HUMAN TRANSIT

How Clearer

Thinking

about Public Transit

Can Enrich Our

Communities

and Our Lives

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WHAT MAKES TRANSIT USEFUL? SEVEN DEMANDS AND HOW TRANSIT SERVES THEM

If you spend any time inside the offices of a transit agency, you get used to seeing messages like "The customer comes first!" and "Service is our business!" Posted in the elevator or in the lunchroom, these messages are supposed to focus employees on a particular mission called "service."

But what kind of service do we need to provide so that people will use it? What is this mysterious thing called "service" anyway?

The most common answer is "Ask the customer!" As in any business, transit customers have needs, desires, and dislikes that must be a starting point in designing and operating a transit system. Most transit agencies do listen to public comments and demands and sometimes change direction because of them.

But most public comments are narrow and self-interested. A person wants transit to stop in a particular place, or not to, because of their personal needs or desires, not because it will help make the system more useful to the entire community.

To plan service for a whole community, including the vast majority who never comment, effective network planners look beyond self-interested demands and think more broadly about what motivates people to use transit. This doesn't mean substituting our judgment for the customer's, but it does mean trying to discern underlying patterns in the diverse comments

that agencies receive, and thinking about how various service changes would improve transit's ability to attract riders and fit the larger goals of the city or region it serves.

OUR SEVEN DEMANDS

In the hundreds of hours I've spent listening to people talk about their transit needs, I've heard seven broad expectations that potential riders have of a transit service that they would consider riding:

1. It takes me *where* I want to go.
2. It takes me *when* I want to go.
3. It is a good use of my *time*.
4. It is a good use of my *money*.
5. It *respects* me in the level of safety, comfort, and amenity it provides.
6. I can *trust* it.
7. It gives me *freedom* to change my plans.

I've listed the demands in the order in which you, as a customer, usually evaluate them. Generally, you would first evaluate transit in terms of whether it exists at all in the place where you need it (demand 1). Then you would consult a schedule and determine whether it's there *when* you need it (demand 2). Next, you might compare the cost of transit (in money and time) with the benefits (demands 3 and 4) to decide whether transit is worth trying compared to your alternatives.

Now you are ready to try the service. You notice whether you feel comfortable and respected as a passenger, and whether you can put your travel time to good use (demand 5). If you become a regular customer, you start noticing whether the service works the same way day after day—in short, you decide whether you can trust it (demand 6).

Finally, as your own needs vary from day to day, you begin to discover how well the service responds to those changes (demand 7). Can you get home, or to school, in the middle of the day to tend to a sick child? Can you, on the spur of the moment, stop off at a cinema and see a movie, knowing that it is still possible to get home 3 hours later? Can you quickly figure out how to make other trips elsewhere in the city, to visit friends

across town, or to attend medical appointments, or to go shopping? In short, does the transit system help you to feel free—able to enjoy all the riches of your city in a spontaneous way?

These seven demands, then, are dimensions of the mobility that transit provides. They don't yet tell us how good we need the service to be, but they will help us identify the kinds of goodness we need to care about. In short, we can use these as a starting point for defining *useful* service.

Side Issues and Side Effects

Do these demands encompass everything that people ask of their transit agencies? Of course not. There are two other important categories of demands.

First, a transit agency hears feedback about how the agency functions as an employer, as a company, and as a corporate citizen. Such issues include fairness to workers, discrimination, sponsorship of community events, donations to charities, relations with other governments, relations with the media, and so forth. These are all important, but they are common to all agencies and companies within a community, regardless of their product, so focusing on these will distract us from understanding public transit in particular. For that reason, I will set these aside for this book's purpose. You don't need to understand transit to understand these issues.

Second, agencies get many comments about the side effects of their equipment and facilities, and these considerations are enormous factors in decisions about new transit infrastructure. The big side effects of transit are emissions, noise, vibration, and the way various transit vehicles affect the look and feel of the urban environment. Many of these are huge issues, and a great deal of money is spent mitigating these impacts. But these comments aren't about the basic work of public transit, either. An especially noisy and polluting bus has the same impact regardless of whether it's a public transit bus or a tour bus; in fact, the same bus may serve either purpose. Other technologies attract advocacy because of positive side effects. Streetcars, for example, are popular in part because of how they look and feel in the urban streetscape.

In considering side effects, we need to think about transit the way we think about the fire department. Firefighting has lots of side effects, including the space the big trucks require and the noise of their sirens. Now

and then, those effects become so objectionable that people complain about them, and fire departments have to respond to those complaints, as they should. So there's a values trade-off here, an example of the plumber's question: Should we reduce the effectiveness of firefighting a little in order to mitigate some of its impacts?

