

The Times

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Envisioning Timetables- The books of Edward Tufte

Making timetables work. Review by GEOFF LAMBERT.

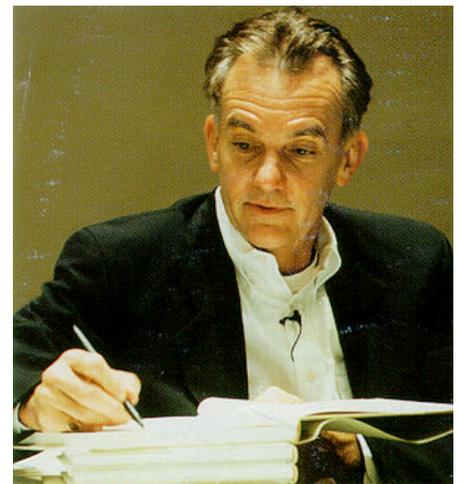
EDWARD Tufte is a professor at Yale University, where he conducts courses in statistical evidence, information design and interface design. He has written seven books on these topics, including the three discussed here: "The Visual Display of Quantitative Information", "Envisioning Information" and "Visual Explanations". Tufte has a considerable interest in transport timetables, both tabular and graphical. A graphical timetable of the Lyon railway in 1885 appears on the cover of the first book. Tufte describes the three books as being about (1) "pictures of numbers", (2) "pictures of nouns" and (3) "pictures of verbs". The books which are about design and content have themselves won many awards for these attributes.

I rather think Tufte is a disciple of Phillip Morrison, the famous physicist who worked on the Manhattan Project

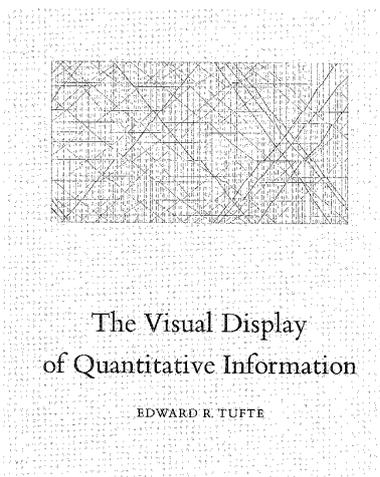
and who has been, for 40 years, the book reviewer for Scientific American. Tufte has certainly had the happy knack of reproducing Morrison's lucid prose style, which the grammar checker on my computer tells me is the clearest it's ever seen.

In "Envisioning Information", Tufte says "issues of timetable design are at the heart of envisioning data- large arrays of fussy annotated numbers, thick information densities, type and image together and multivariate techniques for narrating what is a four or five variable story. And the audience for schedules is diverse, ranging from experts at timetables such as travel agents [and AATTC members] to those who are not travel agents, an audience of uncertain skills, eyepower, patience.

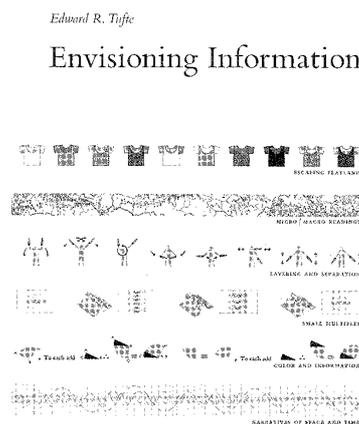
Tufte goes on to assert that "Confusion and clutter are failures of design, not attributes of information... The point is



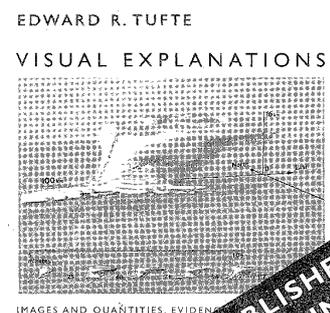
to find design strategies that reveal detail and complexity, rather than fault the data for an excess of complication. Among the most powerful devices for reducing noise and enriching the content of displays is the technique of layering and separation. What matters is the proper relationship between information layers. These relationships must be in proportion and harmony. (this) need not be vague counsel; their meanings are revealed in the practice of detailed visual editing of data displays.



PICTURES OF NUMBERS
The classic book on statistical charts, graphs, and tables.



PICTURES OF NOUNS
Maps of data and evidence. Design strategies for complex information. High resolution displays. Multiples, layering and hierarchy, color and information.



PICTURES OF VERBS
Depicting evidence relevant to cause and effect. Graphics for decision making and presentations. Interface design. Narrative and animation. Scientific visualization.

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For example, in this train timetable, a heavy-handed grid interacts with the type, generating a stripey texture and fighting with the scheduled times. The prominent top position in the table shows the least important information, a 4-digit train identifier used by railroad personnel and nobody else.

