Design Research

Fig. 24 – A rider uses the "Passes/Farecards" machine.
To watch a video of Metrorail riders entering the Ballston Common station click on the icon to the right if you are viewing this document as a PDF or on a CD. This video establishes a sense of the Metrorail experience by following riders as they enter the Ballston Common station from street level to mezzanine level. If you are reading this document as a printed book and viewing the videos on your computer, select the corresponding title of the CD menu.
Looking at the current system, a picture of evolving technology emerges. Since the system’s inception, the AFCS machines have been updated three times, and the entry gates twice to accommodate these changes. The interface design however is remarkably invariant. This echoes a theme from my literature review: far more design effort is invested in the actual mass transit vehicles than the machines that allow entrance to them. Discussions of automated fare technologies, like smartcard and wireless systems, dominate industry talk, while the physical actuality of use and interface design are left for the AFCS manufacturers to consider and decide.

In 1975, Cubic Western Data Corporation of San Diego was awarded a $54 million contract for the design and manufacture of the WMATA AFCS. At the time the company was headed by engineers pioneering the use of magnetic stripe technology, which enabled information about the value of a farecard to be saved, changed, and saved again many times. This meant that riders could keep cards with leftover values and use them for future travel by trading them in. That the cards could be assigned and reassigned values lent itself well to a distance dependent fare system. Riders could purchase a $10 farecard and use it for several trips, with the value recorded in the magnetic strip being updated by the entry gate with each deduction. Updated versions of the original magnetic stripe AFCS machines are still in use at Metrorail stations today (Deiter 1990).

In the mid 1990’s the same company that developed the original AFCS, now known as Cubic Transportation Systems, designed and delivered the SmarTrip system to the WMATA, the first smartcard system of its kind in the United States (Cubic Transportation System 2002). This is a wireless data transfer system eliminating the need for magnetic card readers, which frequently malfunction and are costly to repair. Overall this media system benefits both the transit system and the riders who use it, and the retaining of this technology in new entrance designs would help to bridge both groups into the use of a new system.

This advanced media, the SmarTrip card, is about the size of a credit card, the thickness of two, and contains a microchip capable of keeping track of a card’s value. To use it, a rider simply touches the SmarTrip card’s face to the target on the entrance gates. The card is scanned and a deduction is made to its value, opening the gate. Upon exiting the rider again touches the card to the target; the remaining trip fare is deducted and the gates open again. A rider can add value to his or her smartcard at machines in the station, and via the WMATA website from their personal computer.

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There are currently two farecard machines in use by the WMATA, the “farecards” machine (fig 25) which dispenses only magnetic stripe farecards, and the “farecards/ passes” machine (fig 26) which has expanded functionality, and integrates smartcard use. The CTS engineered machines are tall, steel, rectangular boxes measuring 48 inches wide and 72 inches tall. Risers are used to increase machine height in five-inch increments creating 3 different machine heights of 72, 77 and 82 inches to accommodate people of all sizes. If you are a fully upright person able to see the visual display, the current design may work for you. But anyone shorter than 4 feet, or seated in a chair, will have trouble viewing the visual display and reaching the machine’s controls.

Interface design differences between the “farecards” machine and the expanded “passes/farecards” machine, can be confusing to even the experienced Metro rider. In order to analyze the problems with both, each interface’s functions and design features were labeled, and the issues and shortcomings of each were noted in a sort of “post-it note” exercise. This helped to clarify the functions of each AFCS machine, as well as show how the tasks that users do to move through the entrance process visually coincide with the machine’s parts.
Farecards Machine
3rd generation

1. In/Out of service notice
2. Notice of bills accepted
3. Numbers to indicate order of operations
4. “Push to Cancel” button
5. Coin slot
6. Bill acceptor
7. Bill return
8. Notice of special offers
9. Notice of maximum attainable farecard value
10. Notice of maximum change returned
11. Directions to look elsewhere for fare prices
12. Display of farecard value
13. “Press for Farecard” button
14. Switches to select farecard value
15. New farecard dispenser / Used farecard trade-in
16. Change return bin

Farecards and maps are not located where their information is used.

Dot matrix visual display is too small; the surface produces lots of glare.

Important discount information is lost when positioned here, at the bottom of the machine.

Acceptable currency information needs to be located at the bill collector.

Important information is difficult to see when it is located at the height on the interface and printed in a small font.

Small finger-operated controls require dexterity and coordination to use.

Visually out of order, the “Used Farecard Trade-In” step takes place first in the purchasing process, but is depicted as last on the interface.

The non-recessed machine bottom is not easily wheelchair accessible.

Coin return is too low; user must bend down to remove change.