Still, all sides of debates around firefighting impacts can see that there is a job called "firefighting" that is the defining purpose of these companies. That doesn't mean that it's the only thing that matters or that its efficiency should be ranked above all of its other impacts. But discussions about impacts usually reflect a shared understanding that the firefighters' main job is to put out fires and that everyone has an interest in seeing that job done well.

When it comes to transit, the balance of power in these conversations is different. Not everyone recognizes that transit has a defining activity—personal mobility that does not require personal vehicles—and that a transit agency has to maintain a primary focus on that even as it tries to manage its side effects. Side effects are important, but they should not create confusion about the defining mission of transit, which is to provide personal mobility. The seven demands for useful service are all about that mission.

THE ELEMENTS OF USEFUL SERVICE

So how does transit meet the seven demands that we identified above? How do we translate the demands into specific things that transit agencies have to provide and measure? Figure 2-1 shows how each of the seven demands relates to the key measurable features of a transit service. Don't worry if it looks complicated. We'll step through the key points. Still, you may find it useful for reference as we explore how the various transit concepts are connected.

Demand 1: "It Takes Me *Where* I Want to Go"

The first demand—"it takes me *where* I want to go"—involves two key measurable features of a transit system:

First, the location of *stops and stations* determines how close transit service comes to each place that anyone might want to come from or go to.
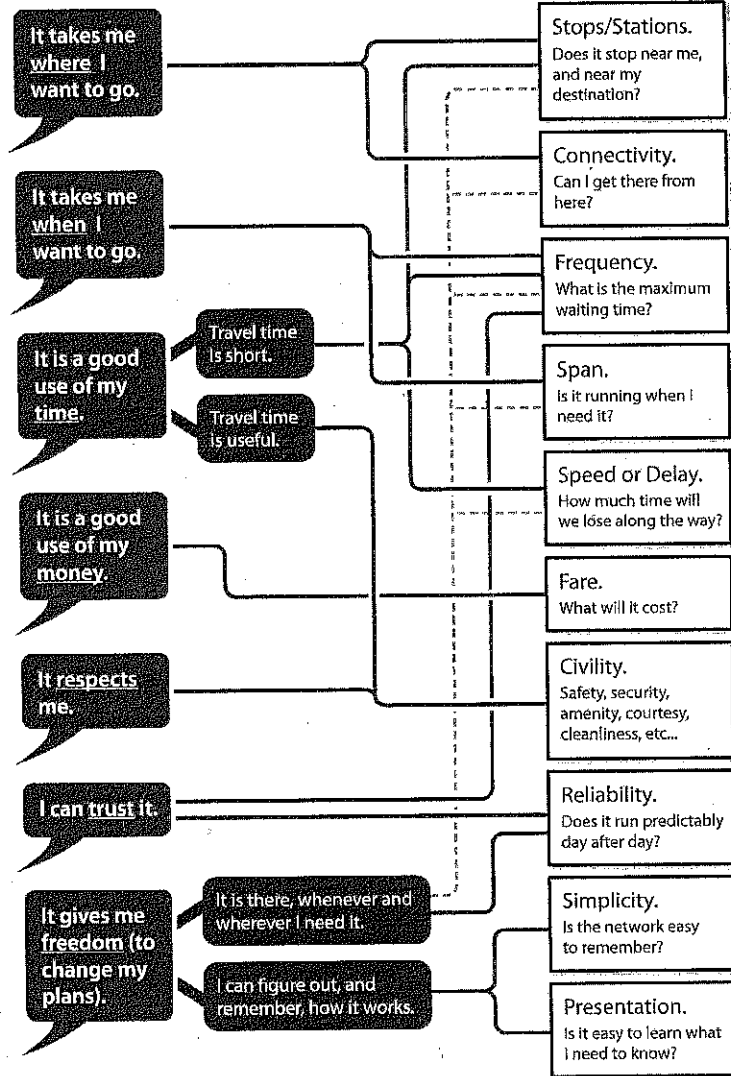
Figure 2-1 Seven desires for useful transit, and how transit serves them. *Credit:* Eric Orozco

We'll discuss stops and stations in chapter 5, and the lines that they form in chapter 4.

Second, *connectivity* is a measure of whether transit links the place you want to go (your *destination*) with the place you are now (your *origin*). Stops near your origin and destination do not guarantee connectivity: a transit agency may serve both point A and point B but be unable to take you from A to B by a reasonably direct path. Chapters 12 and 13 explore connectivity.

Demand 2: "It Takes Me *When* I Want To Go"

The second demand also encompasses two measurable features.

First is the question of whether transit runs at all when you need it; the answer to this is the *span* of service. Span is indicated by the scheduled time of the first and last trip in each direction.

Next is the question of whether the service runs often enough that you can leave when you really want to go. The measure of how often transit runs is *frequency*. Frequency is usually described by the number of minutes between consecutive trips, so—as in golf—lower scores are better. A service that runs every 15 minutes, for example, is twice as useful, and twice as expensive to operate, as one that runs every 30 minutes.

