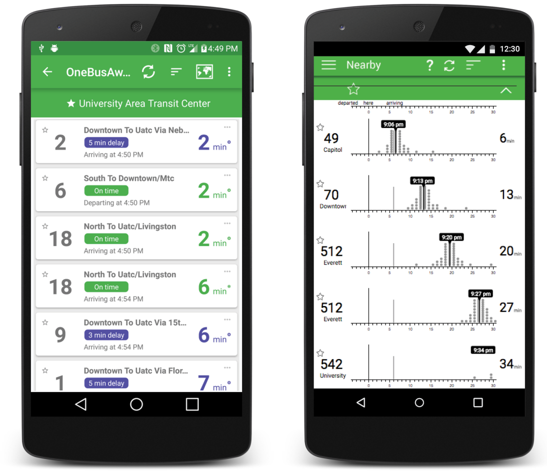


Figure 1. ***(A. left)*** **Build of OneBusAway mobile application used for the Seattle Metropolitan Area as of September 2017.** ***(B. right)*** **Example of interface with a dot50 condition as it would appear to subjects.**

We made the necessary modifications which allow for uncertainty representations to be displayed while preserving both the overall look and feel of the application and information displayed. (Figure 1.B shows how we modified the layout of the current OBA build. Figure 2 provides an example of the two variations tested in our experiment (arrival and no arrival)).

In our observations of how people use OneBusAway, we saw that people often scan the different entries, comparing different buses and deciding which they might take. However, in representations that present bus arrivals spatially on a timeline, this creates a problem: the information for many buses could appear off the screen to the right, and thus be unavailable to the viewer. To address this, we implemented a content-aware scroll animation [14] that shifts the time axis of each bus to the center of the screen upon scrolling. In other words, as the user scrolls to later buses, the time axis shifts to the left, centering predictions that occur further to the right in time on the timeline. In cases where even this automatic scrolling cannot display a prediction, the label for point predictions of later busses "stick" to the right edge of the screen(as seen in the bottom row of Figure 1.B). This ensures all predictions are available to the user in some form, and facilitates comparisons among buses without reducing the horizontal scale of the timeline to unreadable sizes.

From feedback gathered in our pilot experiment, we choose to omit annotations informing a rider how late or early a bus is relative to its scheduled arrival time. In early runs of our pilot experiment, we found pilot subjects were using "late" annotations incorrectly in their decision-making process. Late annotations in OBA inform a rider on how late or early a bus may arrive compared to the original scheduled arrival time of the bus. However, riders cannot accurately determine if a bus will come earlier or later based off the late annotation alone because the factors that make a bus late will differ from situation to situation. Similar to the real-world, the late annotations in our interface did not encode any accurate uncertainty information not already accounted for in the predictive distribution (the predictive distributions, which are based on models from Kay *et al.*, already account for uncertainty caused by a bus being later than its scheduled time). In our pilots, some participants indicated that they would treat these annotations as some sort of indicator of uncertainty. Thus we removed the late annotations to reduce noise in our measurements caused by some participants misusing this cue.

Bus Arrival Time Predictive Distributions

To develop displays of probabilistic predictions of bus arrival times, we needed a model of probabilistic bus arrival times to ensure our approach was effective on realistic-looking predictions.We adopted the model developed by Kay *et al.* [20] (described in more detail in their supplemental materials). They collected bus arrival data and OBA predictions from the Seattle Metropolitan area, and fit a Box-Cox t regression model [25] to them. From their model, we generated a set of distributions resembling "typical" bus arrival predictions (not overly narrow or overly wide; see supplemental material). Each predictive distribution has a single most probable arrival time (the mode) a minimum of 5 minutes from "now" (0) a maximum of 25 minutes from "now".

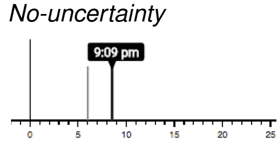
Uncertainty Displays

We developed a set of experimental conditions representing different uncertainty displays that allowed us to ask, at a high level, if uncertainty information improves decision-making about bus arrival times, how expressive should a representation be, and what framing of uncertainty (e.g., discrete outcome, interval, etc.) is most effective. Our no uncertainty condition represents the status quo point estimate depiction used in many current transit systems.

We choose display types based on prior work, described below. Additionally, prior work on communicating uncertainty in OBA found that while bus riders want to see uncertainty information, they also still want to see point estimates [20]—point estimates may aid *glanceability* in the quick decision-making context of realtime transit. Consequently, we designed two versions of each representation: one which displayed a point estimate (most probable arrival time of a bus) and another which did not (Figure 2).

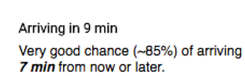
We discuss the rationale for the inclusion of each representation below, presenting each condition in an order of increasing complexity that we believe they present to a real-time transit decision maker.

No-uncertainty



This display type represents the status quo: it is informationally similar to the existing OneBusAway app, except we did not include annotations for how late or early a bus's expected arrival time is relative to its scheduled arrival time (for the reasons described above).

Textual Predictive Intervals: 60%, 85%, and 99%



Compared to visual representations of probabilistic estimates, natural language representations provide a condensed illustration of a distribution in a possibly easier- (and faster-) to-digest form than