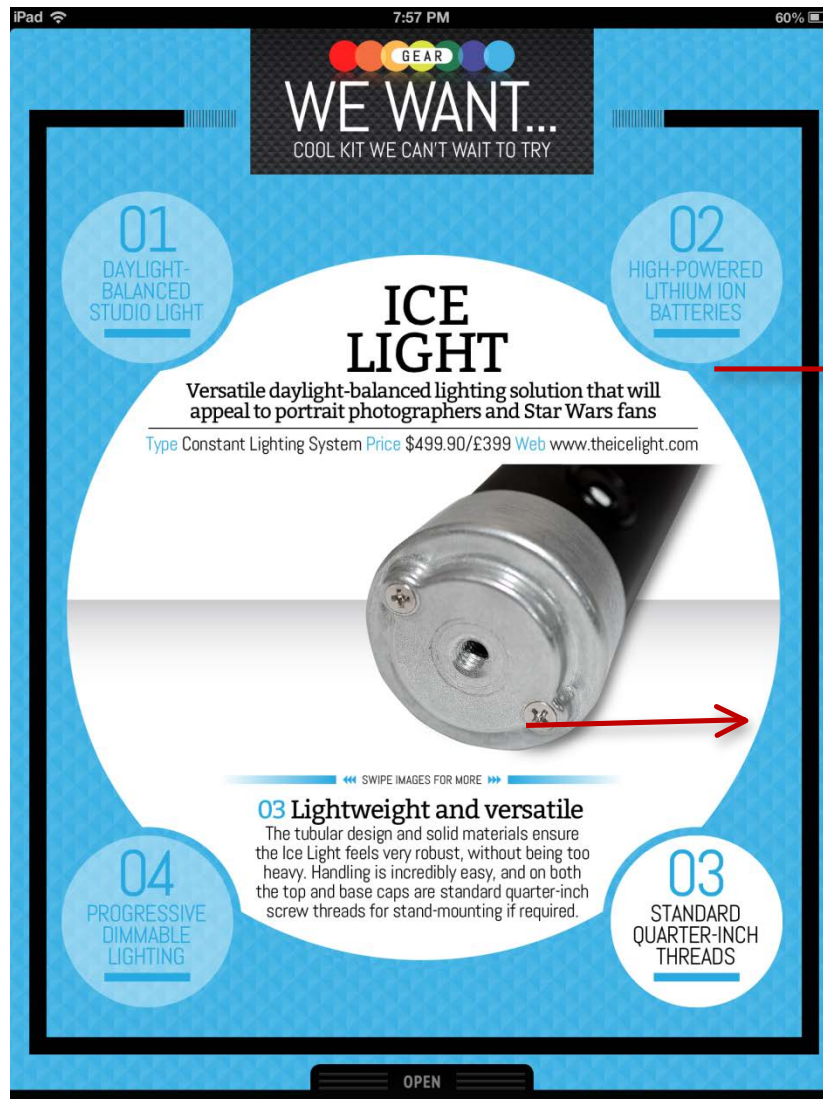
Photography Week for iPad. Users can swipe to get to the next article or they can swipe to change the image in the center of the page. Often in these types of situation, when the ambiguity is present only on some pages, people are not aware of it and become stuck when they cannot produce the behavior they desire.

96. **Avoid assigning different meaning to the same gesture depending on when the gesture is made.**

Swipe ambiguity refers to overloading the same gesture on different regions of the page. But sometimes the same gesture can mean different things depending on the actions that were performed before that gesture.

In Interior Design for iPad, the drag gesture can mean two things: (1) it can move the user around the canvas (similar to scrolling), or (2) it can move an object around the screen. By default, dragging is used to scroll; however, when

is preceded by an object-select operation, it means move. (Note that the move gesture does not have to start on the object being moved).

Interior Design for iPad: The drag gesture scrolls the plan (above row) or, if a room is selected in advance, changes the position of the room (below row).

Drawing apps often have a conflict between scrolling around the canvas and drawing — they both are traditionally done with the same gesture (drag). As a result, many drawing applications either invent a completely different gesture for scrolling (e.g., drag with two fingers) or, like Interior Design, use the preceding actions to disambiguate between the two meanings.
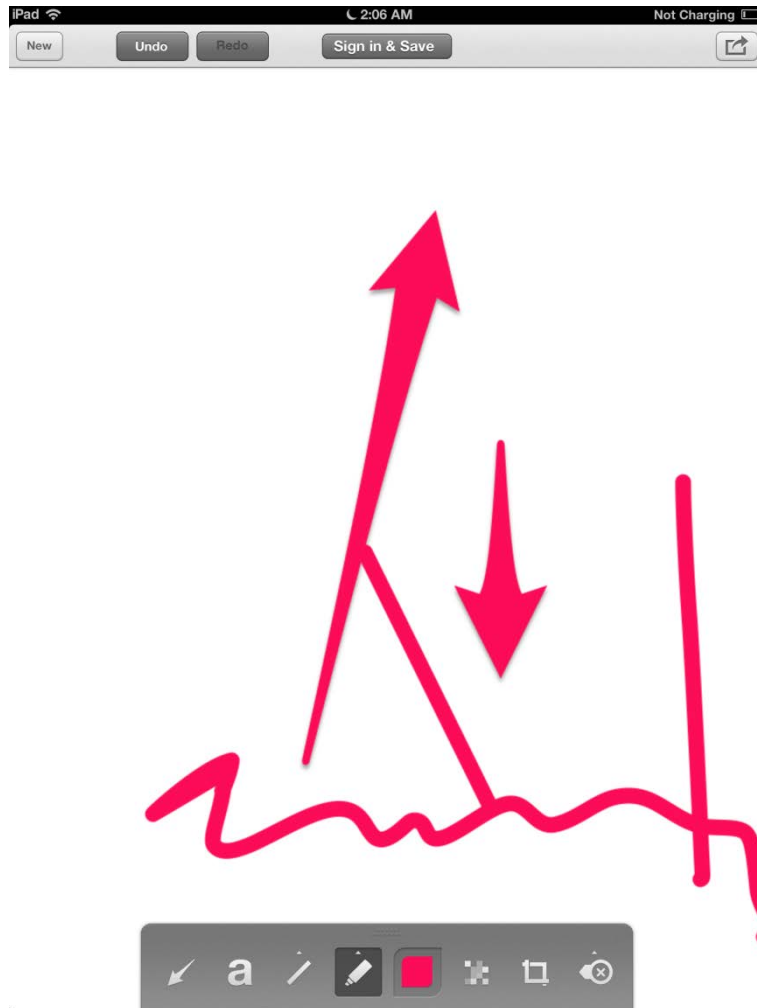
Skitch for iPad. This drawing and annotation app uses the (normal, one-finger) drag gesture for drawing and a two-finger drag for scrolling around the canvas.
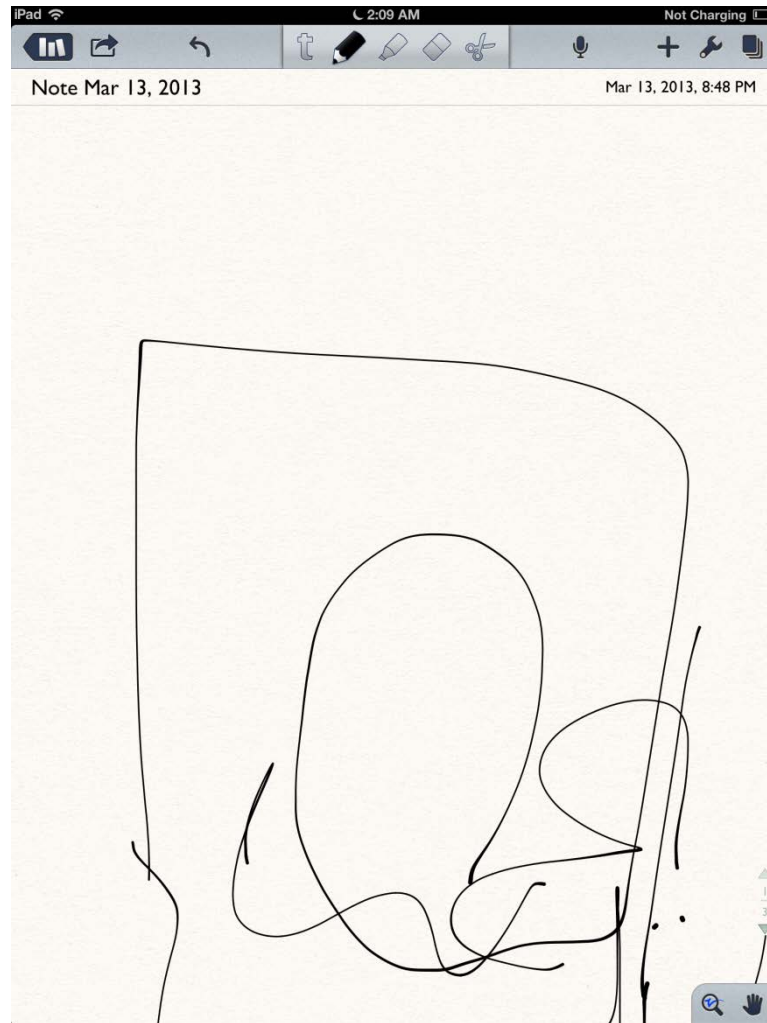
Notability for iPad. This drawing app uses the arrows for scrolling when a pen is selected; the drag gesture can be used for scrolling when a pen is not selected (e.g., text is selected). This context-gesture pairing makes remembering how to scroll in this app more difficult.

Gesture overload makes users work harder, because they have to remember what they need to do in a given context in order to achieve their goal. Instead of remembering just the pairing gesture–action, now they have to remember the triplet context–gesture–action, combinatorially exploding their memory load.

97. Use gestures consistently across different sections of the app.

This guideline is a version of the previous one, when the context is given by a different page in the app.

One of our users was annoyed with how Interior Design implemented object selection. When creating a plan of the house, users had to tap over an object (i.e., room) in order to select it, and then they could move it elsewhere on the canvas. However, when decorating the rooms, users could move furniture right

away, without selecting it first. Tapping on a piece of furniture in fact opened a larger view of the object. One of our users noticed that it was hard for her not to tap on a piece of furniture to select it after getting used to this method for object selection in the previous section — *"the app has trained me too well!"*
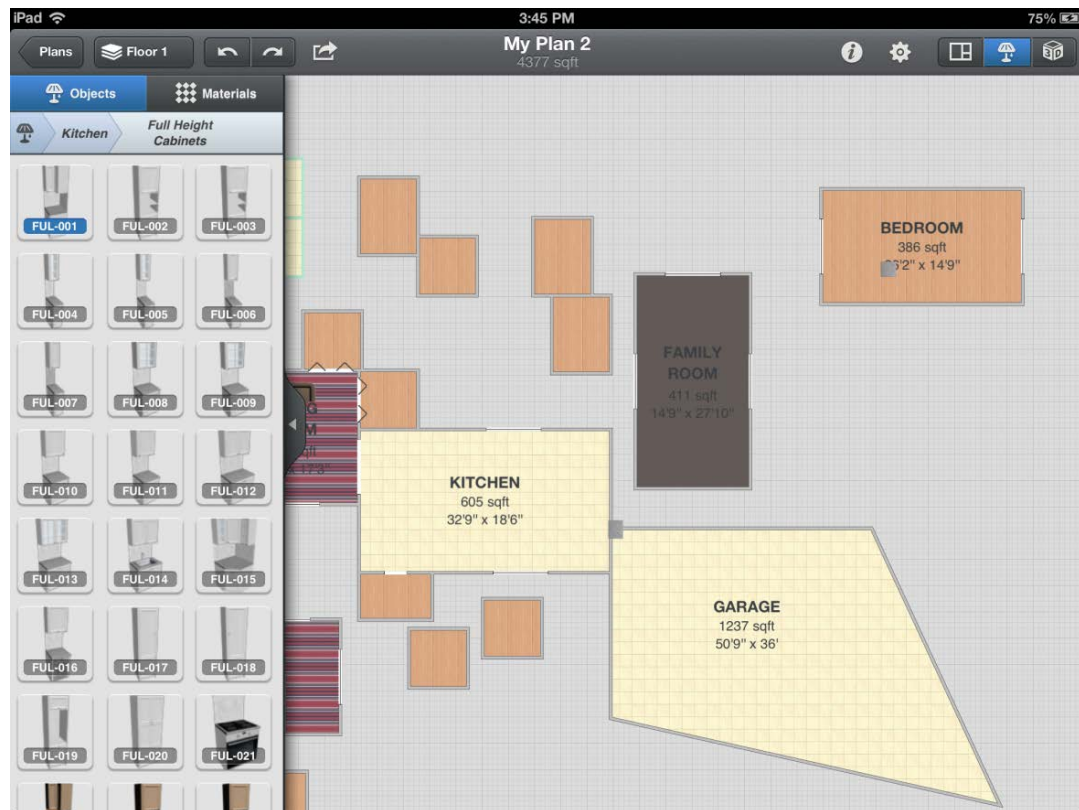
Interior design for iPad: In the Decorate section, users did not need to select an object in order to move it in the room; they could simply drag it from the list of objects. Users who, in other sections of the app, had learned that they needed to tap on objects to select them first, were confused by this inconsistency.