This number—the gap between consecutive trips in minutes—is called the *headway*. If we change a frequency from every 30 minutes to every 15 minutes, we say that we've doubled the frequency by halving the headway. Again, when you hear the term *high frequency*, that means a *low* headway, such as service every 10 minutes or less. A high headway, such as 60 minutes, is a low frequency.

Frequency is one of the most misunderstood concepts in transit. We'll return to it often throughout the book, especially in chapter 7.

Demand 3: "It Is a Good Use of My *Time*"

Demand 3 includes all the ways of making travel time useful to the passenger. These efforts can involve providing reading lights, electrical outlets, phones, Internet access, and other facilities that enable a passenger to work, sleep, or do something else valuable while waiting and riding.

Still, we want travel time to be short. Travel time is one of the most critical elements of a passenger's decision about whether to use transit rou-

tinely, and for this reason, the models that predict ridership give it huge weight.

When we think of saving time, we usually think of speed. When we're driving, the average speed that we'll achieve is the measure of how fast we'll cover the distance to our desired destination. When people who usually by travel by car think about a transit issue, they often focus on how fast the vehicles can physically go.

But for transit, the vehicle speed is a small part of the picture. What matters is how much time it takes to complete an *entire* desired trip. So to understand this demand, we have to look in more detail at all the phases of a trip and the potential for delay involved with each. We'll come back to that at the end of this chapter, and we'll dissect speed further in chapter 8.

Demand 4: "It Is a Good Use of My *Money*"

This fourth demand is relatively simple, since *fares* are the primary monetary cost of transit use. People compare the cost of using transit with the cost of getting somwhere in some other way, and this can strongly influence their decision. Chapter 11 explores fares.

Demand 5: "It *Respects* Me"

At its core, the fifth demand is about whether the rider feels valued as a customer, as a citizen, and as a human being. Obviously, this demand is so subjective that it could come apart into a million values.

Fortunately, most of us do agree on some things that contribute to our sense of being respected. For example, comfort, courtesy, safety, and security all signify we are valued as human beings and as customers. Some of these features also help to give value to our time, so they follow also from the third demand.

All of these values fall under a large category that I'll call *civility*. These values are not about transit's ability to transport us but, rather, about its ability to treat us like human beings while it is doing so. By "civility," I mean widely shared values unrelated to travel time or cost—such as comfort, cleanliness, courtesy, safety, security, and amenities that give value to our time.

Although they can't all be quantified, the elements of civility in transit are, by definition, widely agreed upon within a culture. Everyone understands the importance of comfort, cleanliness, courtesy, safety, and security. Some level of civility is essential if we are to carry a diverse range of customers. When a transit system gets the reputation of being "only for poor people," despite good speed and frequency, it is often because its civility has fallen so low that most people don't consider using it as an option. Often, by this time, other important values will have declined as well, because the only people who care about them are politically powerless.

Definitions of civility may vary from one culture to the next. In some cultures, for example, civility may include separate seating areas for men and women. The acceptable standard for certain elements of civility may also vary by culture. Passenger railways in India may not offer the personal space and comfort that a North American visitor would expect, but they do meet the expectations that prevail in India, so they're popular. Civility includes, by definition, whatever expectations are widely shared within the culture.

Civility is hugely important, and problems in this area often send signals that a transit system is uninterested in serving the whole community. Still, the work of creating civility in transit is not much different from what it is in other endeavors. The customer service skills of a merchant, for example, are easily transferred to the customer-contact role of a transit information agent or, for that matter, a bus driver. Creating a civilized waiting environment for transit is not that different from designing waiting areas for other businesses and government functions. So, this is an area where we can rely on expertise from other fields, and indeed much good work is being done on the topic. For that reason, in a book that focuses on transit in particular, I won't discuss civility in great detail.

Demand 6: "I Can *Trust* It"

Your transit service may get you to work on time 90 percent of the time, but if you're going to a meeting that's crucial for your career, you might not want to risk the one-in-ten chance that it will let you down. Our ability to trust a transit operation is called *reliability*, though frequency is also an important aspect of trust because it reduces our dependence on the reliability of any single transit vehicle.

Demand 7: "It Gives Me *Freedom* (to Change My Plans)"

Freedom is a crucial sensation, and in most places it is the private car's crowning virtue. When limited transit schedules interfere with people's lives—forcing them, for example, to decline a last-minute dinner invitation or cut short the family's day at the zoo—we see why transit is not the mode of choice for more of the trips we make.

