

Cognitive Walkthrough of London Underground Ticket Vending Machines

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This document is the text of a Cognitive Walkthrough usability analysis carried out independently by the first of two analysts. The analyst made use of information and sample interface descriptions supplied by the second analyst.

The document originated as an appendix to Connell et al. 2004 (submitted to Behaviour & Information Technology in 2004).

A. Cognitive Walkthrough of FFM

Preliminary questions:

- Who will be the users of the system? (What can be assumed about their prior experience and knowledge?)

Users will be members of the general public. It is assumed that they are familiar with the underground system and with fares and ticketing rules (at least approximately), but not with this particular machine. They are competent English speakers.

- What task (or tasks) will be analysed? (Here a 'task' refers to achieving a particular outcome, not the procedure for achieving it.)

Two tasks will be analysed:

- 1) Buying an adult return (from Arnos Grove or AG) to Whitechapel at 10am on a Thursday.
- 2) Buying an adult single ticket from AG to Holborn at 8am on a Tuesday (Note: I first had this as an adult and two child single tickets to Heathrow, but then realised that this machine doesn't support this task).

- What is the correct action sequence for each task?

I'm choosing one of the possible sequences for each task:

- 1) Select 'adult day travel card' -> insert coins to value <how much?> -> take ticket and change
- 2) Insert £2.70 -> Select 'adult single zone 1' -> take ticket (and change if any)

- How is the interface defined? (What will the user see or otherwise experience after every action?)

(Analyst used illustrations and screens as feature in figures 1 and 2.)

Walkthrough: task 1

Step 1: select 'adult day travel card'

- Will the user try to achieve the right effect? (i.e. given their domain goal, will they identify the correct device goal?)

Yes, though it takes some mental effort: there is a notice on the machine about travel cards, and it is common knowledge for regular travellers that travel cards are the cheapest way to travel after 9.30am. Therefore the user is likely to choose a travel card. (Note, however, that this machine cannot issue a ticket for this journey before 9.30am as the destination is in zone 2 via zone 1.) A supplementary issue is that the user may not know which zone Whitechapel is in, and may need to refer to the map that shows the zones and stations, otherwise they may think it is in zone 1 and select an adult return to zone 1, which would be erroneous (though if the machine issues a travel card then there isn't actually a problem!).

- Will the user notice that the correct action is available? (i.e. will the user be able to discover the action easily?)

The possible actions are clearly labelled, though the buttons are slightly separated from the labels, and it is possible that some users may try and press the labels instead of the buttons.

- Will the user associate the correct action with the effect trying to be achieved? (i.e. will it be obvious that the action addresses the goal?)

Yes – shouldn't be a problem here.

- If the correct action is performed, will the user see that progress is being made towards solution of the task? (i.e. will the feedback be helpful?)

The machine displays 'please pay <however much>'. Although the travel card button doesn't apparently include the price, the user should be able to infer that the amount being requested is the price of a Travelcard, and hence that they are making progress towards the goal.

- Notes:

The user has to be aware of what tasks this machine supports – there are many perfectly reasonable goals that cannot be achieved with it. It may take a new user a while to realise that they cannot achieve their goals with the machine, or they may incorrectly formulate their goal relative to the device in order to make it fit what's possible.

Step 2: insert money

- Will the user try to achieve the right effect? (i.e. given their domain goal, will they identify the correct device goal?)

The coin slot displays 'coins accepted' (which might conflict with other information saying machine is 'closed', but we're not considering that situation). As long as the user has enough coins, there shouldn't be a problem. The instruction about what to do next is clearly displayed.

- Will the user notice that the correct action is available? (i.e. will the user be able to discover the action easily?)

The coin slot is clearly visible on the display, so shouldn't be a problem.

- Will the user associate the correct action with the effect trying to be achieved? (i.e. will it be obvious that the action addresses the goal?)

Coin slots are a familiar payment mechanism, so shouldn't be a problem.

- If the correct action is performed, will the user see that progress is being made towards solution of the task? (i.e. will the feedback be helpful?)

The display apparently counts down the 'please pay ...' display so that the user is getting feedback on each coin inserted and knows how much more to pay. Shouldn't be a problem.