LEARNABILITY

One word about learnability. Many people ask us whether gestures get eventually learned and then become easy to use. We didn't aim to study learnability in most of our studies. However, some of our studies were scheduled immediately after a tablet came out on the market (sometimes as soon as one week after), so we ended up making participants use our own device[6] and thus could assess their initial learning curve with new gestures.

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[6] In all these cases, our users had been exposed to other touchscreen devices (usually phones) for at least 3 months before the study, so they were fairly used with that type of interaction.

In all these studies, we gave participants some time to inspect and familiarize themselves with the device.

In most our studies, the lack of exposure to the interface had a limited effect. The only study were exposure to the interface might have had an effect is the Windows 8 study. Participants were totally lost in some Windows 8 apps, and we assumed that part of the problem might have been the unfamiliarity with conventions created by Windows 8 (swipe around edges to expose controls).

To mitigate for that, in some of the sessions we actually told participants in the beginning that swiping around edges may be useful. They tried it at the beginning of the session, and then promptly forgot about it as they were doing the various tasks. The result may have been different if the swipe gesture would have been reinforced more by repeated usage.

However, there are some lessons to be learned out of this:

(1) Getting tips or tutorials once in the beginning is not enough (see our section on Tutorials and Tips).
(2) Learning doesn't always generalize to a different context (our users had tried swiping on the tablet home screen, but may have thought that it doesn't apply within apps).
(3) Even after being exposed to a tip once, the interface needs to be suggestive and create the right affordances for gestures.

In most of our studies, test participants used their own tablets, which they had usually owned for at least half a year (often a year or more, particularly when counting earlier releases for those users who had upgraded to a new tablet). These users still had not learned advanced gestures, which shows that the long-term learning curve still doesn't get most people to a stage where such gestures are easy or second-nature.

Of course, we don't know what will happen after ten or twenty years of tablet use, but experience from other categories of user interfaces — from line-based command systems to window-based GUI designs — shows that most users' learning curve is extraordinarily flat during long-term use: people don't tend to pick up much additional UI knowledge during multiple years of use.

Tutorials and Tips

Most of the time users are not patient enough to sit through a tutorial. And often, even if they were to carefully pay attention to a tutorial or instructional video, they would be unlikely to remember most of its content. That type of instructional information, presented all together, often before users have gotten a chance to interact with the interface, is overwhelming.

For that reason, we recommend that you do not use lengthy tutorials when the app is first launched. If you must give users instructions, offer them well-placed, contextual tips.

98. Avoid content-dense tutorials when the app first launches.

The tutorial below is not even lengthy, but because the information is presented out of context, it seems daunting. Most of the items have no referent in the user's mind when the app is first launched.

99. Do not use video tutorials.

Video tutorials are even worse than other types of tutorials, because users must absorb the information at a constant pace. There's no way to skip faster during a part that is less relevant, and to spend more time on something that seems more difficult.

The app Note Anytime has several video tutorials available. None of the participants who tested this app bothered to watch the videos. One participant said:

"I don't want to sit and watch videos".

(Note: When we tested the app, it had no tips or tutorials in the beginning, and the only modality to learn the fairly complex interface was through the videos. One week after testing, Note Anytime released a new version with tips and a 9-page tutorial shown when the app was first launched.)
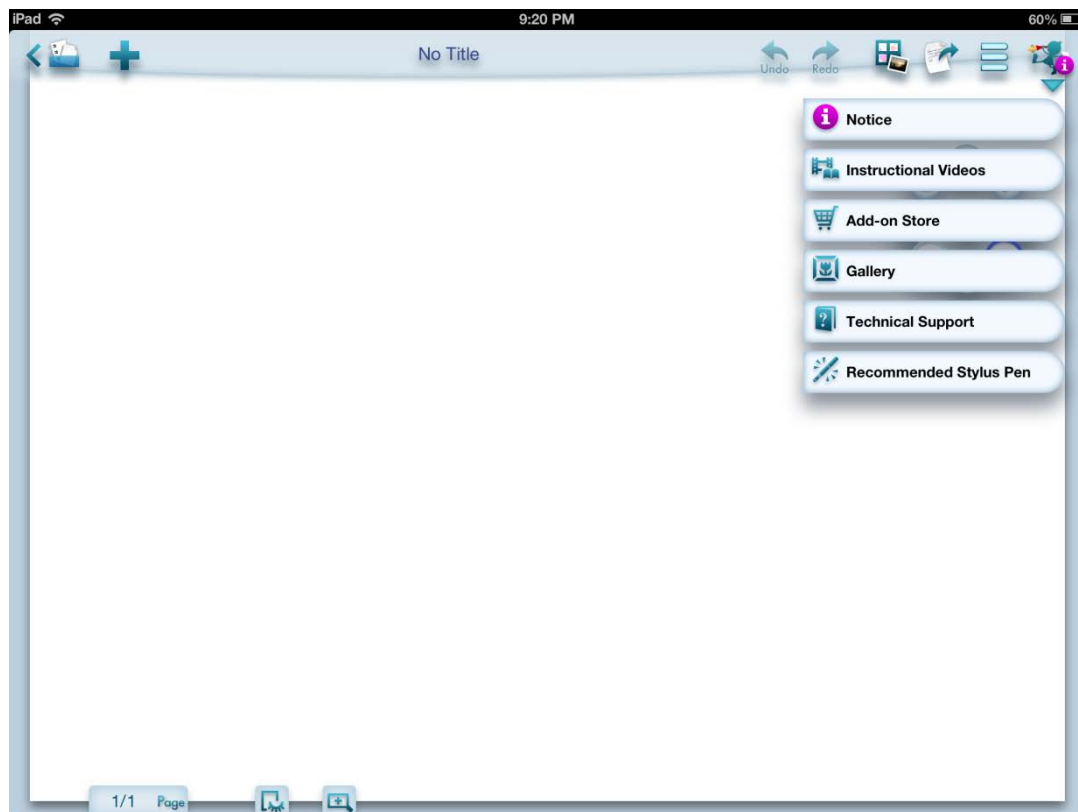
Note Anytime for iPad: Users could not be bothered with the instructional videos.

100. Allow users to interact with tutorials.

Not only is learning-by-doing more effective than learning by reading all the information in the tutorial, but many times users try to interact with tutorials that look more visual.

Let people practice some of the tasks illustrated in the interface if they are so inclined.
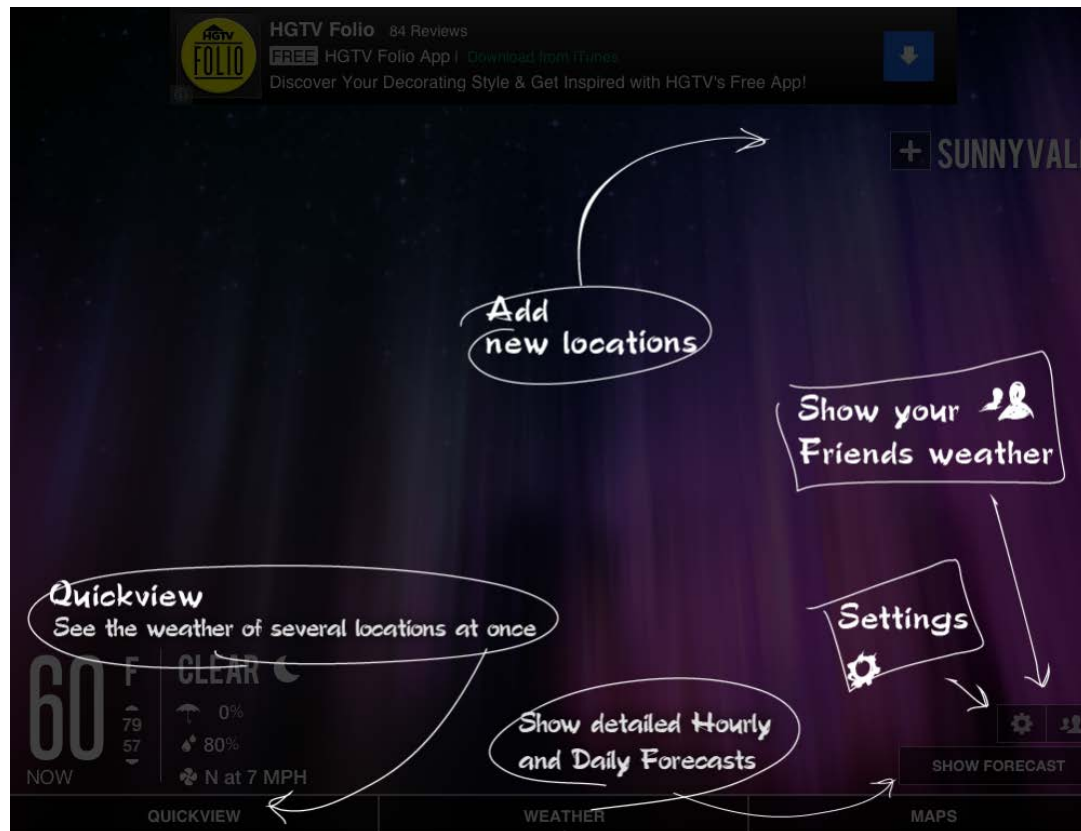
Clear Day for iPad: When first launch, the app shows a quick tutorial. One of our users tried clicking on the different bubbles to get more information.

101. Make it clear that tutorials are not actual parts of the interface.

When we test interfaces for children such as games, we often find that if the game starts with an instructional video, kids are confused and think that the game has already started. They want to interact with the interface and are disappointed and think that the game is broken if that is not possible.

A similar thing happened with adults on tablets. First, people wanted to start right away interacting with the app (and thought that the tutorials would be interactive); and second, some users did not realize that they were dealing with a tutorial and expected to be able to navigate starting from the icons shown in the tutorial.
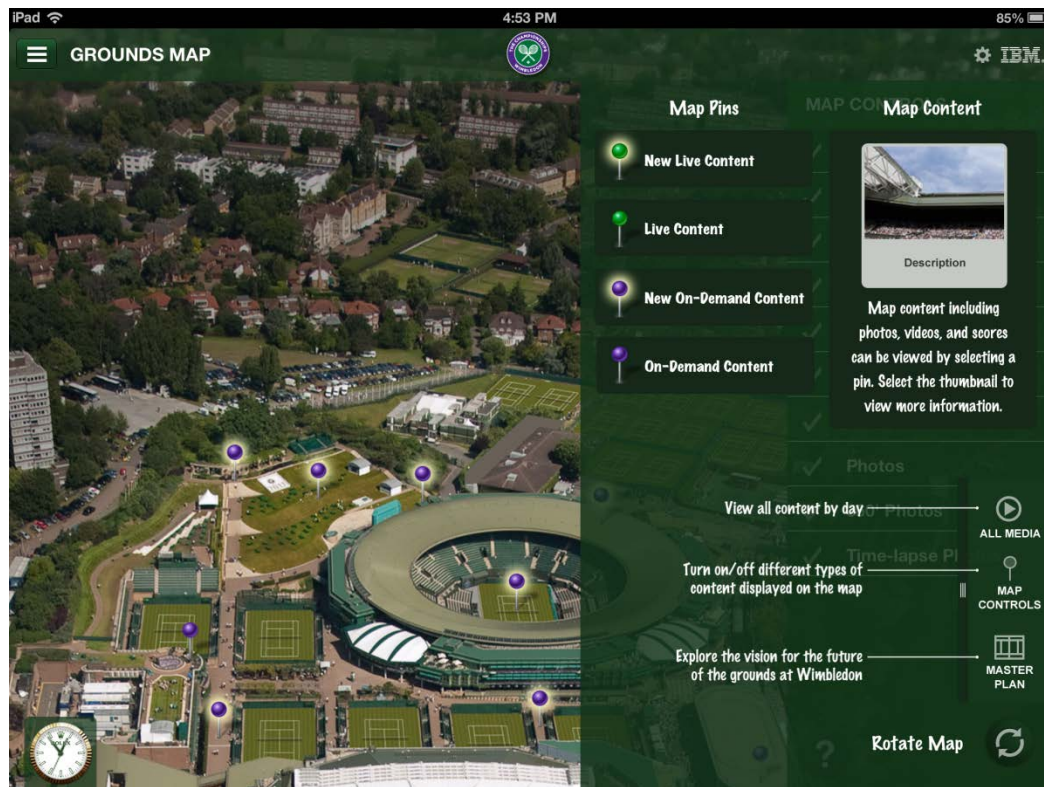
Wimbledon for iPad: Some users thought that the initial tutorial was navigation and wanted to interact with it.