In transit, the real test of freedom is spontaneity. Can I change my plans suddenly? Can I get home if I need to, or to my child's school if something comes up? Can I simply move freely around my city, following whatever impulse I may feel at the moment? Some transit systems approach that level of convenience, at least in dense cities. In some of those same cities, you'll find that your car is an encumbrance. If you've ever been stuck in traffic on a busy downtown street while pedestrians and cyclists flow past you and subway trains zoom beneath you, you know that sometimes your car can become your prison.

If anything, the demand for spontaneity is increasing as families diversify. In the United States, for example, most households no longer have a parent devoted solely to the home; the norm is increasingly a couple who both work or a single working parent. These people have complex lives in which "something may come up" during the day that requires unexpected travel. Corporate styles are demanding more self-management and accountability from their employees, which often means that employees may go to work in the morning without knowing exactly when they'll come home.

This demand for spontaneity is met mostly by values that we've already listed. A transit system offers freedom if it offers *frequency* and *span* (so that there is service whenever you suddenly need it) and a reasonable average *speed* compared to your alternatives. We might think of these values as "squared" by their role in meeting the demand for freedom in addition to their role in meeting one of our other basic demands.

But freedom is also the biggest payoff of *legibility*. Only if you can remember the layout of your transit system and how to navigate it can you use transit to move spontaneously around your city. Legibility has two parts: (1) simplicity in the design of the network, so that it's easy to explain and remember, and (2) the clarity of the presentation in all the various media.

No amount of brilliant presentation can compensate for an overly complicated network. Anyone who has looked at a confusing tangle of routes on a system map and decided to take their car can attest to how complexity can undermine ridership. Good network planning tries to create the simplest possible network. Where complexity is unavoidable, other legibility tools help customers to see through the complexity and to find patterns of useful service that may be hidden there. For example, chapter 7 explores the idea of Frequent Network maps, which enable you to see just the lines where service is coming soon, all day. These, it turns out, are not just a navigation tool, but also a land use planning tool.

Another important legibility technique is to minimize the difference between the transit network and the street network, the latter of which you can assume your customers already know. Suppose you're in San Francisco and see a bus whose overhead sign says "38: GEARY 48th Ave." If you live in San Francisco, you probably know where Geary Boulevard and 48th Avenue are. So just a glance at this sign tells you that there's a bus that runs out Geary as far as 48th. The sign gives everyone who sees it a full sense of what the service does and how it might be useful. Clear information is often the best marketing.

This legibility is not the result of just a well-phrased sign. It's also the result of planners deciding that it's best for transit to just run the length of Geary Boulevard, rather than branch off of it in complicated ways that could never be described or remembered so easily.

As for maps and schedules, these used to be the transit agency's job, but the role is shifting to the private sector. Many transit agencies are now releasing their route and schedule data in standard formats, so that anyone can design printed maps or online applications to present it. This is a welcome change. There's no reason you should rely on a transit agency for maps and schedules, any more than you would rely on your government's highway department for maps of the highway network. Presentation of real-time information, which shows actual locations of vehicles rather than just what's scheduled, is also migrating to the private sector, where entrepreneurs are competing to create mobile phone software that will present this information quickly and compellingly.

Legibility may seem like a minor problem compared to the others. For people who use transit only for the same trip every day, legibility is not a problem; you just learn how to make your routine trip and ignore all the

other complexities. But if you want transit to be a primary transport mode for your city, then you want passengers to use transit for many purposes, not just a regular trip, and in this case the legibility of the system becomes a critical value. Anyone who has spent 15 minutes on hold waiting for a transit system's information line (and who only called because the maps, schedules, and website were not helpful) knows that the lack of legibility really does add to travel time and crushes any sensation of freedom.

What It Costs

Journalists love to quote the eye-popping numbers for the construction cost of major transit lines, but *operating cost* is the eternal reality that governs most transit budgets. If you don't understand the essence of operating cost, you won't understand planning proposals.

In general, operating cost roughly doubles if you

- double the total length of the transit lines you operate, either by extending existing lines or by creating new ones;
- double frequency, for example, by cutting the headway from 30 to 15 minutes; or
- double the duration of service, for example, by expanding from 8 hours a day to 16 hours a day.

But one popular improvement saves operating cost: increasing speed. In general, if you were able to cut the travel time of a service in half—that is, double its average speed—your operating cost would drop by up to half. That's because most operating cost is labor, so it varies with time rather than distance. Run faster, and you use labor more efficiently.

For more on operating cost, see http://www.humantransit.org /02box.html. For now, remember: route distance, frequency, and span all *cost*, but speed *saves*.

THE SEVEN PHASES OF A TRIP

Another useful way to sort the elements of useful service is to think about how they relate to the phases of a transit trip. Any trip on transit has the following phases or steps, and in each one we seek both an efficient use of our time and money and a civilized experience.