Train No	3701	XM 3301	3801	A 67	3 3803	3 3201	A3 51	3 3703	3 3203	A3 61	3 3809	A3 47
New York N.Y.	A.M. 12.10	A.M. 12.40	A.M. 1.30	A.M. 3.52	A.M. 4.50	A.M. 6.10	A.M. 6.25	A.M. 6.35	A.M. 6.50	A.M. 7.10	A.M. 7.30	A.M. 7.33
Newark N.J.	12.24	12.55	1.44	4.07	5.04	6.24	6.38	6.49	7.04	7.24	7.45	7.47
North Elizabeth	....	....	....	....	....	....	....	....	....	7.30	....	....
Elizabeth	12.31	1.03	1.51	....	5.11	6.31	....	6.56	7.11	7.32	....	7.54
Linden	12.36	....	1.56	....	5.16	6.36	....	7.01	7.15	7.37	....	7.59
North Rahway....	....	....	....	....	....	....	7.03	....	7.39	....	....	....
Rahway	12.40	1.11	2.00	....	5.20	6.40	....	7.06	7.20	7.42	....	8.03
Metro Park (Iselin)	12.44	....	2.04	4.26	5.24	....	6.56	7.10	7.25	....	8.04	8.07
Metuchen	12.48	....	2.08	....	5.28	....	....	7.14	7.29	....	....	8.11
Edison	12.51	....	2.11	....	....	....	....	7.17	7.32	....	....	8.14
New Brunswick	12.55	....	2.15	....	5.35	....	7.05	7.21	7.35	....	....	8.18
Jersey Avenue	1.02	....	2.18	....	....	....	....	7.28	....	....	....	8.21
Princeton Jct S	....	....	2.31	....	5.50	....	7.19	....	7.50	....	....	8.34
Trenton N.J.	....	....	2.42	4.58	6.03	....	7.28	....	8.01	....	8.31	8.44

A redesign calms the grid, moves the New York departure times to the very top, de-emphasises the less-important data and adds new information. A separating line is formed by tiny leader dots, which read as gray, making a distinction, but not a barricade

	a.m. €											
New York N.Y.	12.10	12.40	1.30	3.52	4.50	6.10	6.25	6.35	6.50	7.10	7.30	
Newark N.J.	12.24	12.55	1.44	4.07	5.04	6.24	6.38	6.49	7.04	7.24	7.45	
North Elizabeth	....	....	....	....	....	....	....	....	....	7.30	....	....
Elizabeth	12.31	1.03	1.51	....	5.11	6.31	....	6.56	7.11	7.32	....	7.54
Linden	12.36	....	1.56	....	5.16	6.36	....	7.01	7.15	7.37	....	7.59
North Rahway	....	....	....	....	....	....	7.03	....	7.39	....	....	....
Rahway	12.40	1.11	2.00	....	5.20	6.40	....	7.06	7.20	7.42	....	8.03
Metro Park (Iselin)	12.44	....	2.04	4.26	5.24	....	6.56	7.10	7.25	....	8.04	8.07
Metuchen	12.48	....	2.08	....	5.28	....	....	7.14	7.29	....	....	8.11
Edison	12.51	....	2.11	....	....	....	....	7.17	7.32	....	....	8.14
New Brunswick	12.55	....	2.15	....	5.35	....	7.05	7.21	7.35	....	....	8.18
Jersey Avenue	1.02	....	2.18	....	....	....	....	7.28	....	....	....	8.21
Princeton Jct S	....	....	2.31	....	5.50	....	7.19	....	7.50	....	....	8.34
Trenton N.J.	....	....	2.42	4.58	6.03	....	7.28	....	8.01	....	8.31	8.44
Train No	3701	3301	3801	67	3803	3201	51	3703	3807	3203	61	3809
Notes		xm	>	3	3	>3	3	3	3	>3	3	3

The focus is now given over to information, transparently organised by an implicit typographical grid, defined simply as the absence of type.

Still working within his native north-east United States, Tufte dissects a timetable for the New Haven line as follows:

NEW YORK TO NEW HAVEN					
MONDAY TO FRIDAY, EXCEPT HOLIDAYS					
Leave	Arrive	Leave	Arrive	Leave	Arrive
New York	New Haven	New York	New Haven	New York	New Haven
AM	AM	PM	PM	PM	PM
12:35	2:18	2:05	3:45	Y 8:25	8:19
5:40	7:44	3:05	4:45	Y 7:05	8:56
7:05	8:45	Y 4:01	5:45	Y 8:05	9:45
8:05	9:45	4:41	6:25	Y 9:05	10:50
9:05	10:45	Y 4:59	6:53	10:05	11:45
10:05	11:45	Y 5:02E	6:33	11:20	1:05
11:05	12:45	X 5:20	7:08	12:35	2:18
12:05	1:45	X 5:42	7:28	.....	.....
1:05	2:45	Y 6:07E	7:48	.....	.....
PM	PM	PM	PM	PM	PM
SATURDAY, SUNDAY & HOLIDAYS					
AM	AM	PM	PM	PM	PM
12:35	2:18	2:05	3:45	7:05	8:45
5:40	7:37	S 3:05	S 4:45	H 8:05	H 9:45
8:05	9:45	4:05	5:45	9:05	10:45
10:05	11:47	5:05	6:48	11:20	1:00
12:05	1:45	6:05	7:48	12:35	2:18
PM	PM	PM	PM	AM	AM