102. Don't overload users in the beginning with a ton of instructions.

CVS starts with a 6-page tutorial that tells people what they can do with the app and how to interact with. Unfortunately, a tutorial like that is hard to memorize and users are not motivated to spend the time to go through the tutorial.
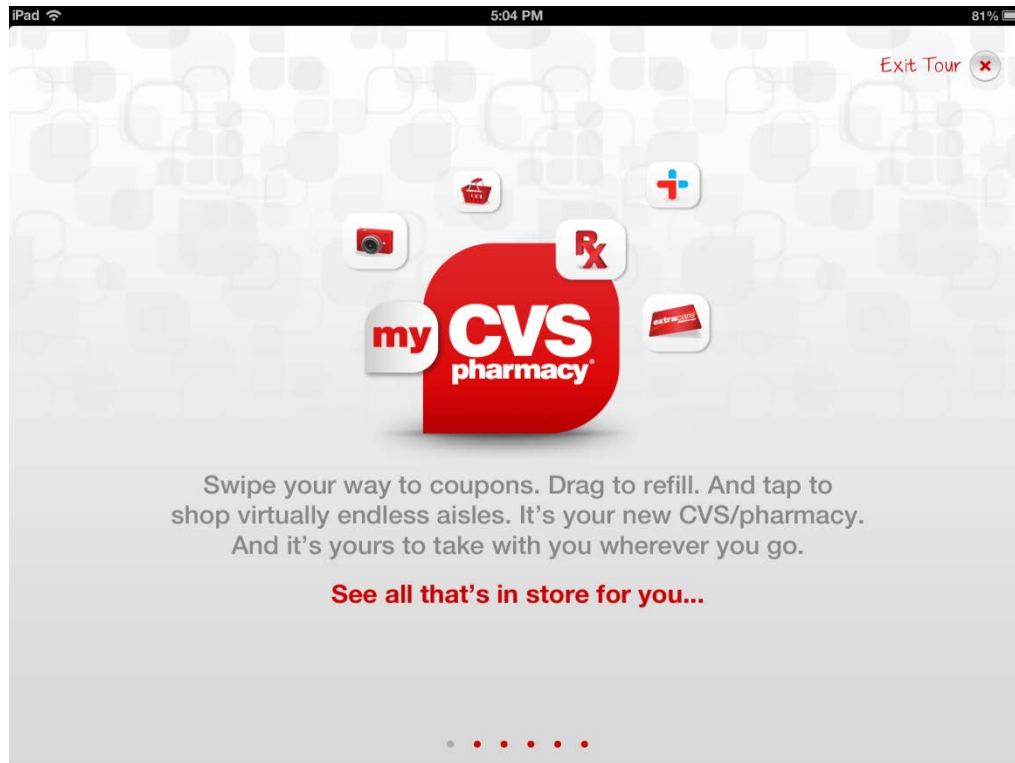
CVS for iPad: The app starts with a tour explaining the different sections of the app. Users were quick to exit the tour.

103. Use contextual tips that instruct users when they need help.

It's a lot easier to understand and learn instructions when they are presented one-by-one, at the right moment.

When we tested Note Anytime, there were no tips; users complained and it was hard for them to figure out the app by themselves. As one user put it:

"There are no directions; I have to guess" [what I am supposed to do].

Since our test, Note Anytime has added tips and a tutorial to both the Android and the iOS versions:
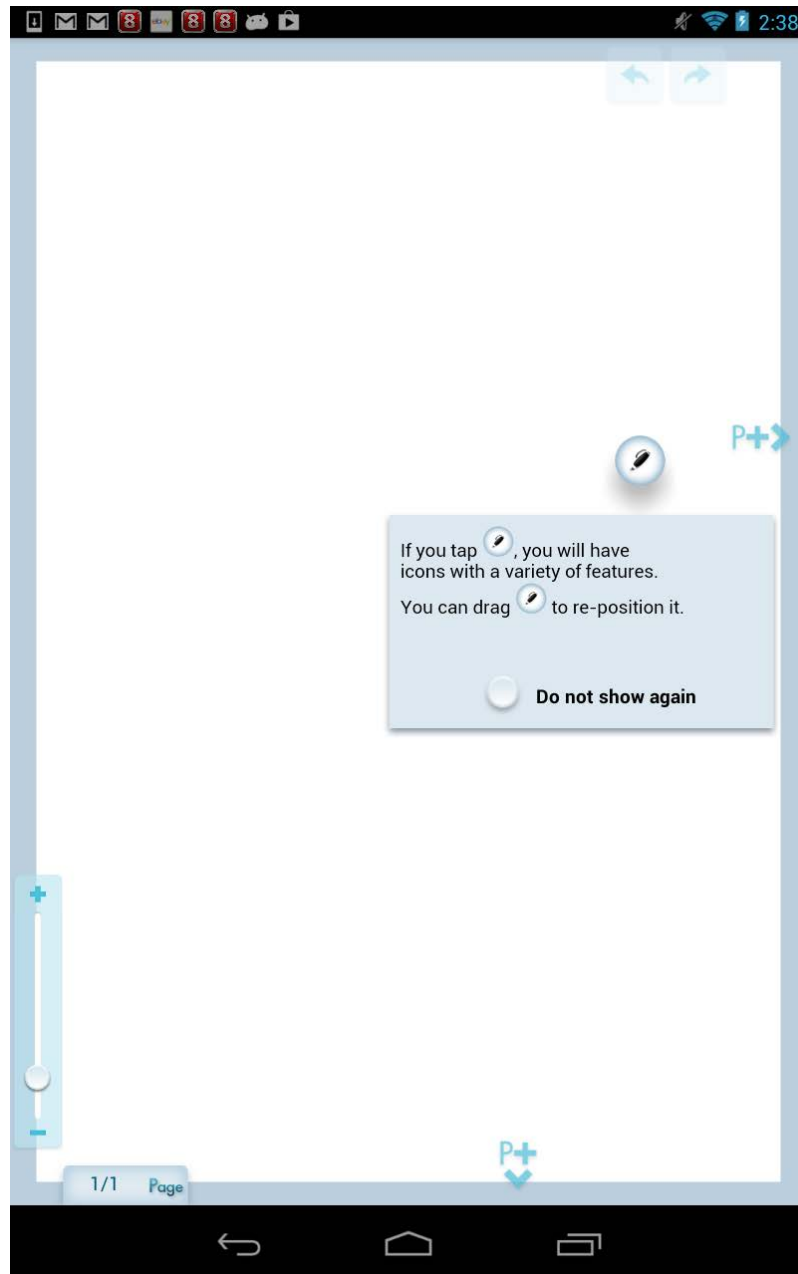
Note Anytime for Android (newer version). The tip appears on the relevant page, next to the widget that it describes.

Content

104. **On a small screen structure content so that the user can get a high level picture of the most important points. Then let them delve into details if they wish.**

    Because the screen is small, it's easy for people to lose track of the context in which information is presented and misinterpret it.

    For instance, we had one user who was looking for houses in Kings Beach, CA using Redfin. For every single house that she saw, she thought it that the house was not on the market anymore and was puzzled that Redfin would show it to her. The houses were actually on the market, but each house page had information about the previous sales. The participant saw the word "sold" on these pages and thought that the house had already been sold, without noticing the other content around that disambiguated the fact that the information referred to previous sales.

Redfin for Android: Our participant was confused by the sales data, thinking that the house had been already sold. Redfin should have simplified the page and hidden the non-essential information (such as Property History) in an accordion menu (or on a secondary page) so that the user could focus on the essential details.

In contrast, IMDb below shows content that is better structured. The page presents a short description of the movie, followed by links to other information that may be of interest to various users.
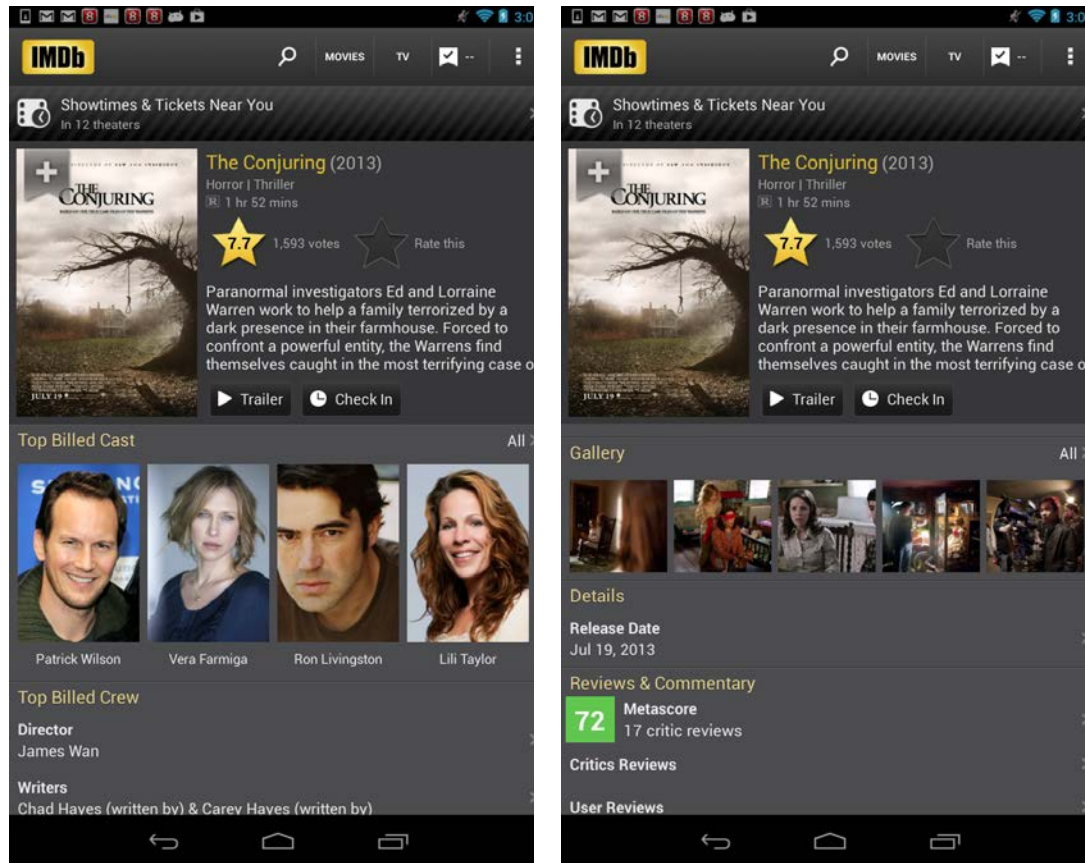
IMDb for Android. The information is nicely prioritized. A short description, the main cast and the director are presented on the page (first screen). All the other information is delegated to secondary pages and can be accessed through links below the fold.