1. *Understanding*. First, you must form a sufficient understanding of the service, frequency, and fare to know how to make the trip. This is the role of *legibility* as discussed earlier.
2. *Accessing (at the origin)*. You then walk, drive, or cycle to the stop or station where you will board the service. Here, there are limits to what your transit agency can do, apart from locating the stop at a logical place, making it a civilized place to wait, and providing parking options for your car or bike, where appropriate. Other than this, you're at the mercy of the city's street network and development pattern.
3. *Waiting*. Waiting is everyone's least favorite phase of a trip. It's governed mostly by *frequency* and *reliability*, but of course the quality of the waiting environment has a big impact. Waiting is also being transformed in interesting ways by personal technology, most notably by real-time information that tells you how long you have to wait.
4. *Paying*. We think of paying as spending money, but paying can also cost time, especially if you are unfamiliar with the system. If the driver collects the fares, your act of paying takes the time of everyone already on-board. That's why higher-volume transit systems (rail, bus, or ferry) are shifting to forms of fare collection that require you to buy a ticket before you board (more on this in chapter 11).
5. *Riding*. The time spent on the transit vehicle is governed by average speed (or *delay*) and *reliability*. The quality of the time, which is also important, is governed by both the quality of the vehicle and your ability to make use of the time, often through personal technology. Chapter 8 explores these issues.
6. *Connecting*. If your trip requires a connection, you'll repeat steps 2 through 5 for that connection. Minimizing the hassle of these steps is the work of *connectivity*, as we'll explore in Chapter 12. For example, fare systems that offer free connections eliminate the cost and hassle of repeating step 4.

7. *Accessing (at the destination)*. Finally, you'll repeat step 2 in reverse, traveling by some means from the transit stop/station to your actual destination. Again, the location of *stops/stations* (chapter 5) is the main transit feature that governs this access, but the design of the local area, which is usually outside a transit agency's control, is also a major impact.

Notice again that frequency appears multiple times. Frequency rules step 3 (waiting) and counts again in step 6 if a connection is required. But frequency also plays a big role in step 1 (understanding). A very frequent transit service is one where you don't worry about a timetable, and that's a huge step toward making understanding easier.

How Much Does Each Phase Matter?

The phases of a trip raise an important question that's likely to have a very personal answer: Do you just want to minimize your total travel time? Or, do you dislike certain phases of the trip so much that you'd endure a longer trip in order to minimize them? (Some of us might also endure a longer trip in order to have a particular pleasure, such as a ride on a vehicle that they perceive as fun, but this is even harder to quantify, as the nature of fun is so subjective and variable.)

Many studies have looked at how different kinds of delay seem to influence people's decisions to use transit, mostly for the purposes of ridership prediction. There are many ways to frame this question, but the most useful for our purposes is: "How much does a minute of this time deter someone from riding, as compared to the deterrent effect of a minute of riding time?" Table 2-1 shows some figures cited in an influential US manual, derived from studies in eight North American cities dating from 1960 to 1995.[1]

For example, when Table 2-1 says that walk time is weighted, on average, at 2.2 times riding time, we mean that 1 minute of walking time has as much deterrent effect as 2.2 minutes of riding time in determining whether someone will choose to use transit. For an extreme but simple example, if you could get to your destination in either 10 minutes of pure walking or 20 minutes of pure riding (with no wait or walk delay), these models say that, on average, people would rather have the 20-minute ride, even though they'd get to their destination 10 minutes later.

Table 2-1 Deterrent Effect of Various Kinds of Travel Time (relative to ride time = 1)

Delay Type:	Walk	Initial Wait	Ride	Wait for Connection
Governing Feature:	Stops, Stations (chapter 5)	Frequency (chapter 7)	Speed, Delay (chapter 8)	Frequency, Connections (chapters 7, 12)
Minimum	0.8	0.8	1.0	1.1
Average	2.2	2.1	1.0	2.5
Maximum	4.4	5.1	1.0	4.4

Source: Transit Capacity and Quality of Service Manual, 2nd ed.

When you put it that simply, it's easy to say, "Wait, but I wouldn't do that!" Factors like these have to be used with care. They're the result of observing many people's travel behavior in complicated situations where many motivations overlap, so an observed behavior that appears to be a response to waiting time may actually be about something else, such as the quality of the waiting environment, the reliability of the service, or the availability of information. Analyses like the one discussed here are often cited as reasons why transit planners shouldn't expect customers to walk, or to make a connection, even if that makes their trip faster. But look at the minimums! All of these types of delay have, in various situations, been reduced to around 1.0. Achieving that would mean that for most people in most situations, all the elements of travel time are equally tolerable. That, in turn, would mean that with a manageable number of exceptions, the total door-to-door trip time, compared to the customer's alternatives, could be viewed as the main kind of time that matters to ridership.[a] If that were

true, it would be much easier to decide, for example, that most people will walk farther to a faster service that will get them to their destination sooner. Suddenly, technical debates about transit would become exponentially simpler.