REFERENCE NOTES
 Economy off-peak tickets are not valid on trains in shaded areas.
 Check displays in G.C.T. for departure tracks.
 E-Express
 X-Does not stop at 125th Street.
 S-Saturdays and Washington's Birthday only.
 H-Sundays and Holidays only.
 T-Snack and Beverage Service.
HOLIDAYS-New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving and Christmas.

- Bold sans serif capitals weak in distinguishing between two directions: NEW HAVEN TO NEW YORK NEW YORK TO NEW HAVEN
- Column headings repeated 3 times and 24 AM's and PM's shown due to folded sequence of times. The eye must trace a serpentine path in tracking the day's schedule; and another serpentine for weekends: ~~~~~
- Poor column break, leaving last peak-hour train as a widow in this column.
- Too much separation between leave/arrive times for the same train.
- Too little separation between these unrelated columns.
- Most frequently used part of schedule (showing rush-hour trains) is the most cluttered part, with a murky screen tint and heavy-handed symbols.
- Rules segregate what should be together; a total of 41 inches (104 cm) of rules are drawn for this small table.
- Wasted space in headings cramps the times (over-tight leading, in particular). Well-designed schedules use a visually less-active dot between hours and minutes rather than a colon.
- Ambiguity in coding; both x and E suggest an express train, or even E for Economy.

Says he, *Millions of copies of this standard typographical table have been distributed by the railroad for years. Space is poorly allocated; much of the paper is given over to categories at the top that labor incessantly to make only 3 binary distinctions (between New York/New Haven, leaving/arriving and week-days/weekends). All the little boxes create an elaborate but false appearance of systematic order 1/4 1/4 only 21% of this timetable's area is devoted to display of times that trains run. Disorderly footnotes lurk in the basement waiting to derail insufficiently vigilant travellers.*

The re-design below eliminates all the assorted convolutions from the schedule and yields a graceful but unceremonious layout. The numbers, no longer serpentine, are now set in Matthew Carter's Bell Centennial, a telephone book typeface designed for clarity of reading in tight spaces. But can you spot the error in Tufte's new time table?

NEW YORK → NEW HAVEN
Grand Central Station

Monday to Friday, except holidays		Saturday, Sunday, and holidays	
Leaves New York	Arrives New Haven	Leaves New York	Arrives New Haven
12.35 am	2.18	12.35 am	2.18
5.40 am	7.44 am	5.40 am	7.37 am
7.05	8.45		
8.05	9.45	8.05	9.45
9.05	10.45		
10.05	11.45	10.05	11.47
11.05	12.45 pm		
12.05 pm	1.45	12.05 pm	1.45 pm
1.05	2.45		
2.05	3.45	2.05	3.45
3.05	4.45	3.05 <small>Saturdays only</small>	4.45
4.01	5.45	4.05	5.45
4.41	6.25		
4.59	6.53		
x 5.02 •	6.33	5.05	6.48
5.20 •	7.08		
5.42 •	7.26		
x 6.07 •	7.46	6.05	7.42
6.25	8.19		
7.05	8.56	7.05	8.45
8.05	9.45	8.05 <small>Sundays only</small>	9.45
9.05	10.50	9.05	10.45
10.05	11.45		
11.20	1.05 am	11.20	1.00 am
12.35 am	2.18	12.35 am	2.18

Economy off-peak tickets are not valid on trains in boxed areas.

X Express
• Does not stop at 125th Street

Holidays: New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving and Christmas.

NEW YORK ← NEW HAVEN
Grand Central Station

Monday to Friday, except holidays		Saturday, Sunday, and holidays	
Leaves New York	Arrives New Haven	Leaves New York	Arrives New Haven
12.35 am	2.18	12.35 am	2.18
5.40 am	7.44 am	5.40 am	7.37 am
7.05	8.45		
8.05	9.45	8.05	9.45
9.05	10.45		
10.05	11.45	10.05	11.47
11.05	12.45 pm		
12.05 pm	1.45	12.05 pm	1.45 pm
1.05	2.45		
2.05	3.45	2.05	3.45
3.05	4.45	3.05 <small>Saturdays only</small>	4.45
4.01	5.45	4.05	5.45
4.41	6.25		
4.59	6.53		
x 5.02 •	6.33	5.05	6.48
5.20 •	7.08		
5.42 •	7.26		
x 6.07 •	7.46	6.05	7.42
6.25	8.19		
7.05	8.56	7.05	8.45
8.05	9.45	8.05 <small>Sundays only</small>	9.45
9.05	10.50	9.05	10.45
10.05	11.45		
11.20	1.05 am	11.20	1.00 am
12.35 am	2.18	12.35 am	2.18

Economy off-peak tickets are not valid on trains in boxed areas.