105. Use meaningful labels. Avoid jargon.

In Interior Design users were put off by the model numbers that were listed next to each piece of furniture that they could select. As one user put it, "model numbers don't mean anything."
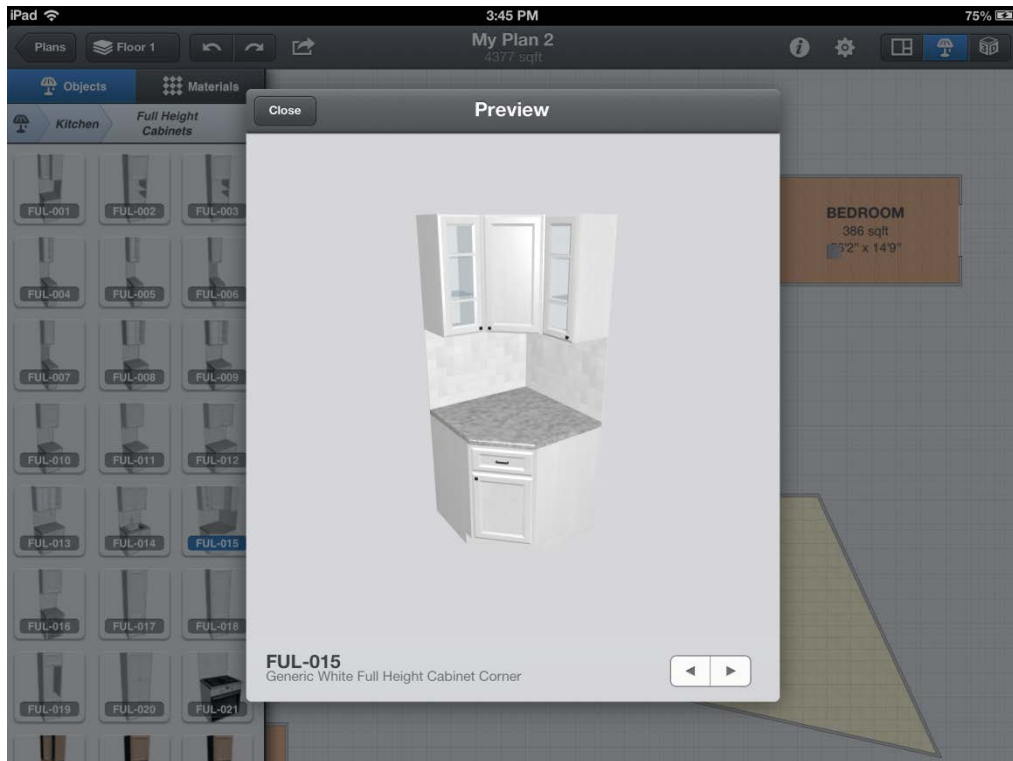
Interior Design for iPad: Model numbers next to furniture objects are meaningless for users.
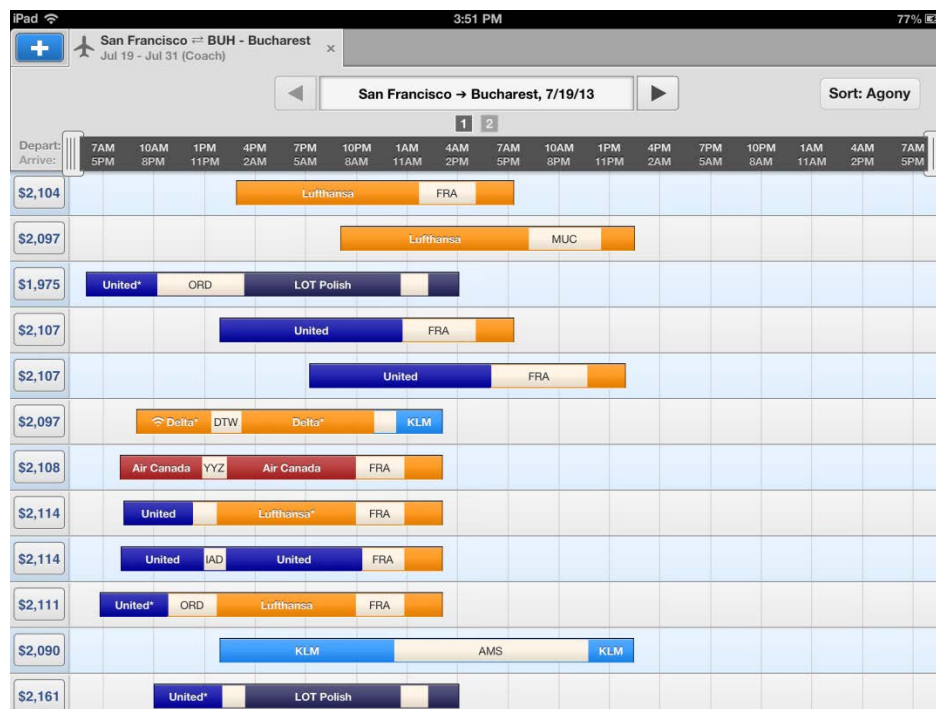
Hipmunk for iPad: Users did not know what "agony" meant.
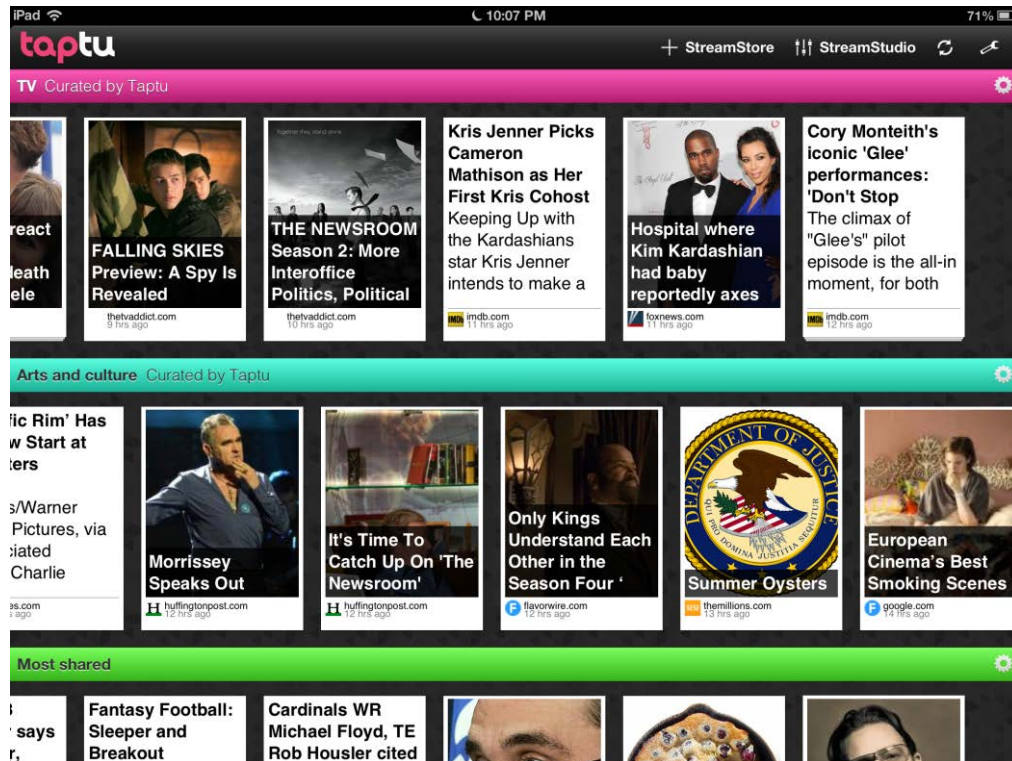
Taptu for iPad. Users commented that they'd like a search box, and did not know what Stream Store or SteamStudio were. (In fact, StreamStore was a fancy name for the search feature.)
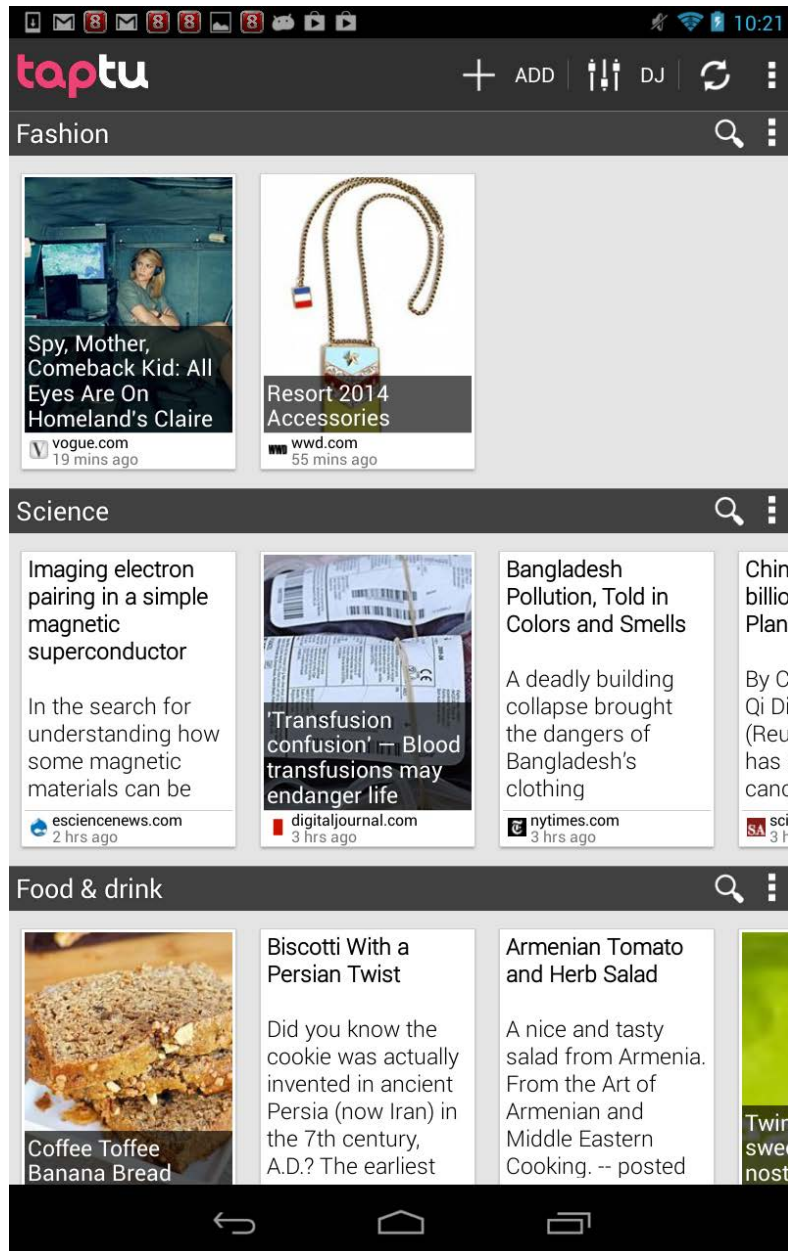
Taptu for Android. The Add button is a lot clearer than the equivalent "Stream Store" on the iPad. However, DJ is quite obscure (it refers to stream customization).

Waiting Times and Latencies

106. When a substantial piece of content is being downloaded, let users interact with it as soon as possible (before the whole download is finished).

Users rarely have the patience to wait for a long time for a big download to finish. Whenever possible, allow them to preview part of the content while they wait.

When using NARR8 (a comic reader), participants complained that they had to wait until the comic was completely downloaded and couldn't start reading before that.

In contrast, most magazine apps today have learned their lesson and allow readers to start reading very soon after the download has started. The access to the issue is limited, but users feel as if they use their time productively.

107. Whenever downloading data or requiring the user to wait for an action to be completed, the app should display a progress bar to indicate to the users an estimate of how much more they have to wait.

Some apps display a spinning gear (or the equivalent — like Hipmunk and Expedia below) instead of a progress bar. Unfortunately, a spinning gear is not good enough, because users have no idea for how long they still have to wait.
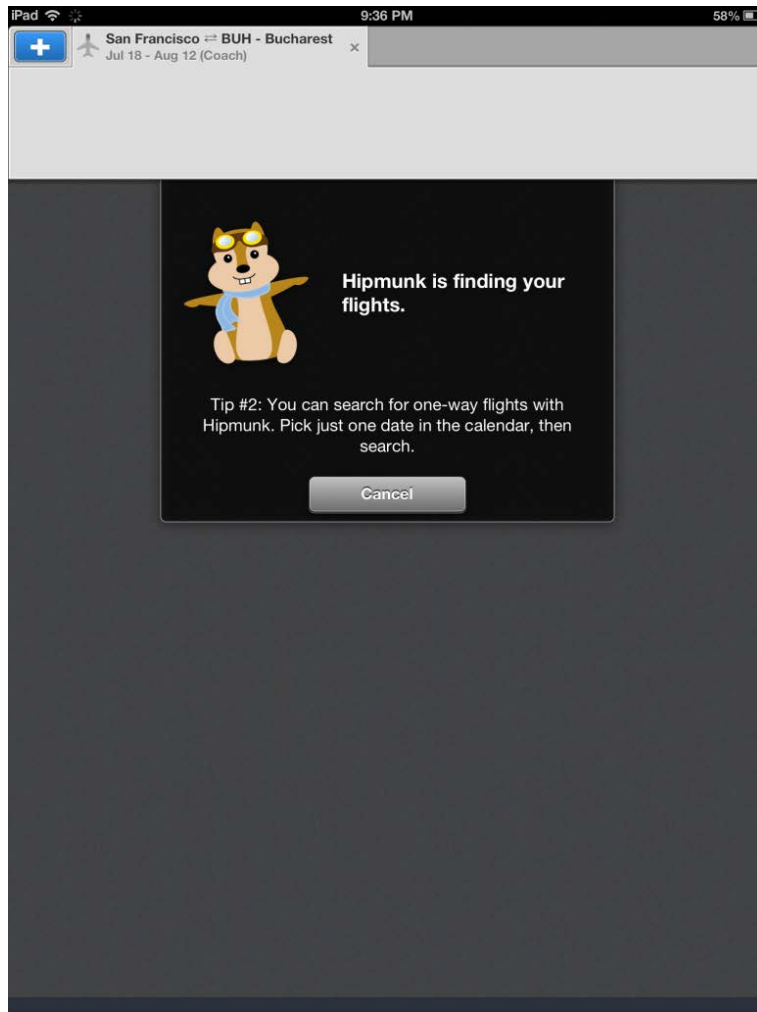
Hipmunk for iPad