Is that possible? If it were our objective, we could certainly get much closer than we are now. Chapters 5 (on stop spacing), 7 (on frequency), and 12 (on connections) will look at these three kinds of travel time and how we can minimize their deterrent effect. Of course, we also have to care about in-vehicle travel time, which is the subject of chapter 8.

But there's another reason for optimism about bringing down the deterring effects of walking, waiting, and connecting, and that is today's revolution in information, which is not reflected in these twentieth-century figures. Most of these figures, for example, were developed in the absence of trip planning software, which allows you to evaluate your own transit options for a trip and decide for yourself if you prefer a longer trip that avoids walking or connecting. Without that knowledge, many passengers may have navigated by habit rather than choice because the available information encouraged that.

Real-time information is also transformative. Walking, waiting, and connecting are all made worse by uncertainty. Think about how different a walk to the bus or streetcar stop will feel if you know that the vehicle you want will be there in exactly 9 minutes. Even if you're in a hurry to reach your destination, you won't need to hurry while walking, so you'll enjoy the walk more. Waiting and connecting, too, become less onerous if you know the exact length of the wait, so that you can do other things with your time.

As mobile phone–based information sources become more sophisticated and universal, we will see a decline in uncertainty. Eventually, we may well reach a point where the length of the whole trip is really the only duration that matters. With clear, immediate, and reliable information, won't people find it easier, when they're in a hurry, to choose the fastest way?

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[a] There will always be exceptions, but there can also be continuous efforts toward addressing those exceptions, efforts made simpler by a clearer goal. Right now, many people commuting long distances value a good on-board work environment, but wireless internet and smartphones will eventually improve the working environment on most long-distance transit services. Weather deters walking and waiting sometimes, but this can be addressed through weather-protected connection points, heated or cooled shelters, and the continuous awnings that some cities (such as rainy Wellington, New Zealand) require in business districts. If enabling people to get where they're going as fast as possible were the objective, a great many available innovations—in urban design, information systems, and network planning—could be brought to bear, and new innovation would have a clearer goal to pursue.

3

FIVE PATHS TO CONFUSION

Throughout this book, you'll find examples of common misunderstandings about transit. In each case, my goal is not just to refute them but to suggest why they are so common and understandable, so that we can forgive and correct these mistakes both in others and in ourselves. A lively transit debate may seem to reflect many kinds of confusion, but we can penetrate the chaos by noticing a few common themes.

MAP-READING ERRORS

During their television coverage of the 2010 US election night, CNN repeatedly called the viewer's attention to a map of the United States in which the congressional districts were colored red for Republicans or blue for Democrats. Each time, we were shown the map showing the pre-2010 makeup of Congress. Then the reporter said, "Now, watch this!" As he waved his hand, the map changed to show the post-2010 makeup, with many blue areas changed to red. We were meant to perceive a vast Republican wave pouring across the nation.

CNN was asking us to make the most common of all map-reading errors: *perceiving map area as though it were population.* The visual impression that a map makes comes from the sizes of areas on the map; a big zone

looks more important than a small zone, even though, if the zones are congressional districts, both represent the same number of voters.

While the Republicans picked up many seats in 2010, CNN's map visually exaggerated those gains because only rural and outer-suburban districts are big enough to show up on a national map. Many outer-suburban districts, which often include extensive rural areas and therefore show up as big, tend to be close to the political center, so they frequently flip in elections. Many of them turned from blue to red in 2010, and it was these districts that created most of the CNN map's apparent "red wave." The same map would have shown an equally exaggerated "blue wave" for the Democrats two years earlier.

What you cannot see on a national map are the many districts that are inside of urban areas. They are too small in area to see unless you zoom into them, which CNN didn't. I am not sure if CNN's emphasis on this map was malice or foolishness, but it certainly showed how easy it is to misread map area as population, and thus form a distorted impression of what is occurring.

Transit planning requires looking at maps of data about populations, so you will encounter many opportunities to make this mistake. Suppose you're looking at a map showing the rate of zero-car households in a city. On the edge of the city is a huge zone that's all wilderness except for six recluses living in mobile homes deep in the woods, four of whom have cars. That's a 33 percent rate of zero-car households, and the whole vast zone will show up as having one of the most extreme rates of carlessness in the city. In fact, this large, brightly colored zone may be the most prominent thing on the map. Some people viewing this map may think: How terrible! We clearly need transit out there! The antidote to this map-reading error is to keep asking: "Wait, how many *people* are we talking about?" In this example, the answer is two.

In chapter 7, we'll encounter a similar map-reading error when it comes to looking at maps of transit service. Briefly, most transit maps show the paths that transit runs on but not how frequently it runs. As a result, they tend to conceal the patterns of good service, which tend also to be the patterns of good ridership. So when looking at a transit map, you may need to say: "Wait, these are just routes. What are the frequencies? How late do they run? In other words, how much actual service am I looking at here?"