X Express
• Does not stop at 125th Street

Holidays: New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving and Christmas.

Tufte loves graphical timetables. So do I, so I found fascinating his explications of what they stand for, how they work and how they can be made intricately detailed, without losing their purpose. Tufte believes that graphical timetables offer a better alternative to bus schedules, an alternative everyone can grasp. He has designed, (and sells for \$10 a set) graphical bus timetables attached to clear colour aerial photographs of the routes to which they apply. They have been an abysmal failure in the public sphere.

Tufte takes as his prime example, a “wondrously complex” train graph from Java, sometimes known as the “spy timetable”. It is illustrated on the cover of this issue of The Times.

“This 16-variable schedule served as an internal planning document for the Java railroad; it was then obtained by agents working for Japan preparing for their military invasion of Java

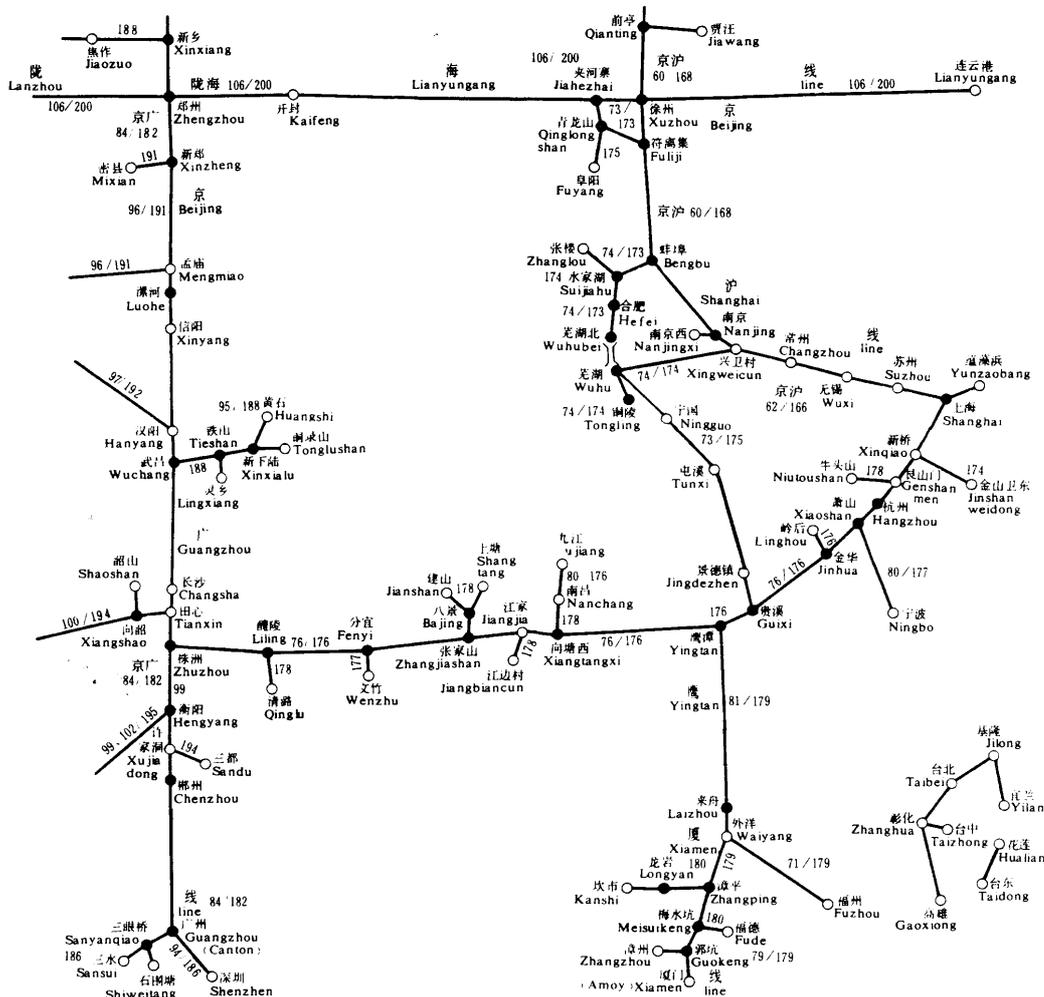
during 1942. In the upper righthand corner, this railroad timetable is classified as ‘secret’