Hipmunk does not display a progress bar. Although it does show the equivalent of a spinning gear (the moving mascot), users don't know how much longer they have to wait to see the results.
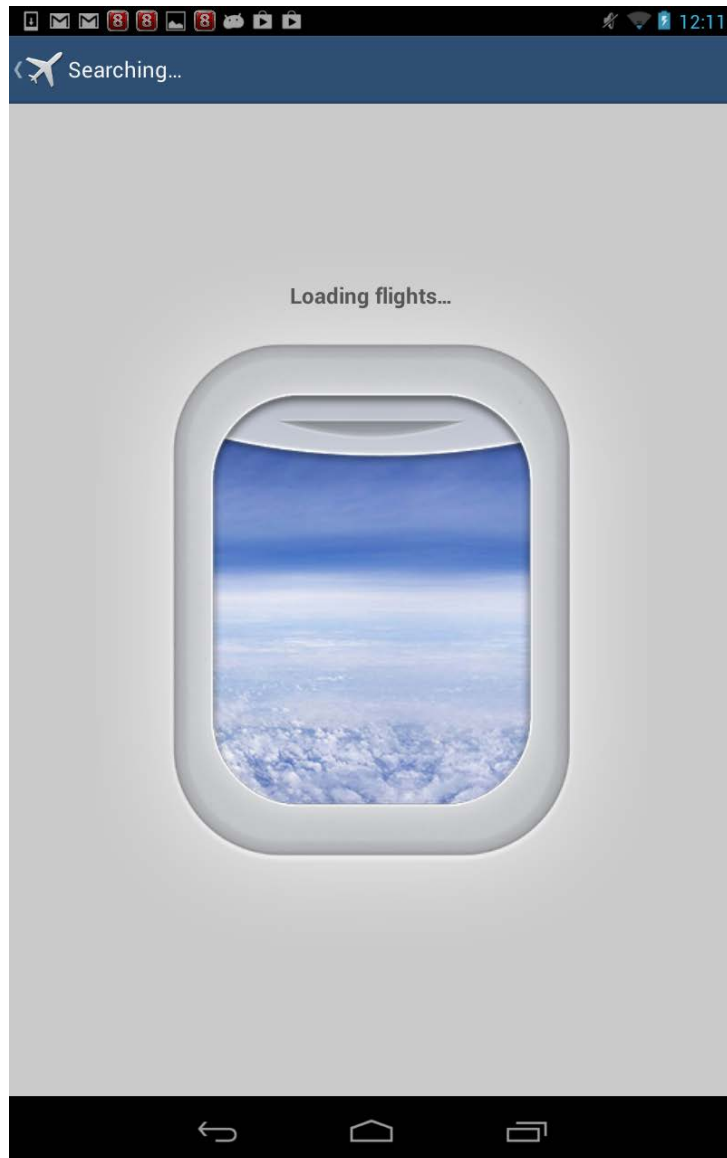
Expedia for Android: No progress bar, just a subtle animation.

Maps and Locations

108. Do not aggregate points of interest on a map.

One of the challenging issues in displaying maps is: how do you show multiple pins on a map, without crowding the map too much and without forcing the user to make a mistake because they accidentally hit the wrong one?

Redfin tried to solve the problem by aggregating multiple points of interest. Thus, if you are searching for houses within an area, instead of displaying all the houses, Redfin is going to combine all the houses close to each other into a single icon with a number inside. The number stands for the houses that were aggregated into that icon.

The solution seems elegant, except for the fact that most users don't get it. People are utterly confused when they see the different numbers, and that confusion only amplifies when, after tapping on one of these numbers, it gets expanded into a few house icons and another number.
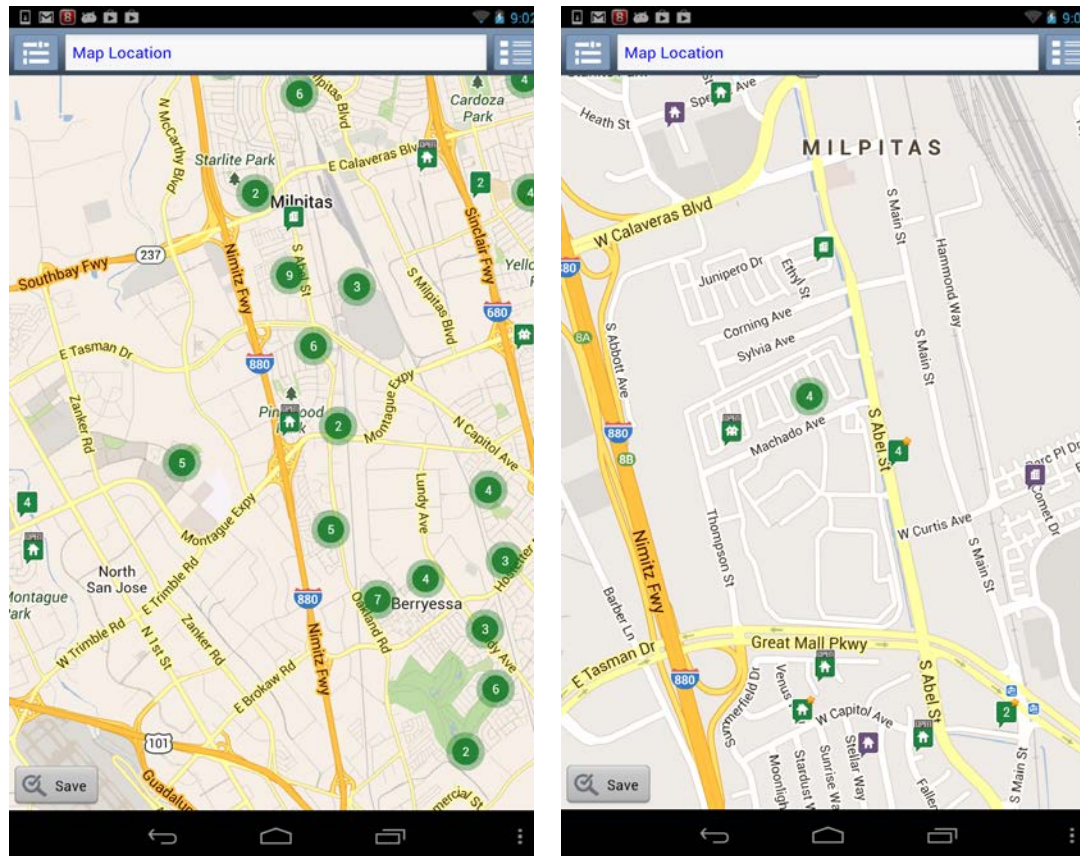
Redfin on Android: Houses are aggregated into numbers (left). When people tap on a number, the area is zoomed into, and they may see some house icons and some numbers, if some of the houses are still too close to each other (right).

109. Adjust the zoom level on the map to include the current location and at least a few points of interest, and to keep targets fairly spaced.

Instead of following Redfin's solution above, a more intuitive solution involves adjusting the zoom level so that it includes the current location and a few locations of interest.

Zillow below starts with a comfortable zoom level that allows the houses to be not too crowded.
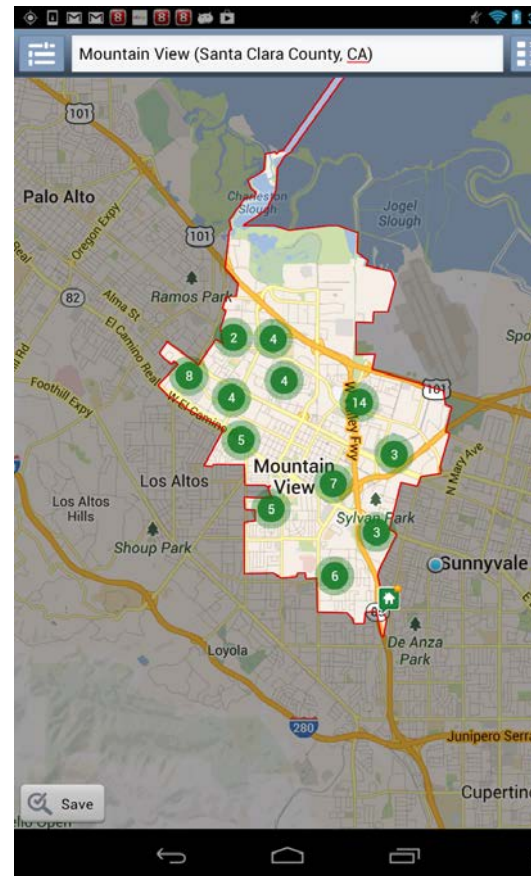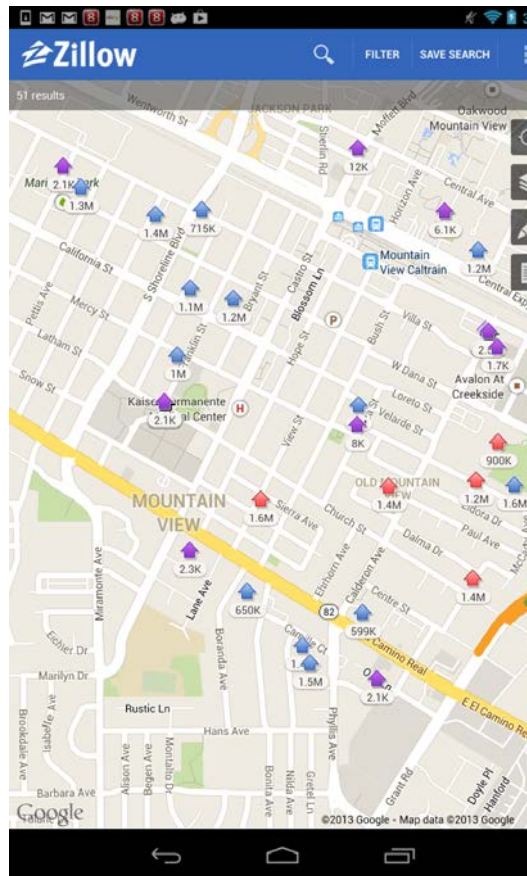
Zillow for Android (left) starts with a higher zoom level than Redfin for Android (right).

Sound Effects

Unexpected noises can be bothersome and startling. We strongly recommend against using transition noises in an app or starting videos without warning.

110. Do not startle users by starting the app with a noise.

111. Make sure that people can turn noise off in the app.

PADD for iPad, an app that simulates the PADD device from *Star Trek*, starts with a noise. It then continues making arbitrary noises during the session (with no way of turning them off). Even if these noises make for a more accurate replica of the original device, it's still possible that users may want to occasionally use the app without sounds.

112. When people navigate to a new page, do not start playing a video automatically.
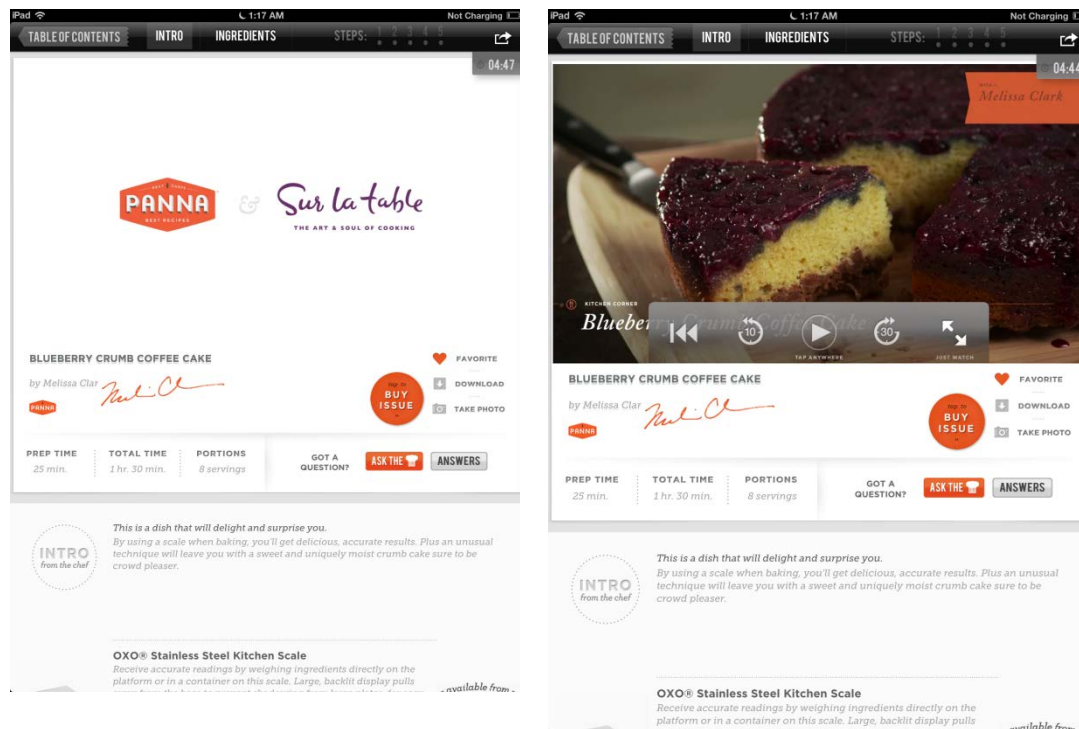
Panna for iPad. When navigating to a new recipe page, a video starts playing automatically. Users must know to tap on the video in order to expose the controls and stop it.