MOTORIST'S ERRORS

A *motorist's error* is any mistake that arises from unconsciously thinking about transit as though it works just like cars and roads.[a] These errors often come up when people who usually travel by car find themselves making decisions about transit. Understandably, they tend to think about transit as an analogy to the mode of transport that they know. Many people who drive are strong transit supporters, and they can still make good transit decisions, but it helps to be aware of this risk and consciously correct for it.

Many such errors are obvious. Someone who has never tried to walk along a busy street as a pedestrian, for example, may not grasp why such a walk could be unsafe or intolerable, and what might need to be done to fix that problem. That's an example of an obvious difference between motoring and transit, one that most people can easily notice and correct for.

But the pervasive motorist's errors are more subtle. The most common is overvaluing speed and undervaluing frequency, because speed is meaningful to a motorist's experience while frequency really isn't. Roads are there whenever you need them, so there is no road equivalent of the transit concept of waiting time. The closest thing to frequency that most motorists experience is the cycling of traffic signals, but this is not a close analogy at all, since each signal delay is rarely more than 2 minutes. Transit riders, by contrast, may face major waits at the beginning of a trip or at a connection point. For them, waiting time—that is, frequency—is often the major variable that governs actual travel time. We'll come back to this motorist's error in chapters 7 and 8.

BOX ERRORS AND FALSE DICHOTOMIES

Sometimes, we're tempted to think about a *spectrum* as though it were a series of box-like *categories*. If you and a friend disagree about whether something is blue or purple, you're making this error together. Blue and purple

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[a] To be fair, these errors can be made by anyone who rides transit rarely but frequently pilots a vehicle down a road, including cyclists. I call these motorist's errors only because motorists tend to dominate political discussion in many cities and are most likely to be unaware of how their motoring experience may affect their transit thinking.

are adjacent zones on a continuous spectrum of colors (technically, wavelengths of light), and zones on a spectrum can only have fuzzy or arbitrary edges. So if you disagree about whether something is blue or purple, you can both be right, based on slightly different notions of where you mark the boundary in the fuzzy area where blue shades into purple. If one of you is right and the other wrong, it can only be because of some arbitrary standard about where blue ends and purple begins, a standard you've both agreed to respect.

Color is really a spectrum, but our language makes the spectrum hard to talk about. Our category words feel like boxes with hard edges: blue, purple, tall, wealthy. They invite us to say "Jim is tall," and to assume that this statement must be true or false. But like colors, most category words really refer to directions or zones on a continuous spectrum. There's no objective basis for saying, "Jim is tall," unless we just mean, "Jim is taller than most people." "Tall" is not a box; it's just a range or direction on a spectrum of possible heights. We all know that, and for simple ideas like height or color this error rarely causes trouble.

But when we talk about emotive categories, such as wealth or success, we can easily lose sight of the spectrum, and as with blue and purple, this can cause pointless arguments. Consider a famous comment widely (if falsely) attributed to former British prime minister Margaret Thatcher: A man who, beyond the age of 26, finds himself on a bus can count himself as a failure.[1] Stated that way, "a failure" sounds like a box that you're either in or out of. Associating buses with failure or poverty is a common attitude in certain cities. If you think about failure or poverty as a box, this can be an easy way to decide that buses aren't worth your attention and that there's no point in thinking about how buses and rail transit can work together as one network.

But even if it's true that bus riders are poorer than rail riders on average, you can change your perspective by reminding yourself that the boundaries of "poor" and "middle class" and "wealthy" are as fuzzy or arbitrary as the boundary between blue and purple.

When a box error divides the spectrum into just two categories, it's called a *false dichotomy*. For example, you may sometimes hear transportation experts divide all transit riders into two boxes. One box, called a *discretionary* or *choice* rider, contains people who have the option of driving, and who will use transit only if it outcompetes their car. In the other box is

the *transit-dependent* or *captive* rider, who has no viable alternative and therefore has to use transit. Dividing up riders this way leads to the idea that transit must compete for choice riders, while captive riders will ride no matter how poor the service gets.

These categories are imposed on reality, not derived from it. Transit dependence, like wealth itself, is a spectrum, with vast numbers of people in gray areas between "choice" and "captive." For example, many people with low incomes own a car out of necessity but experience owning a car as a financial burden. If we give these people credible alternatives to car ownership, they can experience the result as *liberating*, even though some transportation planners will now call them *captives*. Often they will find better things to spend that money on, such as education. Many people are in situations like these, and we can achieve both environmental and social good by giving them the option to own fewer cars. The two-box model of society, where everyone is either choice or captive, prevents us from seeing those possibilities.