“By smoothly suppressing a dimension first here and then several times there, finessing perspective treatments entirely, and changing the focus, this 24-hour plan traces out multiple paths through three-space and time, in a four-dimensional tour with a dozen other variables carried along. Graphical time-tables turn the three spatial dimensions of our daily world into one train-relevant dimension by measuring distance along the track itself. The left margin of the timetable reflects another viewpoint, with a profile of all the valleys and mountains crossed by rail. This visual detail is accompanied by quantitative details, to the right of the profile, where columns of numbers describe the grade and path. Note how the vertical has been used repeatedly to array parallel sequences of thor-

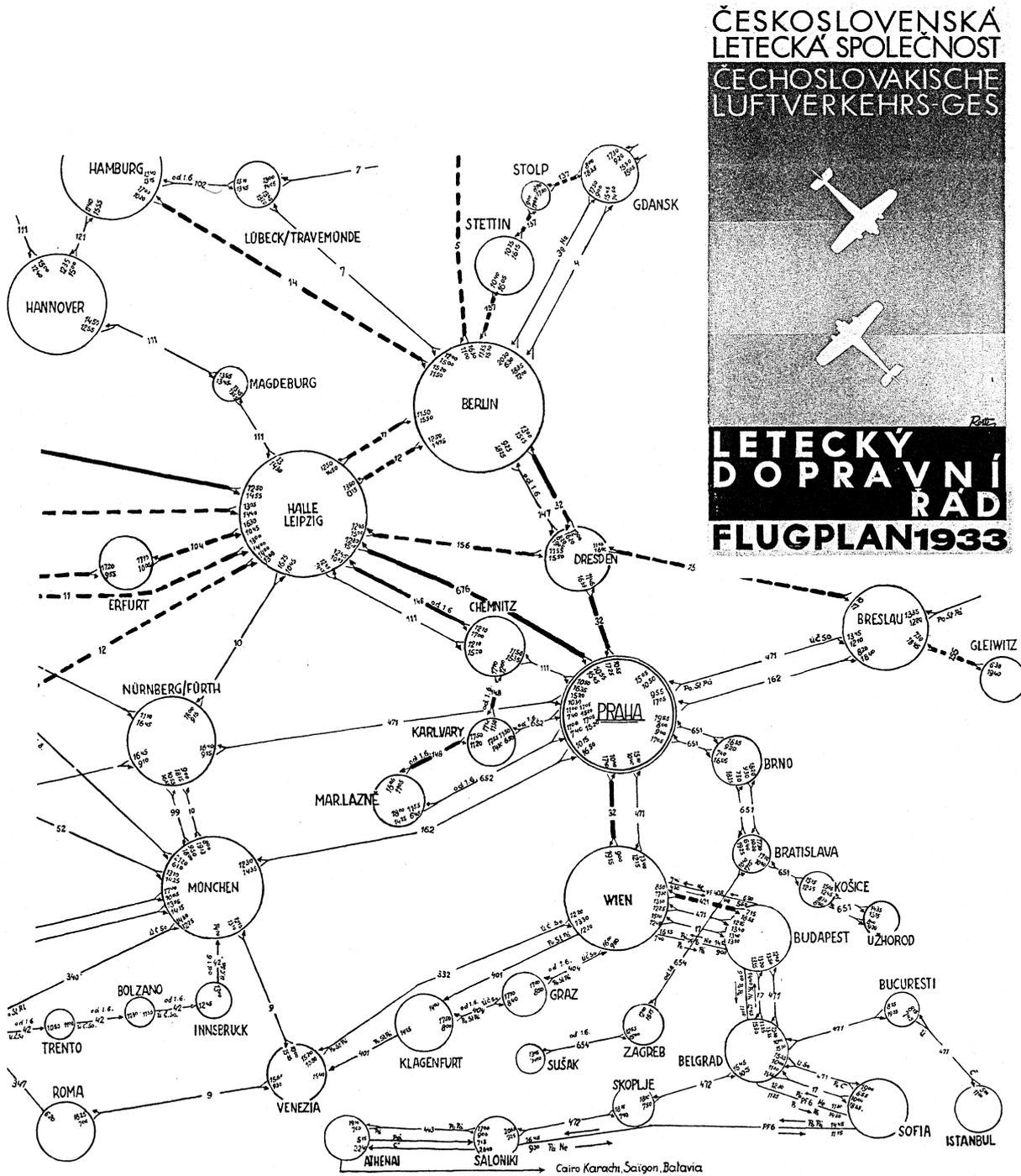
oughgoing data. In Flatland, after all, every opportunity to spread additional information over an already available dimension must be cherished ¼

“Within each station, still another view- for what is important here is activity on the flat ground. Aerial views of the intricate networks of station switching tracks are shown, encoded with symbols, icons, and dingbats describing the local facilities. ¼

“The train diagonals cleverly multiple-function, as those marks record six variables all at once: the location of a train between towns, time of that position, direction, train type, relative speed, and yearly pattern of operation. A two-dimensional matrix organises lines by type and seasonality, encoding the diagonal path of the train through the space-time field



Tufte presents a pre WWII Czech airline timetable as a “brilliant map/schedule, an exceptional union of graphic and information design. Here a complex network of routes is brought together with flight times and identification numbers. A China Rail route map, similar in concept, appears on our page 6.



