

## Overview

During this phase of design, we produced wireframe models of the “Bill Splitter” app and measured user interaction by means of 1-to-1 interview with 10 users.

The interview involved participants:

1. vocalising their interaction with the app in controlled, timed **scenarios**.
2. indicating their preference when presented with alternate **design options**.
3. providing feedback on **item splitting** features
4. providing any **qualitative feedback** they may have on the design so far.

## Scenarios

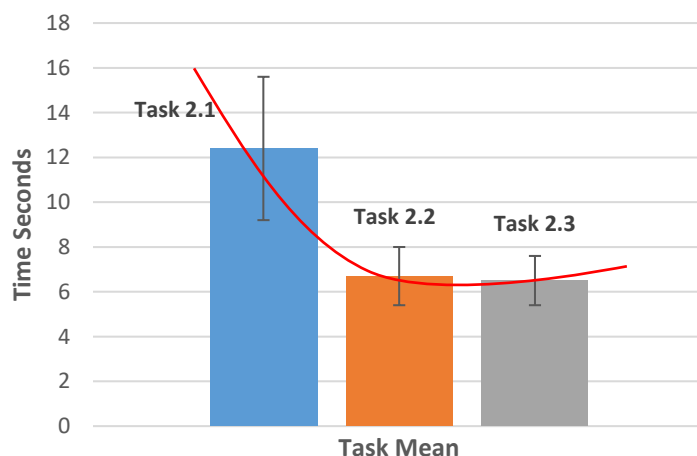
### 1: Identifying & Selecting Items



**Figure 1.** Graph to show mean time-on-task while Identifying & Selecting Items (Error bars = 90% CI)

We can conclude with 90% confidence that **users** became **significantly faster with repeated use** of the app while identifying and selecting items. As demonstrated in Figure 1 (above) by the absence of overlap between error bars of tasks 1.1 and 1.3. This was further corroborated by T-test to compare the mean time-on-task for tasks 1.1 and 1.2, the results of which suggest that we can say at 90% confidence that task 1.2 has a significantly lower mean than 1.1. However, there was an **observable impact of cognitive load** with 3 task failures due to forgetting items. This suggests we should endeavour to make the task of identifying and selecting items easier.

### 2: Identifying & Removing Items

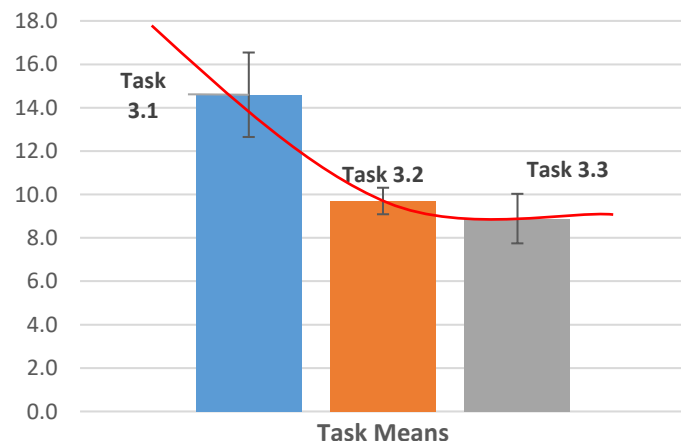


**Figure 2.** Graph to show mean time-on-task while Identifying & Removing Items (Error bars = 90% CI)

Similarly to scenario 1, we found with 90% confidence that **users** became **significantly faster with repeated use** of the app while identifying and removing items. Figure 2 (above) illustrates the learnability of this task, with no overlap in error bars between Task 2.1 and tasks 2.2 and 2.3 showing a significant decrease in mean time-on-task.

We can also be 90% confident that there is no significant time-on-task difference between tasks 2.2 and 2.3, suggesting a ceiling-effect as **users quickly become proficient with using the app**.

### 3: Change User & Identify Items



**Figure 3.** Graph to show mean time-on-task while Change User & Identify Items (Error bars = 90% CI)

As with scenarios 1 and 2, we see a similar pattern of **learnability as users use the app more**, as evidenced by Figure 3 (above) where there is no overlap between error bars of task 3.1 and tasks 3.2 and 3.3 (90% CI).

Furthermore, similarly to scenario 2, there is an observable **ceiling-effect** as can be seen by the overlap between error bars of tasks 3.2 and 3.3.