Tablet Orientation

Tablet users seem to report a slight preference for the landscape orientation, at least for the larger screen tablets. People assimilate the landscape orientation with laptops and computer monitors, so by association, some prefer the same orientation for their tablets.

However, even people who have a preference, will not use their tablet in that one preferred orientation at all times. Sometimes the task or the context may impose a certain orientation (e.g., people may rotate their tablet to watch a video in landscape). We noticed that people switch orientations to best adapt to the content on the screen — for instance, they will switch to portrait if the picture is best seen in that orientation; they may switch to landscape to avoid horizontal scrolling on a full site.

That means that people don't switch orientations just to see if there are any other features or different types of data available in the other orientation. So it's important for the interface and the content to be consistent across orientations.

Two years ago these were important recommendations because many apps actually changed their functionality depending on the orientation. Today, most app designers have gotten the message and it is difficult to find substantial interface or content changes from portrait to landscape.

113. Make the interface consistent across orientations.

114. Make the content consistent across orientations.

115. Strive to ensure that your app works in all possible orientations.

Supporting all orientations is ideal, as it gives the users the most flexibility. However, many apps work in a single orientation (e.g., CVS for iPad only works in landscape; Linkedin for Android only works in portrait). That is acceptable, although not optimal — users may be annoyed occasionally, but the unique orientation is unlikely to cause a major burden, because it's relatively easy to rotate a tablet.

116. Avoid forcing users to switch orientations often within the same apps.

If your app contain content that is best seen in one orientation (e.g., comics panels, pictures) make sure, as much as possible, that all the items that are in portrait are placed together and all the items that are in landscape are grouped together as well, so the users won't have to switch orientations too often.
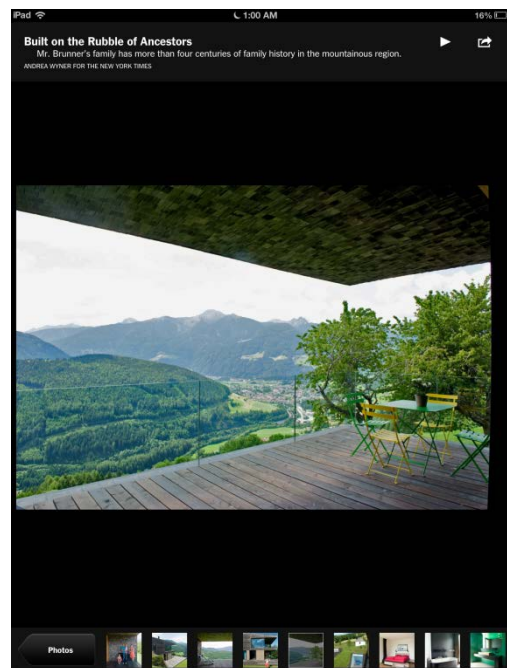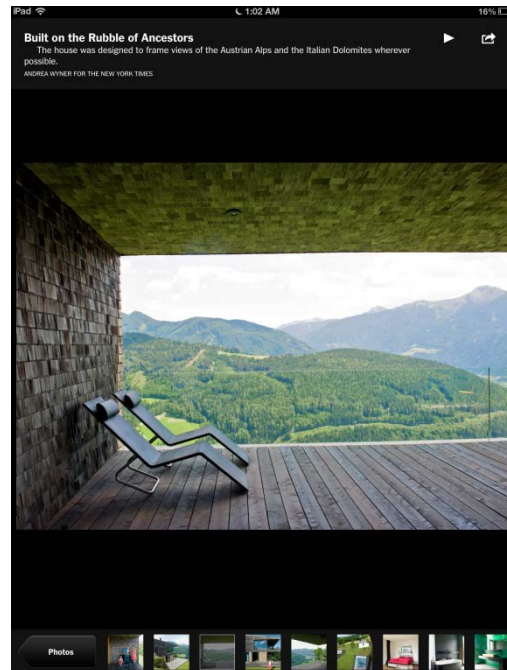
New York Times for iPad. Four consecutive pictures in a slideshow; portrait and landscape orientations alternate, forcing the user to change orientation for optimal viewing.

Other

BROWSER VIEWS WITHIN APPS

117. Whenever the app contains an embedded browser, make sure to give users the same flexibility as the default system browser (e.g., Safari on iOS, Chrome on Android).

Many apps have embedded browsers that deliver web pages to the user. This feature can be useful in a variety of situations — for instance, to refer the user to supplementary information on a website.

The app Note Anytime allows users to capture a webpage and then annotate it. In order to take advantage of that feature, users need to navigate to the desired web page using the in-app browser. However, this embedded browser is a lot more restrictive than a regular browser — for instance, it does not recognize URLs that do not start with "http:". Our users did not realize what the problem was and left the app frustrated because they were not able to navigate to the desired webpage and they thought that the app did not work.
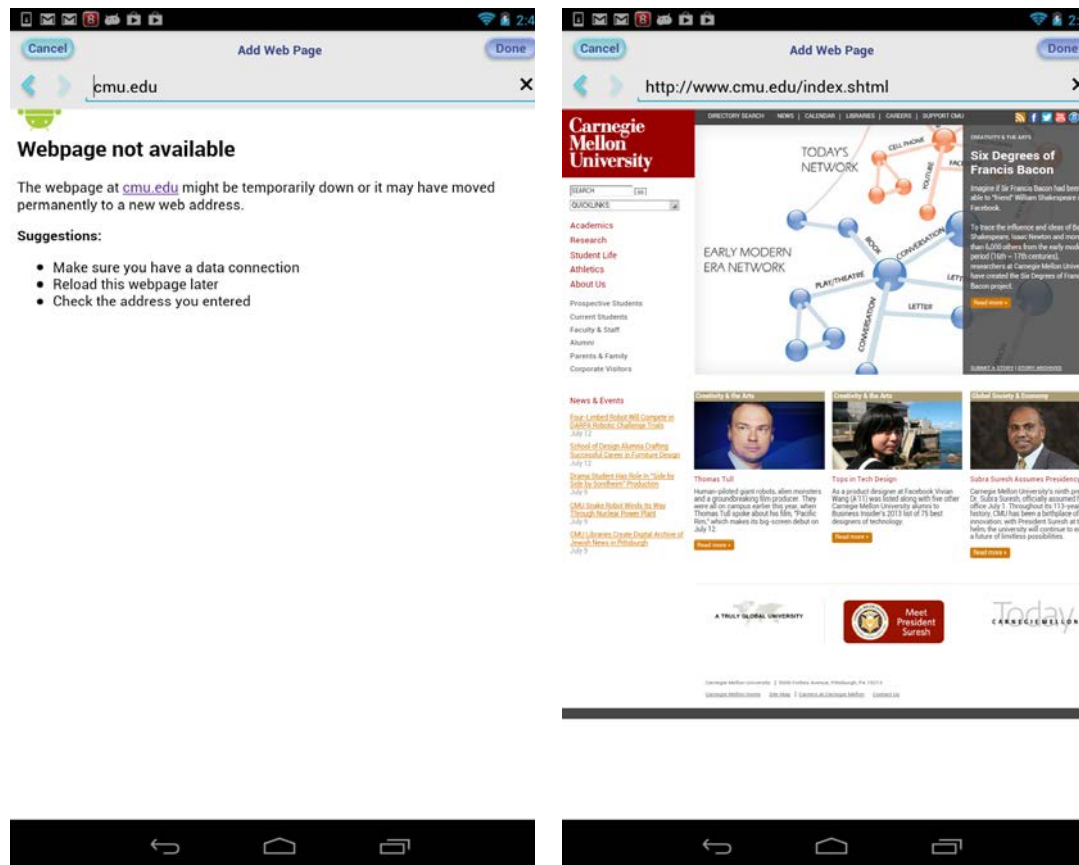
Note Anytime for Android: The embedded browser does not recognize URLs that do not start with http://. Thus "cmu.edu" produces an error (left), but "http://cmu.edu" works (right).

SELF-SUFFICIENT DESIGN

118. Apps should be self-contained and present the users with all the data necessary to make a decision.

Although many apps strive to partition the screen into multiple regions and present different types of information at the same time, on iOS and Android you cannot have two applications on the same screen at the same time. (In Windows 8 it is possible to have two apps share the screen). Because of that, when designing an app you must strive to offer all the info that the users might need in order to complete the task supported by the app. Otherwise, people will need to quit the app, find the information elsewhere, and then bring it back into the app.

Here are a few examples of apps that are not self-sufficient.

Skyscanner, a flight search engine, lets people search for travel, but does not show on what day of the week the travel dates fall.

Syscanner for iPad: The app does not show on what day of the week the departure and return dates fall. Users need to go to a calendar and check the date.

When trying to find a hotel in the Gothic Quarter in Barcelona, our users had difficulties figuring out where the Gothic Quarter was on the map, and whether a hotel was in that neighborhood or not. Several mentioned that they would go to a search engine, figure out where the Gothic Quarter was, and then, based on that come back to the app and select the appropriate hotels. Some said that they'd rather do a task like that on a computer because they'd like to have all the info in front of their eyes, in separate windows.

A newer version of Booking.com on the iPad splits the screen into two windows, one for map and one for hotels. The map does show the neighborhood names, but some of the neighborhood names are obscured by the many targets that are presented on the screen. Moreover, it's hard to know exactly where the boundaries of the neighborhoods are (and even, to the untrained eye, that these represent neighborhoods). In this situation, a simple link to a map with the various quarters would have helped; alternatively, the ability to filter hotels based on the neighborhood would have also solved the problem.
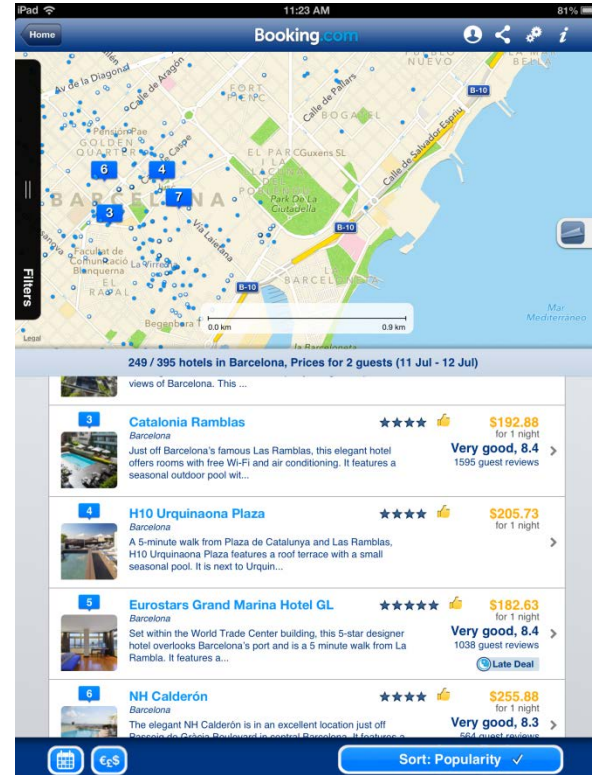
Booking.com. The Android version (left) does not contain neighborhood information on the map (although it does have a "district" filter — but the Gothic Quarter was not among the offered options for that filter). The iPad version shows neighborhoods in gray, but users did not notice them and thought they had to go elsewhere to find the information.