Tufte shares Orwell’s impatience with double-think and humbuggery, his insight that bad thinking and bad expression travel in a pair. “Clear and precise seeing becomes one with clear and precise thinking”. Tufte provides terse stunning evidence of the real-world consequences of bad design by tracing

out the thinking, processes, charts and communications (or failure of communications) in the fatal decision to launch the Challenger space shuttle in exceptionally cold weather. He contrasts this with a Victorian doctor’s brilliant use of charts and tables to trace the origins of a cholera epidemic.

Grasping our world requires grasping numbers, and trusting that we have grasped them correctly. Tufte’s work becomes a friendly compass in an information wilderness and, when necessary, a machete to chop through thickets of disinformation.

Why don't new arrivals to Australia use public transport?

By **DEREK CHENG**

Who says this doesn't relate to timetables? But first I must clarify my position. There are not that many immigrants using public transport, just like the Aussies. But look at the cars on the road and the patience you need in traffic jams. Using Hong Kong as a comparison, from the February *Times* we know that most bus services come every 10-20 minutes. The worst bus frequency in HK is 25-40 minutes and ferries come every hour or two but they do issue timetables. The underground Mass Transit Railway (MTR) comes every four minutes at least. Much the same happens in Singapore.

Therefore, are the immigrants willing to wait an hour for a bus, then 30 minutes for a train to the City from some outlying suburbs? Of course not! It is also a fact that they are not used to reading timetables. They just walk out the door and expect a bus to arrive in minutes. When we moved to Australia we thought the frequency would be similar to that in HK but we waited and waited and waited because we had just missed one. Most give up and drive. No wonder they say public transport is no good in Australia or the US or Canada. They say you cannot live in these countries without a car. It is like having no legs.

A friend of mine is a good example. One day at high school I had to go somewhere after school. During recess I opened a Sydney Bus timetable I had taken with me and this friend, who had

been living in Sydney for 7 or 8 years, asked "What is this? I have never seen one before." Seven years, my God! What has he been doing? He said he just went to the station and waited. That was when the Main North off-peak frequency was half hourly.

Because I am a bus enthusiast I got him into buses quickly. He lives at Ryde and now catches the 500 to the City. He used to hop on the first bus without looking at the route number. If he ever got on a 501 just think of the time he wasted.

Apart from timetables, some immigrants I know say they will not use public transport because:

1. Lack of double decker buses. HK people, used to double deckers (below left), do not look upon singles (below, right) as buses. They equate them with school buses or tourist buses.

2. Bus Fares. HK people who pay price M for a product at home expect to pay M for it elsewhere. Oops, forgot about the currency exchange rates. That makes goods and services 5 or 6 times more expensive than in HK or Singapore. Catching a three section (about 5kms) would cost \$1.80 (HK\$10) in NSW. Ask someone who has been to HK how far they could go for HK\$10. In fact, for HK\$10.4 you could catch a 69X from Tin Shui in the far North West Territories to Kowloon Station.



This is a 44.3km trip, taking 105 minutes. How much would a comparable ride be in Sydney? Even with TravelTen savings the similar distance journey from Wynyard to Palm Beach on the L90 would cost \$4.00. This is more than HK\$20. For HK\$15 you can catch a 69X air-conditioned bus with comfort you can't get on an L90 artic.

3. Train fares. Even Cityrail discounted off-peak fares are higher than in HK, though the difference is not as great as in the case of the buses. A return trip from Epping to the City (about 23km) costs \$3.60 but on HK's Kowloon Canton Railway (KCR) from Sheung Shui in the far North New Territories to Kowloon (more than 30km) is only HK\$8.4 single, HK\$16.8 return (about A\$3.00). Further saving can be made by using the newly introduced 'Octopus' smartcard.

This article focuses on immigrants from the north west of Australia. People from places like China, Japan, HK, Singapore, Indonesia etc form only 3% of the population. If public transport is to attract more passengers getting the remaining 97% to use it is vital.



A real bus



A make-believe bus

"HK people, used to double deckers, do not look upon singles as buses. They equate them with school buses or tourist buses"

The Long Plains Rail and Bus Service

A timetable operating from Monday, 7/2/77. Reviewed by DAVID HENNELL

This free handout timetable consists of 2 single sided A4 typed and duplicated sheets published by the (unnamed) South Australian State Transport Authority – Rail Division.