Important discount information is lost when positioned here, at the bottom of the machine.

Display of farecard value

Switches to select farecard value

New farecard dispenser / Used farecard trade-in

Change return bin

Coin slot

Bill acceptor

Bill return

Notice of special offers

Notice of maximum attainable farecard value

Notice of maximum change returned

Directions to look elsewhere for fare prices

Display of farecard value

“Press for Farecard” button

Small finger-operated controls require dexterity and coordination to use.
Passes/Farecards Machine
3rd generation

1. In/Out of service notice
2. Directions to purchase a single farecard
3. Directions to look elsewhere for fare prices
4. Numbers to indicate order of operations
5. "Push to Cancel" button
6. Notice of bills accepted
7. Coin slot
8. Bill acceptor
9. Bill return
10. SmartCard interface
11. Purchasing directions for multiple farecards
12. Age requirements and refund policy
13. Notice of special offers
14. Notice of maximum charge returned
15. Dot-matrix visual display and selection controls
16. "Press for farecard" button
17. Switches to select farecard value
18. Bank or credit card payment area
19. New farecard dispenser / Used farecard trade-in
20. Change return bin

Fig 30 – photo of a passes/farecards machine

Directions for single pass purchase are visually lost; Text is too small to be legible from standing or sitting heights

Farecharts and maps are not located where the information is used
This information is visually lost here

Visual display is small, text is too small, and screen face has glare problems

Placed here the cancel button is out of order and confusing

Small hand controls require dexterity and coordination to operate

Inclusion of SmartCard functions is confusing and make the interface look "busy"

The non-recessed bottom is not easily wheelchair accessible; Wear and tear shows heavy use

Poor visual hierarchy: these multiple farecard purchasing directions are lost here
This information should be located next to the bill collector
Payment options should be grouped together in one area
The step "Billed-In Farecard" is first in the process, but shown out of order here when depicted as last
These directions should be next to where farecards are ejected
Loss change return bin requires the user to bend down in order to reach it
Ascom's "Metrolink" ticket machine and Pepsi Co. softdrink machines

Long Island Rail Road's "QuickTicket" and a U.S.P.S. stamp machine

Schlumberger's "Billetterie", "DBR"; Ascom's "Discovery" and a First Union bank ATM

Vending Paradigms

It was clear that whatever the eventual product yielded by this thesis turned out to be, it needed to do a better job of relating to the interior environment of a Metrorail station than the current AFCS does. Examples of other transit systems' AFCS's were sought out to inform the research process, as well as the design strategy. Personal experiences using rail transit systems in several major U.S. cities including New York, Atlanta, Boston, and Chicago, also contributed to these ideas about entrance system design. Functionally, all of those systems employ the use of an AFCS, though New York and Boston still allow riders to purchase an entrance ticket directly from a member of the system's staff.

Among the machines I looked at, diverse interface solutions included buttons both small and large, computerized systems with touchscreens, joysticks, and track balls. There were also many methods of organizing information, with different pathways into and through it. Many machines included a system map, either digitized or a printed graphic, and listed prices for all available travel options. For some machines a map was the interface. Users would touch points on it to plan a trip and purchase their fare. Some machines' functions reached beyond fare purchase, offering access to general system information and schedules as well. But more features do not necessarily make for a better interface, as every user who has ever puzzled over the interface of their VCR, microwave, or one of so many other examples, knows all too well.

It was also interesting to note that every machine appeared to be very much "in the box". All of the ticket machines appeared to be cousins of a soft-drink vending machine, sometimes "twice-removed" they resembled an automated teller machine (ATM). Some were predictable and could be operated on the same level as a vending machine, others took an "all-in-one" approach, presenting too many features at once. The analogy of a vending machine has both positive and negative connotations. Pluses include the use of visual or pictorial product descriptions, simple and often singular functions, and shared interface standards recognizable across product categories and cultures. Minuses include physical forms and interface controls that are not universal in design, and extremely poor aesthetics. One exception I saw to this generality is United Airway's automated ticketing stations. A vending machine is the lowest common denominator of interface design in this modernized world.

Vending and automated machines are everywhere, and everyone uses them. Consider the number of times in an average day that you pump gas for your vehicle, or walk past a soda machine, a phone card machine, or an ATM machine. It is likely that most people would inherently know how to use any of these ubiquitous vending machine examples, though they may not always be physically able to. This begs the question: are vending interfaces this way because it makes the most sense to the user, or because the user has been conditioned to expect and understand this format of automated experience? The later seems to be more accurate, as evidenced in this culture by people's increasing comfort with machines, allowing them to perform such important tasks as money transactions and food preparation.

Vending Culture