ERRORS

119. Always have an error message rather than just marking the field that caused the error.

In the absence of an error message, users have to guess what the problem is.
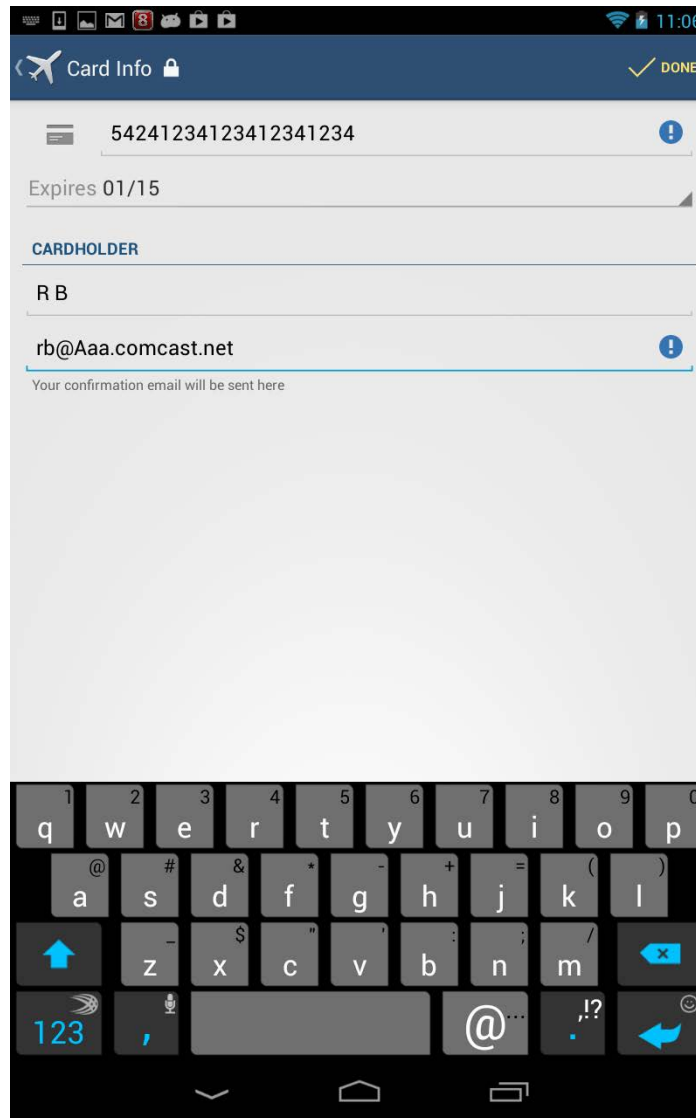
Expedia for Android: The exclamation points seem to signal that there is a problem with the credit card and the email fields, but it's not clear what the problem is.

120. **When writing an error message, be as specific as possible. Always let the users know what the problem is rather than asking them to figure out what the problem is.**

None of our users figured out why they weren't able to use Redfin to search for properties in Incline Village, Nevada. They checked their spelling, they changed "Nevada" to "NV", but nothing seemed to help. And especially the error message, which put the burden of figuring out what the problem was on the user.

121. The error message should attract users' attention and should be persistent. Where applicable, it should be placed immediately next to the source of the error.

One of our Android users downloaded a PDF document and repeatedly tried to open it. She did it several times, and nothing happened. Eventually, she noticed the tiny error message "Cannot open files" below her Downloads dialog. (The error message disappeared after a few seconds, so she had missed it

before because she was looking at the Downloads window and not at the region below it.)

Downloads on Android: The error message "Cannot open file" was far away from the users's focus of attention and she missed it several times.

122. In an error message, don't instruct users where to go to solve the problem; instead, provide a link that takes them there.

When Redfin finds no results to a search, it triggers an alert box with a big button "Return to previous search". Unfortunately, tapping that button dismisses the alert and the user is left to figure by herself how to get back to the previous search.
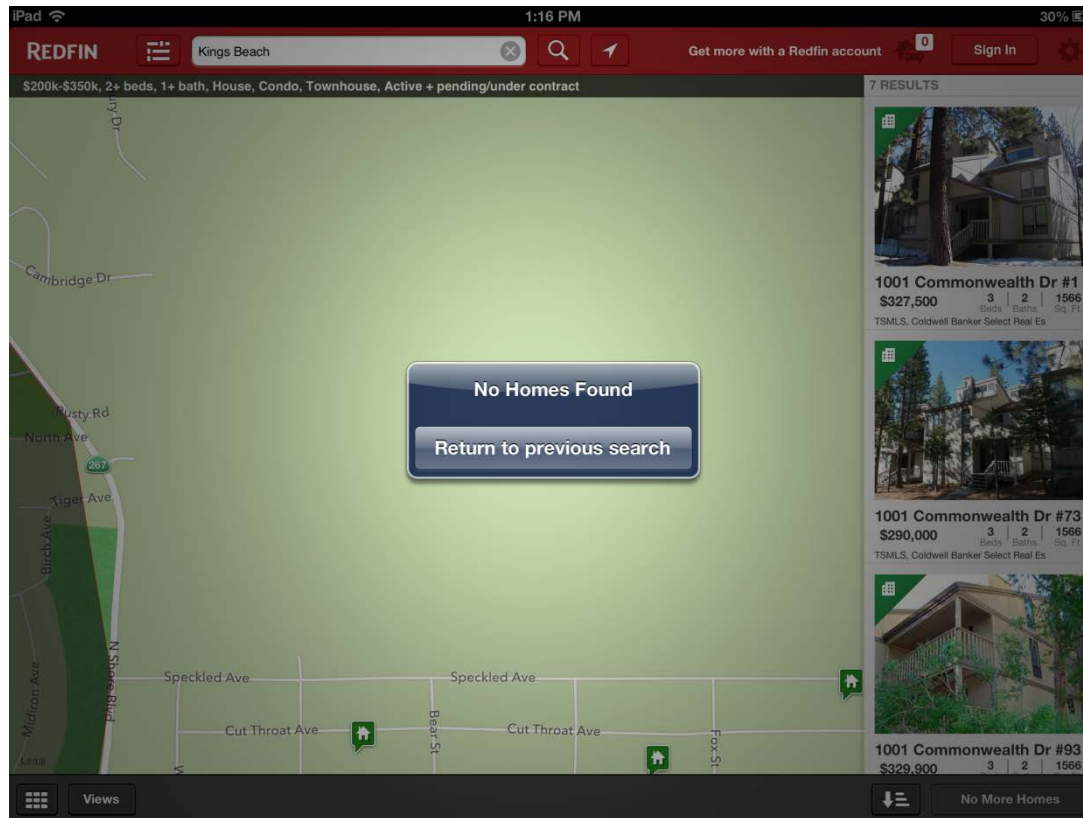
Redfin for iPad: The button "Return to previous search" does not take
users to the screen containing the previous search parameters. Instead, it
just dismisses the alert.

**123. Whenever an action performed by the user cannot be completed,
explain why, rather than just reverting the state of the app to the
moment before that action.**

An explanation makes the user think she is in control; otherwise, if the app
seems stuck, the user will not know if the problem can be fixed or the app is
simply buggy.

Consider these cases "teachable moments" where you can grow the user's
mental model of your application in a useful direction. Not only do you help the
user overcome the current impasse, but you improve their future use by
improving their understanding of the system and *why* certain things are
possible under certain conditions.

As our study participants attempted to draw their house plans in the app called
Interior Design, several struggled with the fact that occasionally they could not
move the rooms around the plan or change their shapes because the app did
not allow overlapping rooms; however, the users were left to figure that out by
themselves. The app would simply move the rooms back in their original
position whenever the user attempted to place them somewhere where they
overlapped a different room.
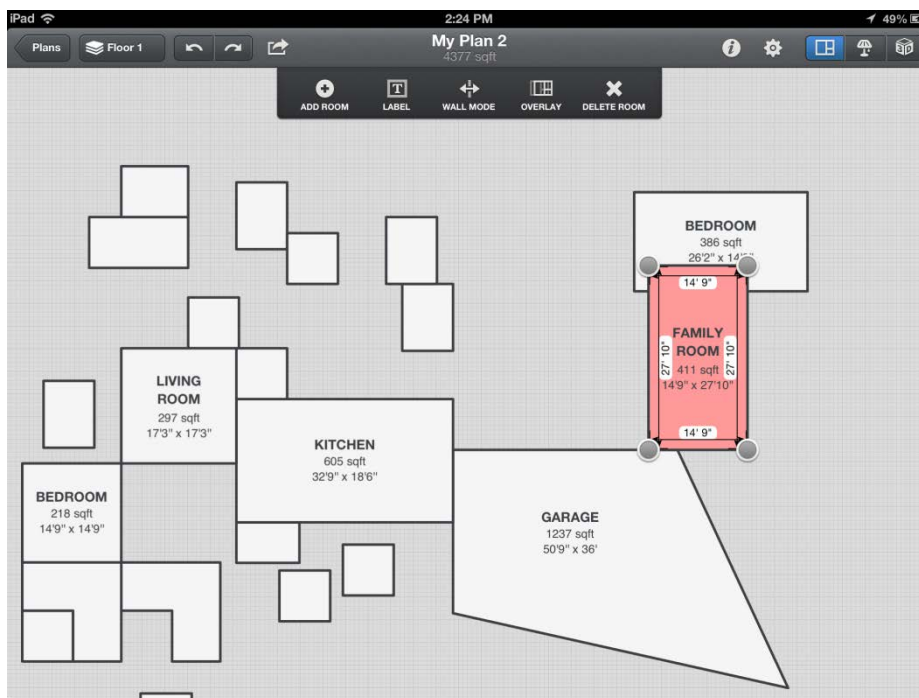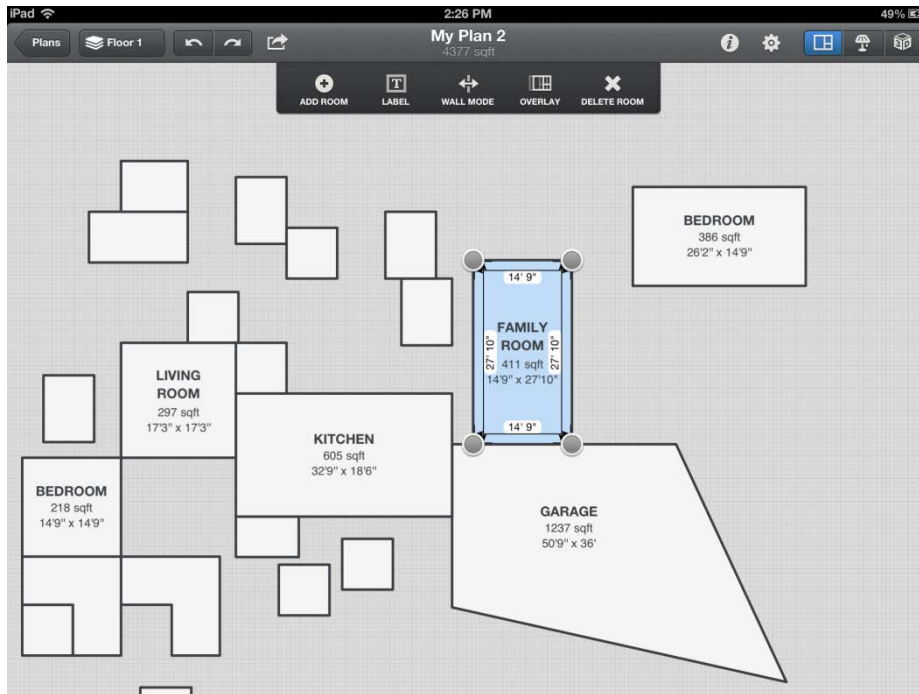
Interior design for iPad: The user selects the family room (above) and then tries to move it away (below), but the family room automatically moves back to the original spot (in the screenshot above) without any explanation.

INFO@NNGROUP.COM   Other

SHOPPING

124. In an e-commerce app make sure that you include a shopping cart link or button in a place that is easily accessible and discoverable.

It seems obvious that any shopping app should let customers quickly access the shopping cart. In Costco for Android the only way to see the shopping cart is to navigate to a product page and add the product to cart. Only then, a View Cart button appears.
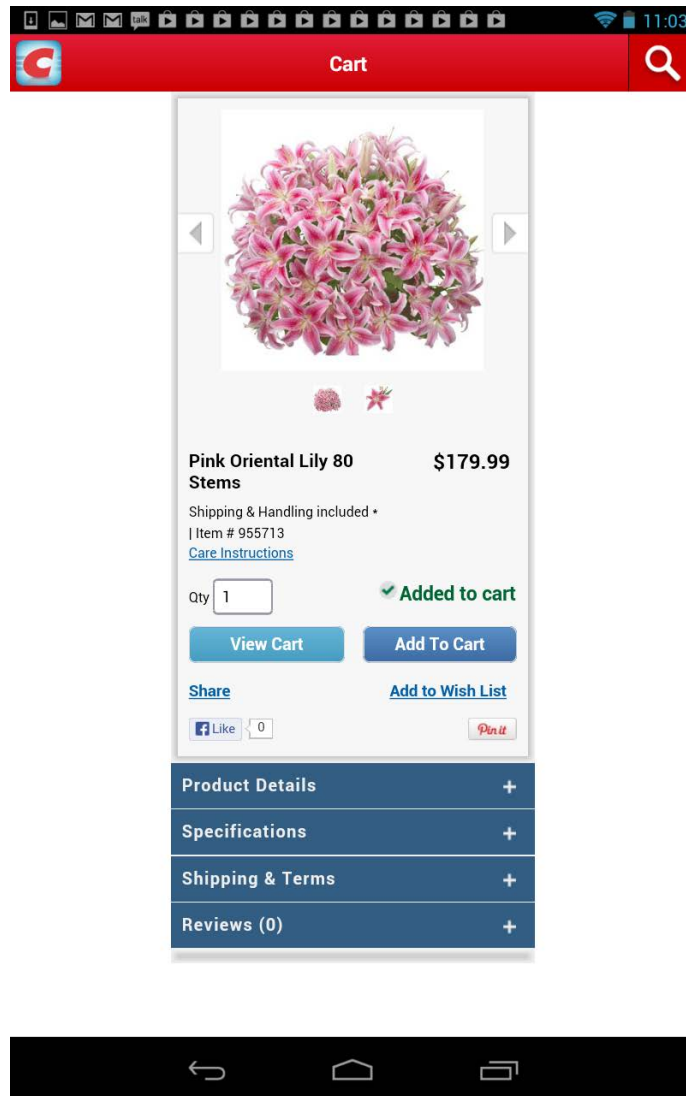
Costco for Android: The only way to view the cart is to navigate to a product page and then add it to cart. Once the product is added to the cart, a View Cart button appears. The Cart is present nowhere else in the interface.