Coincident with the withdrawal of the Adelaide - Moonta rail passenger service in 1969, the Monday to Saturday local stopping passenger motor between Adelaide & Bowmans via Long Plains was cancelled. It was replaced by a road bus service operating Monday to Friday between Salisbury & Long Plains, connecting with suburban trains at Salisbury. A local trip between Salisbury & Virginia was also provided using the same vehicle.

Significant changes occurred to this service on 7th February 1977 when a Saturday bus service was introduced and one of the early morning Penfield suburban trains was altered to work to Virginia. The full service to all stations and authorised level crossings between Salisbury & Long Plains is shown in this handout timetable.

The layout of the timetable suggests that rail passengers north of Salisbury were required to change

at Salisbury on many services but this was not the case as all trains worked through between Adelaide & Virginia or Port Pirie. Bus passengers were required to change.

It is interesting to note that the Up buses had compulsory stops shown at 2 of the level crossings but, surely, they didn't stop if there weren't any passengers. The omission of stops at Direk and Calomba from the schedule of the Sunday Down is not a typographical error but one wonders about the level crossing stops shown for this train. 21.64 km was the short platform on the Port Pirie line adjacent to Hilra on the Penfield line. The Virginia train was the only regular working of suburban Red Hens on the Port Pirie line.

The public timetable book dated 10th July 1977 has this service intact but with the 7.41 am train from Virginia altered to depart at 7 26 am and arrive at Adelaide at 8 04 am. However, the Saturday buses were withdrawn soon after, apparently lasting about 6 months in all. Concurrent with the cessation of the Saturday buses, the 12 30 pm *East-West* express to Port Pirie was altered to set down at Virginia &

Two Wells (but not Mallala) on Saturday only as a replacement service. The Monday to Friday buses and the Virginia local train lasted a few more years, well into Australian National days.

The buses displayed supplementary destination boards showing route 900 (numbered as part of the metropolitan route numbering scheme) and it is interesting to note that the present (1998) Salisbury to Virginia route operated by Serco for the Passenger Transport Board is still numbered 900. [Is it coincidence that both Adelaide and Melbourne used 900 series routes (900 and 901, 902 & 903 respectively) for metropolitan railway bus services?]

Virginia was the limit of the Adelaide suburban area on the Port Pirie line and normal suburban fares & tickets applied. Country fares and condition applied for journeys north of Virginia and weekly tickets for use on both trains and buses were issued, these being the last country weeklies issued in South Australia.

[And the editor thought it would be interesting to see today's timetable for this trip, so he tried Transadelaide's Web-site:

Destination result

Travelling between **SALISBURY** and **TWO WELLS** on a **WEEKDAY**.

Sorry no direct service was found.

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ADELAIDE, VIRGINIA, TWO WELLS, MALLALA AND LONG PLAINS.RAIL AND BUS SERVICES.(OPERATIVE FROM MONDAY, 7/2/77).

STATIONS AND STOPPING PLACES	RAIL SERVICES						
	MON. TO FRI.	MON. TO SAT.	SAT.	MON. TO FRI.	MON. TO FRI.	SUN.	MON. TO FRI.
	AM	AM	PM	PM	PM	PM	PM
ADELAIDE dep.	6.30	8.05	12.40	3.45	4.35	4.45	6.05
SALISBURY arr.	6.58	8.24	1.02	4.12	4.58	5.03	6.24
	<u>RAIL</u>	<u>RAIL</u>	<u>BUS</u>	<u>BUS</u>	<u>BUS</u>	<u>RAIL</u>	<u>RAIL</u>
SALISBURY dep.	6.59	8.25	1.06	4.14	5.03	5.04	6.25
SALS.HIGH SCHOOL	-	-	*	4.18	5.06+	-	-
SALS.NTH.TECH.H.S.	-	-	*	4.21	-	-	-
21.64 km	7.01	-	-	-	-	*	*
DIREK	-	*	-	-	-	-	*
29.73 km	-	-	-	-	-	*	*
VIRGINIA RAIL	7.10	8.36	1.26	4.35	5.23	5.14	6.35
37.03 km		-	1.31+		5.28+	*	*
38.50 km		-	1.33+		5.30+	*	*
40.17 km		-	*		*	*	*
TWO WELLS RAIL		8.46	1.39		5.36	5.25	6.45
45.42 km		-	*		*	*	*
47.71 km		-	*		*	*	*
50.67 km		-	*		*	*	*
57.530 km		-	*		*	*	*
MALLALA RAIL		9.02	1.55		5.52	5.40	7.00
61.97 km		-	*		*	*	*
63.84 km		-	*		*	*	*
65.70 km		-	*		*	*	*
67.87 km		-	*		*	*	*
CALOMBA		9.12	2.03		6.00	-	*
74.00 km		-	*		*	*	*
LONG PLAINS		9.18	2.08		6.05	5.53	7.13

Distances in Kilometres shown in left-hand column are authorized level crossings, and distance is by rail from Adelaide.