Step 3: take ticket and change

- Will the user try to achieve the right effect? (i.e. given their domain goal, will they identify the correct device goal?)

The user will be expecting to collect a ticket (and possibly change). The display changes to 'wait by machine', which isn't a direct instruction to collect the ticket, so the user may not know exactly what they are expected to do next.

It may also change to 'wait for change' (which presumably appears after ticket has been dispensed?), which is a clear instruction if the user hangs around long enough to see it (cf. post-completion errors).

- Will the user notice that the correct action is available? (i.e. will the user be able to discover the action easily?)

The ticket & change slot is quite low down, so may not be immediately spotted by the user, but is quite large, so shouldn't be too problematic.

- Will the user associate the correct action with the effect trying to be achieved? (i.e. will it be obvious that the action addresses the goal?)

The large label saying 'tickets and change' should ensure the user makes the correct association.

- If the correct action is performed, will the user see that progress is being made towards solution of the task? (i.e. will the feedback be helpful?)

The user will recognise that the goal has been achieved.

- Notes:

There may be a problem if the machine is out of change and the user is expecting some – e.g. the machine has some change, so is not displaying 'exact fare only', but doesn't have enough.

Walkthrough: task 2

Step 1: insert money

- Will the user try to achieve the right effect? (i.e. given their domain goal, will they identify the correct device goal?)

The user will be expecting to pay for a ticket – they may even know how much it costs. I'm not sure what the message display window shows initially, so I'm not sure how obvious it is to the user that they can pay first.

- Will the user notice that the correct action is available? (i.e. will the user be able to discover the action easily?)
- The coin slot is quite obvious, and looks like a coin slot, so shouldn't be a problem.
- Will the user associate the correct action with the effect trying to be achieved? (i.e. will it be obvious that the action addresses the goal?)

As above, shouldn't be a problem.

- If the correct action is performed, will the user see that progress is being made towards solution of the task? (i.e. will the feedback be helpful?)

The display shows 'you have paid ...', so it should be obvious to the user that coins are being accepted OK. However, the display doesn't show any relationship between the amount paid and the kind of ticket the user can select for that amount: there is a poor match between the state and the goal.

- Notes:

This is probably a less natural sequence for most users, as they will expect to specify what they are buying before paying for it.

Step 2: select 'adult single zone 1'

- Will the user try to achieve the right effect? (i.e. given their domain goal, will they identify the correct device goal?)

As above, the user needs to know that they want a single to zone 1 (since that is where Holborn is). The map should help confirm this.

- Will the user notice that the correct action is available? (i.e. will the user be able to discover the action easily?)

The buttons are reasonably obvious. See above.

- Will the user associate the correct action with the effect trying to be achieved? (i.e. will it be obvious that the action addresses the goal?)

See above.

- If the correct action is performed, will the user see that progress is being made towards solution of the task? (i.e. will the feedback be helpful?)

I assume the display goes straight into 'wait by machine' state. There is no explicit confirmation that enough money has been paid for the ticket, or of what kind of ticket the user has requested. If the user needs change, they may only notice the 'wait for change' instruction, and not realise that the ticket has been issued.

- Notes:

Step 3: take ticket and change

See discussion under task 1.

B. Cognitive Walkthrough of MFM

Preliminary questions:

- Who will be the users of the system? (What can be assumed about their prior experience and knowledge?)

Uses will be members of the general public. It is assumed that they are familiar with the underground system and with fares and ticketing rules (at least approximately), but not with this particular machine. They are competent English speakers.

- What task (or tasks) will be analysed? (Here a 'task' refers to achieving a particular outcome, not the procedure for achieving it.)

Two tasks will be analysed:

- 3) Buying an adult return (from Oakwood) to Whitechapel at 10am on a Thursday.
- 4) Buying an adult and two child single tickets to Heathrow at 8am on a Tuesday.

- What is the correct action sequence for each task?

I'm choosing one of the possible sequences for each task:

- 3) Select 'please press here' -> 'one day travel cards' -> insert coins to value <how much?> -> take ticket and change
- 4) Select 'please press here' -> 'other single destinations' -> 'H' -> 'Heathrow' (I assume it's shown on this screen...) -> 'multiple tickets' -> 1 adult, 2 children -> confirm selection -> insert money -> take tickets (and change if any)

- How is the interface defined? (What will the user see or otherwise experience after every action?)