125. Alert customers to the fact that they placed an order.

126. On the confirmation page, give customers a way to cancel an order.

Because tablets have touch screens, it is easy to accidentally hit a button. To avoid consequential mistakes, it's always a good idea to confirm the placing of an order, and also to give a way to quickly cancel it if it was placed in error.

One of our participants inadvertently submitted an order for a print in the CVS app for iPad. He expected to have to enter a credit card to order, but the app let him upload a photo and schedule a pick up without having him enter a credit card. So he pressed the Submit order button thinking that it will ask for payment information (or would not go through because he hadn't entered any).

Sometimes too little information can hurt the app; when it comes to placing an order, always confirm with the user (to make sure they haven't pressed the Submit button accidentally), and, on the confirmation page, let them quickly cancel the order if they wish to.

CVS for iPad: Users could order prints without entering any payment information. One participant was confused and unintentionally placed an order for a print.

Methodology

The guidelines discussed in this report are based on two types of studies carried out over 3 years: traditional usability testing using the think aloud protocol, and design-reviews.

USABILITY TESTING

Overview

The findings in this report are based on 6 usability-testing studies carried out over 3 years. All these studies used the think-aloud methodology; their purpose was to understand the typical usability issues that people encounter when using applications and websites on tablets. With the exception of one day of testing that took place in Chicago, IL, all the sessions were located at our headquarters in Fremont, CA.

The six usability studies looked at a variety of tablets with a variety of form factors:

- Two early studies investigated the large-size iPad
- One study scrutinized the 7-inch Kindle Fire
- One study looked at Windows 8 tablets
- Two other studies investigated a variety of tablets with an assortment of screen sizes

Some participants were briefly interviewed about their tablet-related practices at the beginning of each session. They also showed us the apps that they had installed on their devices. Occasionally we created tasks based on the apps that they had installed and asked users to perform them.

All participants had to perform specific tasks on their tablet. A moderator sat next to the participant, and observed, listened, and took notes. Users commented on:

- What they were looking for or reading;
- What they liked or did not like about the site or app;
- What made it easy or difficult for them to accomplish the task.

The participants' interaction with their tablets was recorded using an Elmo document camera. Each individual session lasted 90 minutes; participants were compensated for their time, as well as for the cost of any paid apps that they were asked to download or any purchases that they were asked to make during the session.

Participants and devices

A total of 67 people participated in our tablet studies. Out of these, 48 used their own devices during the testing session. The remaining 19 participants used devices that they did not own and that were very recent at the time (1–2 weeks after release): the original iPad, the Kindle Fire, and the Microsoft Surface. These 19 participants were owners of other touchscreen phones or tablets and were familiar with touch interactions. All participants were from the US.

The operating-system distribution was as follows:

- 42 iPads (including 5 iPads mini),
- 9 Windows 8 tablets,
- 16 Android tablets (out of which 7 were Kindle Fire tablets).

Out of the 67 participants, 34 were male and 33 were female. The table below shows the participants' age distribution:

21–30	31–40	41–50	51+
15	23	19	10

The 48 participants who owned a tablet used it several times per week for a variety of activities. The remaining 19 participants were also frequent users of touchscreen devices (either phone or tablet) and used it several times per week, but had not used the tablet they tested during the study session.

We screened out technical experts and people who worked in usability or marketing, since they were not the target users for the apps and sites we tested and tend to exhibit atypical behaviors due to their expertise.

The following is a partial list of participants' occupations:

- Medical Historian
- Sanitation engineer
- Property manager
- Office manager
- Retired
- Attorney
- Pharmacist
- Chef
- Merchandiser
- Nurse
- Biologist

Method

Each session was divided in several parts:

1. Those participants who brought in their own tablet were asked a few questions related to how they use it:

   "Please tell me what kinds of activities you do on your tablet."
   "Is there anyone else who uses your tablet?"
   "Do you take your tablet with you when you are away from home?"

2. If the participants had brought in their own device, they had to talk briefly about different apps that they had installed on their tablet. We only inquired about apps that (a) were designed specifically for the tablet; (b) were not games. For some of these apps, the facilitator created some ad-hoc tasks and asked the users to perform them.

3. The facilitator gave the participant one task at a time and asked them to (a) first download the corresponding app if they did not already own it; (b) carry out each task as far as they would if they were on their own. The participant was encouraged to think aloud while performing the task.

Each task involved a specific app or website. For a subset of the e-commerce tasks, we gave participants money to shop for an item that they wanted to buy.

Each participant saw a subset of the available tasks. The order of the tasks was randomized for each participant.

All participants were asked to connect to wireless network at the beginning of the session.

Materials

Ad-hoc tasks. These tasks were created on the spot, as the users were showing us the apps that they had already installed on their tablets (in part 2 from the Method section). These tasks were similar to tasks that we had planned for our regular usability testing part of the study; sometimes, the tasks were generated based on participant's interest in the topic (for instance, a participant told us that her spouse had fainted earlier that day and that she was worried). The table below displays examples of ad-hoc tasks and the corresponding apps:

APP	TASK
Adobe Idea	Draw a sketch of your apartment.
Bloomberg	How do you display your favorite news topics on the first page?
Fandango	Find a movie you may want to watch during the weekend and buy tickets for it.
NPR	Listen to the last "Science Friday".
USA Today	Check the latest entertainment news.
WebMD	Your spouse fainted earlier today. What might he have?
Calorie counter	Figure out how many calories you had for breakfast today.
Groupon	Find some food-related deals in your area.

Tasks. The following table shows some of the tasks that we used for the study (in part 3 from the Method section). For some of the apps, we had users use a website and for others they had to use an app. Occasionally, we asked them to do the same task both using the app and the corresponding website — if that is the case, the website is shown in parentheses next to the app name. In those situations, we made sure to balance the presentation order so that the app would be first for some users and the website would be first for others.

APP OR WEBSITE	TASK
ABC News	Check the latest news.
Amazon Windowshop (amazon.com)	Look for a birthday gift for yourself.
Amazon Windowshop (amazon.com)	Look for a flexible iPad keyboard.
BigOven	Find a recipe for lamb roast.
Bing	Check the latest world news.
Bing	You're going to the movies on Friday night. Find a movie to watch.
Flipboard	Check the latest news. Set up the app to show the news topics that interest you.
Fortune	Figure out what makes the largest part of the cost of an airplane ticket.
(www.harvard.edu)	You've heard that some universities have started offering classes on the web available to everybody. Find if Harvard has any such offerings. Do you have to pay for enrolling in such a class? Are there any requirements?
Hipmunk	Book a trip from San Francisco to New York for the last weekend in July.
Kayak	Use the Kayak app to find a room in a 5- or 4-star hotel in Las Vegas for the Thanksgiving weekend. You are looking for a suite with 3 or more beds and two bathrooms.
LightTrack	You want to take a photograph of the Golden Gate Bridge from the vista point. What will the direction of the sun be tomorrow at 12?
Maps app	Use the Maps app to find directions from here to the San Jose Convention Center.
Martha Stewart Cookies Lite	You have 1/2 pound of chocolate that will expire soon. Find a recipe where you could use it.
NARR8	Find an comic about how books were invented.
NASA	Find more info about Mars. When was water discovered on Mars? Does it have any moons and how are they called?

(www.nike.com)	Find a pair of running shoes that you like. Have your name or a message inscribed on each of them. Purchase the pair (Stop just before completing the order.)
Note Anytime	Your friend's son asked you to draw a car for him. Do your best.
Notetaker	Imagine you need to explain to someone how to get from your house to the grocery store where you normally shop. Make a sketch to help that person remember how to get there.
Pennant	What were the most important moments of the game between San Francisco Giants and San Diego Padres, played on Aug 14th 2010?
Pennant	Who pitched for the Giants?
Photoshop Express	Go to Amazon.com and take a screenshot. Crop the upper half part of the picture. Rotate the picture and sharpen the contrast.
(www.Propublica.org)	Find information about what you can do as a patient to avoid medical errors when hospitalized.
Pulse	Check the latest news. Set up the app to show the news topics that interest you.
QVC (qvc.com)	Find a gift under $50 for a friend or a person you care about.
Redfin	Find out how much it would cost to buy a vacation house in Kings Beach, California.
Sears (sears.com)	You want to buy a new dishwasher that saves energy and water, and is as quiet as possible. Find one that satisfies your constraints. Is there a delivery cost? How about an installation cost?
Soundhound	Find the lyrics and music for Queen's Bohemian Rhapsody.
Time	Find the best photographs of the week.
Trulia	Find information about houses that have been recently sold or are for sale in your neighborhood.
Vanity Fair	Find who wrote the different articles featured in the magazine.
Vanity Fair	A friend has recommended an article about the movie "All the President's Men" starring Robert Redford. Find the article and see if it is interesting

	to you.
Washington Post (washingtonpost.com)	Check the latest entertainment news.
Wimbledon	Find the results in the last match played by Maria Sharapova. What is her next match?
Wine.com	Friends are visiting from abroad and you want to take them to Napa Valley for a day trip. Find 2–3 really good wineries where you could stop for wine tasting.
Wine.com (wine.com)	Your friend in Pennsylvania loves wine. Send him a bottle of good California wine under $50.
Wired	Find an article about how the perfect French fries are cooked. Can you watch a video about that, as well?
Wired	What does Drano Prevention contain?
Zappos (zappos.com)	Find a pair of shoes under $70 for yourself for the summer. Stop short of actually making a purchase.
Zillow	Find information about houses that have been recently sold or are for sale in your neighborhood.

Apparatus

For testing we used a setup similar to the one in our mobile usability testing. A document camera recorded the tablet and streamed the recording to a laptop computer, connected through the camera using an USB port. A webcam was used for recording the participant's face. The webcam was connected to the same laptop. The laptop ran Morae, which put together the two video streams from the webcam and the document camera. The laptop computer was also used so that the facilitator and the observers could follow the participants' actions without invading their personal space.

The tablet was mostly kept on a small rectangular plastic pad, in landscape or portrait position (depending on user preference). Users were free to change orientation of the device and move it around, but we cautioned them that they needed to move it above the plastic pad, to allow us to follow their actions.

DESIGN REVIEWS

For the design reviews, one usability expert reviewed the apps and websites mentioned in the task table, as well as other apps and websites. We reviewed many of the apps that were mentioned by the participants, as well as other apps, including:

- Crackle
- AP News

- Boutiques
- Shop Style
- Quickoffice
- Hermitage HD
- Life
- Ansel Adams
- National Gallery Love Art
- Popular Science
- The New Yorker
- Food and Wine
- Glamour
- ESQ
- JCPenney
- Toys R Us
- Sushi HD
- iCircuit
- Newsy
- MOMA Abstract Expressionists
- Dartfish Express
- Hotel Tonight
- ModCloth
- Fitness Class
- Geico
- Westpac NZ
- iCookbook
- Lennox iComfort
- ThinkerDeck
- Conrad Concierge
- Pinterest
- SunPower
- Home Away

List of Guidelines

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CONSULTING

The same experts who conduct our research and teach Usability Week training courses are available for custom consulting including:

- **Evaluating your website, application, intranet or mobile interface** (average cost $38,000 USD)

- **Usability testing** (average cost $35,000 USD)

- **Strategic planning** (average cost $12,000 USD)

- **On-site training with your team** (average cost $9,000 USD per day)

Consulting details: www.nngroup.com/consulting