After completing tasks in each scenario users were asked to complete the Lewis "After Scenario Questionnaire" (ASQ). [2]

	Statement 1 (Effectiveness)	Statement 2 (Efficiency)	Statement 3 (Information)	Statement 4 (Satisfaction)
Scenario 1 (Mean)	5.9	5.7	6.1	5.9
Scenario 2 (Mean)	6.6	6.6	6.4	6.5
Scenario 3 (Mean)	6.5	6.9	6.6	6.7

Figure 4. Table to show mean responses to ASQ

The results of the ASQ, seen in Figure 4, are **very positive**, particularly for scenario 2 (identifying & correcting mistakes) and scenario 3 (changing user & identifying items), however this may be related to the ease of the tasks in these scenarios. Scenario 1 (identifying and selecting items) scored lower across all 3 statements, **supporting the earlier conclusion** that the design for this task can be improved.

## Design Options

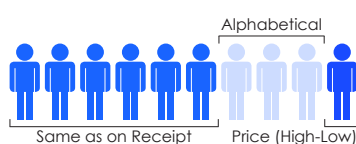


Figure 4. Preferred method of sorting receipt items

As seen in Figure 4, 60% of users preferred that items be listed in the **same order as on the receipt**, suggesting this should be the default sorting method.

However, there was some interest for other sorting methods and should consider offering this functionality as an **additional option**.

Figure 5 shows there was a clear **preference for grouping items together by user** they were assigned to.



Figure 5. Preferred method of grouping receipt items

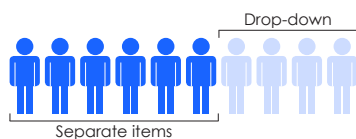


Figure 6. Preferred method of displaying multiples of same item

As seen in Figure 6, 60% of users preferred that multiples of the same item be displayed as separate items, and 40% preferred a drop-down system.

As there is a slight **preference toward displaying items separately**, we should have this as the default option and consider offering drop-down as an **additional option** as there was still notable interest in this method.

multiple tasks, however there may be room for improvement by **reducing the cognitive load on users**. By presenting users with different design options we found that users **prefer** items to be **ordered the same way as on the receipt**, but also **grouped together by diner assignment**. Users also marginally prefer multiple of the same item to be **displayed individually**. Furthermore, users **liked both** our proposed methods for splitting single items.

## Item Splitting

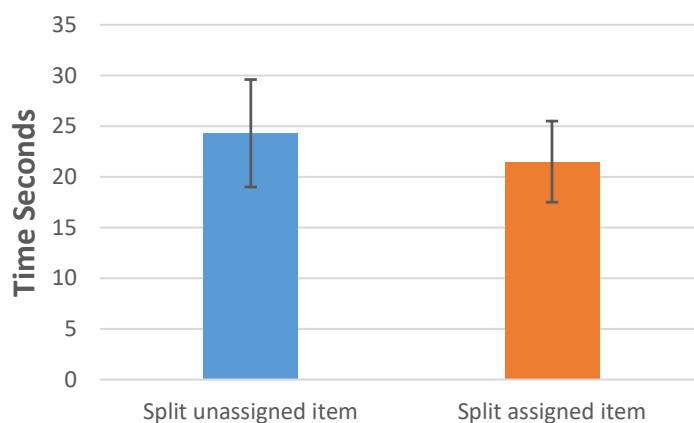


Figure 7. Graph to show mean time-on-task for different item splitting scenarios (Error bars = 90% CI)

After removing a significant outlier result (350% mean), there was **no significant difference** in mean time-on-task (at 90% confidence) between splitting an already assigned item and an unassigned item between two users, as seen in Figure 7.

Following the item splitting scenario (Figure 7), users were presented with two different options for splitting an item between multiple users.

	Splitting unassigned item	Splitting already assigned item
Mean Score (0-7 scale)	6.0	6.4

Figure 8. Table to show mean responses to item splitting options

Both **options were well received**, as seen by mean likert scores (out of 7) in Figure 8, with the option for splitting an unassigned item slightly less so, likely due to some users needing a little more information to figure out the method.

## Qualitative Analysis

Qualitative content analysis revealed certain consistencies within the feedback provided by users.

1. Use of **colour** was helpful, but has significant **room for improvement**.
2. A functionality that offers **sorting by item type** (eg. 'Drink', 'Main', 'Starter' etc.) is desirable.
3. The app may benefit from **tool-tip** style hints.
4. We should avoid making text areas **too wordy**.

## Conclusion

In general, the design was **viewed very positively** by users. Through the scenario tasks we found that the app had a **significant level of learnability** across