(Analyst used illustrations and screens as feature in figures 3 to 5.)

Walkthrough: task 3

Step 1: Select 'please press here'

- Will the user try to achieve the right effect? (i.e. given their domain goal, will they identify the correct device goal?)

The first step is initialisation, not particularly related to the goal. The user is likely to do the right thing as the touch screen is large and obvious within the display. The only problem might be choosing between the top area of the screen and the language flags, but either is likely to work anyway.

- Will the user notice that the correct action is available? (i.e. will the user be able to discover the action easily?)

The large notice saying 'touch screen for tickets' shows that this is a touch screen. Otherwise, it might not be obvious.

- Will the user associate the correct action with the effect trying to be achieved? (i.e. will it be obvious that the action addresses the goal?)

The system makes it fairly obvious that it is necessary to initialise first, and how to do this, so no problem.

- If the correct action is performed, will the user see that progress is being made towards solution of the task? (i.e. will the feedback be helpful?)

Screen changes to show adult ticket types. Users who only want child tickets might find this confusing, but it's OK feedback for our task.

Step 2: 'one day travel cards'

- Will the user try to achieve the right effect? (i.e. given their domain goal, will they identify the correct device goal?)

The user might erroneously believe that what is needed is a return to zone 1. There is a map to consult, and they may know that after 9.30am a travel card is the appropriate option. There is potential for error at this step.

- Will the user notice that the correct action is available? (i.e. will the user be able to discover the action easily?)

The Travelcard option is clearly displayed. As long as the user remembers that this is a touch screen, there shouldn't be a problem.

- Will the user associate the correct action with the effect trying to be achieved? (i.e. will it be obvious that the action addresses the goal?)

There are alternative candidate actions that might confuse the user – notably travel cards zones 1-6 and 2-6.

- If the correct action is performed, will the user see that progress is being made towards solution of the task? (i.e. will the feedback be helpful?)

The next screen shows what ticket has been selected and asks the user to pay. It should be obvious to the user that progress is being made towards the goal.

Step 3: insert coins / notes / card

- Will the user try to achieve the right effect? (i.e. given their domain goal, will they identify the correct device goal?)

The user should realise that it's time to pay (because of the instructions on the touch screen).

- Will the user notice that the correct action is available? (i.e. will the user be able to discover the action easily?)

There are three separate payment units for the different kinds of payment. The user will probably see all three, though they are not well grouped (so the user may not notice one of them, or may misinterpret the function of either notes or card slot).

- Will the user associate the correct action with the effect trying to be achieved? (i.e. will it be obvious that the action addresses the goal?)

The user may confuse two payment slots (as noted above). The user may be confused if any of the slots is closed (not accepting payment). Otherwise, no problems,

- If the correct action is performed, will the user see that progress is being made towards solution of the task? (i.e. will the feedback be helpful?)

The user will see notes / card / coins disappearing into the machine., The sign 'tickets remaining ... please wait for your ticket' is pretty clear.

Step 4: take ticket and change

- Will the user try to achieve the right effect? (i.e. given their domain goal, will they identify the correct device goal?)

Should be no problem.

- Will the user notice that the correct action is available? (i.e. will the user be able to discover the action easily?)

The arrow points quite clearly towards the ticket / change slot, so it should be obvious.

- Will the user associate the correct action with the effect trying to be achieved? (i.e. will it be obvious that the action addresses the goal?)

Yes.

- If the correct action is performed, will the user see that progress is being made towards solution of the task? (i.e. will the feedback be helpful?)

The user will see that the task is completed. Hopefully, (s)he won't forget the change...

Walkthrough: task 4

Step 1: Select 'please press here'

Same as task 3.

Step 2: 'other single destinations'

- Will the user try to achieve the right effect? (i.e. given their domain goal, will they identify the correct device goal?)

The device forces a choice between adult and child tickets which may be confusing for a user who requires both. The user will probably have to select the device goal by a process of elimination – that it's not zone 1, a Travelcard / LT card or a return. There is still a potential confusion between wanting an 'other single destination' and 'other tickets / Travelcards', but the user will probably work towards the correct goal option.

- Will the user notice that the correct action is available? (i.e. will the user be able to discover the action easily?)