POLARIZATION ERRORS

Throughout this book, I will be like your plumber, asking, "Do you want more of this or more of that? You have to choose." This isn't always what you want to hear. People develop a range of responses to these questions, some of them unpleasant for the plumber.

One of the most common responses is to accuse me of advocating a particular answer to the question simply because I've stated the question. For example, if I describe some of the trade-offs between rail and bus options in a particular place, and try to do so with some equanimity, rail advocates may decide that I'm a bus advocate. If you already know where you are on a question, it can feel threatening for me to point out that there is a spectrum of credible opinions and that there are other possible valid positions on that spectrum.

I call this a polarization error, because ultimately it implies a stance of "you're either with us or against us." The polarization error is really an extreme example of a box error or false dichotomy. The speaker insists that his way of dividing the world into two boxes is the only one that's meaningful and that everyone else must judge reality on those terms.

There are some issues where I can describe the spectrum only by taking a position on it, because most people now occupy a different position out of sheer habit. For example, when we turn to the question of "connections or complexity?" in chapter 12, I will come down firmly on the side of encouraging connections in order to have a simpler network. I'll do this, though, because you don't need me to lay out the opposite position; distaste for connections, or "transfers" as Americans call them, is everywhere, and many transit systems work hard to avoid them. The notion that "people hate to transfer" is already well established, so the only way I can usefully show the spectrum of possibility is to explain in some detail why a network that requires transferring might actually be desirable. Still, "connections or complexity?" is a plumber's question, a choice between two things that we value, so there's no technically right answer. When a client agency chooses connection avoidance as the goal, in full understanding of the consequences of that choice, I'm happy to help the client design a network that serves those values.

In some situations, polarization is unavoidable. Most commonly, once you're engaged in a debate about whether to build a particular transit line, you're likely to hear polarizing comments coming from both sides. People who are committed strongly to one position will tend to hear what you say as either "for" or "against." That's one reason to think about transit more generally before you get into the middle of those debates, so that you can see both your own values and their relationship to other possible values that people might rationally hold. This book tries to lay out some of this landscape of choices so that you can find your own home in it.

UNFORTUNATE CONNOTATIONS

Finally, many of the words that we use to talk about transit can carry troublesome connotations. We've already seen one: *captive*. I may understand that my elderly aunt can't drive and thus depends on transit, but I'll still bristle to hear her described as the transit system's captive.

Most of the words used in the transit business also have a more common meaning outside that context. The common meaning forms a connotation that hangs around the word, often causing confusion, when we use the word to talk about transit. So when choosing what words to use, it's im-

portant to think about each word's everyday meaning, not just its transit meaning.

In the next chapter, for example, we'll need a word for the path traced by a transit vehicle. This word is sometimes *route* and sometimes *line*. Which should we use? Listen to the common meaning of these two words.

When a package or message is going through a postal system, we say it's being routed. The person who delivers newspapers to subscribers in the morning is following a paper route. School buses typically follow routes. Explorers trace a route to the South Pole.

What these meanings of the word *route* have in common is that the route isn't necessarily followed very often. A route is a place where some kind of transport event happens, but the event may be rare. It may even happen only once.

The word *line*, on the other hand, has a clear meaning from geometry: a simple, straight, one-dimensional figure. In common usage, we often use *line* for something curved, like the laugh lines and worry lines on a face, and transit lines may be curved as well. But the word *line* doesn't imply an event, as *route* does. A line is a thing that's just there, no matter what happens along it.

Lurking inside these two words, in short, is a profound difference in attitude about a transit service. Do you want to think of transit as something that's always there, that you can count on? If so, call it a *line*. We never speak of rail routes, always rail lines, and we do that because the rails are always there, suggesting a permanent and reliable thing.

If you're selling a transportation product, you obviously want people to think they can count on it. So it's not surprising that in the private sector, the word is usually *line*. Trucking and shipping companies often call themselves lines, as do most private bus companies and, of course, the airlines. This doesn't mean that all these services are really line-like—some may be quite infrequent—but the company that chose the word wants you to think of their product as something that's reliably there, as something that you can count on.

So the word *route* lowers expectations for the frequency and reliability of a service. The word *line* raises those expectations. My broad intention in this book is to raise expectations of transit rather than lower them, so I will generally use *line*. However, when I speak specifically of a service that doesn't run very frequently, I'll use *route*.

Connotations can be a nuisance. Most of the time you don't want any connotation. You just want the meaning. Unfortunately, words without connotations tend to sound evasive or bureaucratic. I could insist on saying "fixed vehicle path" instead of "route" or "line," just as I could say "nonmotorized access" when I mean walking or cycling, but you wouldn't get through this book if I did. To keep our speech vivid and engaging, we often have to use words with connotations, and do our best to choose those connotations consciously.