All the buttons on the touch screen are obvious (as long as the user realises it's a touch screen).

- Will the user associate the correct action with the effect trying to be achieved? (i.e. will it be obvious that the action addresses the goal?)

Probably.

- If the correct action is performed, will the user see that progress is being made towards solution of the task? (i.e. will the feedback be helpful?)

The next screen asks the user to select the first letter of the destination. It should be obvious that this is making progress.

Step 3: 'H'

- Will the user try to achieve the right effect? (i.e. given their domain goal, will they identify the correct device goal?)

OK.

- Will the user notice that the correct action is available? (i.e. will the user be able to discover the action easily?)

OK.

- Will the user associate the correct action with the effect trying to be achieved? (i.e. will it be obvious that the action addresses the goal?)

OK.

- If the correct action is performed, will the user see that progress is being made towards solution of the task? (i.e. will the feedback be helpful?)

As long as Heathrow is shown on the next screen, it should be fine. If not, the user will have to scroll to find it. This should not cause great navigation problems.

Step 4: 'Heathrow'

- Will the user try to achieve the right effect? (i.e. given their domain goal, will they identify the correct device goal?)

The user knows they want to get to Heathrow, so this should be unproblematic.

- Will the user notice that the correct action is available? (i.e. will the user be able to discover the action easily?)

OK.

- Will the user associate the correct action with the effect trying to be achieved? (i.e. will it be obvious that the action addresses the goal?)

OK

- If the correct action is performed, will the user see that progress is being made towards solution of the task? (i.e. will the feedback be helpful?)

The next screen asks the user to pay, which is some progress, but not exactly what the user wants. This screen is likely to cause some confusion.

Step 5: 'multiple tickets'

- Will the user try to achieve the right effect? (i.e. given their domain goal, will they identify the correct device goal?)

The user appears to have achieved the wrong goal here, and will be seeking a way to achieve the intended goal, of having multiple tickets ... unless the user concludes that it's only possible to buy tickets singly. It depends on the user noticing the relatively small option to select multiple tickets on the display.

- Will the user notice that the correct action is available? (i.e. will the user be able to discover the action easily?)

Questionable – it's a bit small.

- Will the user associate the correct action with the effect trying to be achieved? (i.e. will it be obvious that the action addresses the goal?)

Yes – if spotted, the match is obvious.

- If the correct action is performed, will the user see that progress is being made towards solution of the task? (i.e. will the feedback be helpful?)

OK.

Step 6: 1 adult, 2 children

- Will the user try to achieve the right effect? (i.e. given their domain goal, will they identify the correct device goal?)

OK.

- Will the user notice that the correct action is available? (i.e. will the user be able to discover the action easily?)

OK.

- Will the user associate the correct action with the effect trying to be achieved? (i.e. will it be obvious that the action addresses the goal?)

OK.

- If the correct action is performed, will the user see that progress is being made towards solution of the task? (i.e. will the feedback be helpful?)

The selected numbers will change shade, so as long as lighting is adequate, this should be sufficient feedback. Could be better, though...

Step 7: confirm selection

- Will the user try to achieve the right effect? (i.e. given their domain goal, will they identify the correct device goal?)

The user may not realise they have to confirm the selection. Again, the button is rather small.

- Will the user notice that the correct action is available? (i.e. will the user be able to discover the action easily?)

Probably, but could be clearer.

- Will the user associate the correct action with the effect trying to be achieved? (i.e. will it be obvious that the action addresses the goal?)

OK.

- If the correct action is performed, will the user see that progress is being made towards solution of the task? (i.e. will the feedback be helpful?)

I assume it returns to a 'please pay...' screen; I'm not sure exactly what the wording is for 1 adult, 2 children, but I suspect it might be confusing (saying 'adult' in the middle of the screen and '1 adult, 2 children' at the bottom). It's nevertheless clear that progress is being made towards the goal.

Step 8: insert money

See step 3 of task 3.

Step 9: take tickets (and change if any)

See above.

Reference

CONNELL, I.W., BLANDFORD, A.E. and GREEN, T.R.G. CASSM and Cognitive Walkthrough: usability issues with ticket vending machines. Submitted to *Behaviour & Information Technology* in 2004.