* Stop if required to set down passengers.

+ Stop at turn-off to indicated rail crossing and Salisbury High School.

LONG PLAINS, MALLALA, TWO WELLS, VIRGINIA AND ADELAIDE.RAIL AND BUS SERVICES.
(OPERATIVE FROM MONDAY, 7/2/77).

STATIONS AND STOPPING PLACES	BUS AND RAIL SERVICES							
	SAT.	MON. TO FRI.	MON. TO FRI.	MON. TO FRI.	SAT.	MON. TO FRI.	MON. TO FRI.	SUN.
	<u>BUS</u>		<u>BUS</u>		<u>RAIL</u>	<u>RAIL</u>	<u>RAIL</u>	<u>RAIL</u>
	AM		AM		AM	AM	PM	PM
LONG PLAINS Dep	6.24		6.30		8.42	10.17	8.12	8.17
74.00 km	6.27		6.33		-	-	-	-
CALOMBA RAIL	6.33		6.39		8.49	10.24	-	-
67.87 km	*		*		-	-	-	-
65.70 km	*		*		-	-	-	-
63.84 km	6.39		6.45		-	-	-	-
61.97 km	6.42		6.48		-	-	-	-
MALLALA RAIL	6.47		6.53		9.04	10.33	8.26	8.33
57.53 km	*		*		-	-	-	-
50.67 km	*		*		-	-	-	-
47.71 km	*		*		-	-	-	-
45.42 km	*		*		-	-	-	-
TWO WELLS RAIL	7.04		7.10		9.17	10.46	8.40	8.49
40.17 km	*		*		-	-	-	-
38.50 km	*+		*+		-	-	-	-
37.03 km	*+	<u>RAIL</u>	*+	<u>BUS</u>	-	-	-	-
VIRGINIA RAIL	7.22	<u>am</u> 7.41	-	<u>am</u> 8.07	9.27	10.56	*	9.01
VIRGINIA (MAIN ROAD)STATION TURN-OFF	-	-	7.28	-	-	-	-	-
29.73 km	-	-	-	-	-	-	-	-
DIREK	-	-	-	-	-	-	-	-
21.64 km	-	7.49	-	-	-	-	-	-
SALS.NTH.TECH.H.S.	-	-	-	8.20	-	-	-	-
SALS.HIGH SCHOOL	*+	-	*+	*	-	-	-	-
SALISBURY Arr	7.44	7.52	7.50	8.26	X	X	X	X
	<u>RAIL</u>	<u>RAIL</u>	<u>RAIL</u>	<u>RAIL</u>	-	-	-	-
SALISBURY Dep	7.47	7.53	7.53	8.28	-	-	-	-
ADELAIDE Arr	8.12	8.14	8.14	8.57	9.58	11.29	9.20	9.33

Distances in Kilometres shown in lefthand column are authorized level crossings, and distance is by rail from Adelaide.

* Stop if required to pick up or set down passengers.

X Stop if required to set down passengers.

+ Stop at turn-off to indicated rail crossing and Salisbury High School.

A timetable with a difference: Transborder's coach timetable

ACT/NSW border-hopping bus time tables **STEPHEN HABY**

Transborder, based in Canberra and Yass, operate an immaculate fleet of coaches on the Canberra – Yass and Queanbeyan – Canberra – Yass – Cootamundra Countrylink service.

Transborder's current TT dated 10 August 1998, with the front cover shown below, is a fold-out pocket sized format. The actual TT design itself is of interest and is the focus of this brief article.

Many TT are designed using the traditional 'table' style with columns and rows. Transborder has designed their TT incorporating aspects of the traditional style but also some interesting graphical design features.

Essentially the TT is divided into three sections. The first section at the top shows the times for services from Wagga travelling towards Yass, Canberra and Queanbeyan. The middle section shows all the locations that the services stop at as well as visually showing the extent of each service using coloured lines. For example the 'Grasshopper' service between Junee and Yass is shown as a pea green line. The third section at the bottom of the TT shows all the times for services from Queanbeyan – Canberra – Yass through to Wagga.

The frequency of services are shown at either end of the TT and connecting services are shown as well. This includes Fearne's Express and Grasshopper services.

The TT is generally easy to follow except perhaps for the arrangement showing the times for the Fearne's Express and Grasshopper services connecting with Transborder services at Yass. The times for both services are placed in the same row even though

TBX

TRANSBORDER EXPRESS

CANBERRA - YASS

with connections to

- ◆ **MELBOURNE**
- ◆ **WAGGA**
- ◆ **GOOTAMUNDRA**
- ◆ **YOUNG**

Ph: (02) 6241 0033

Fares and route information effective 10 August 1998

TIMETABLE & FARES

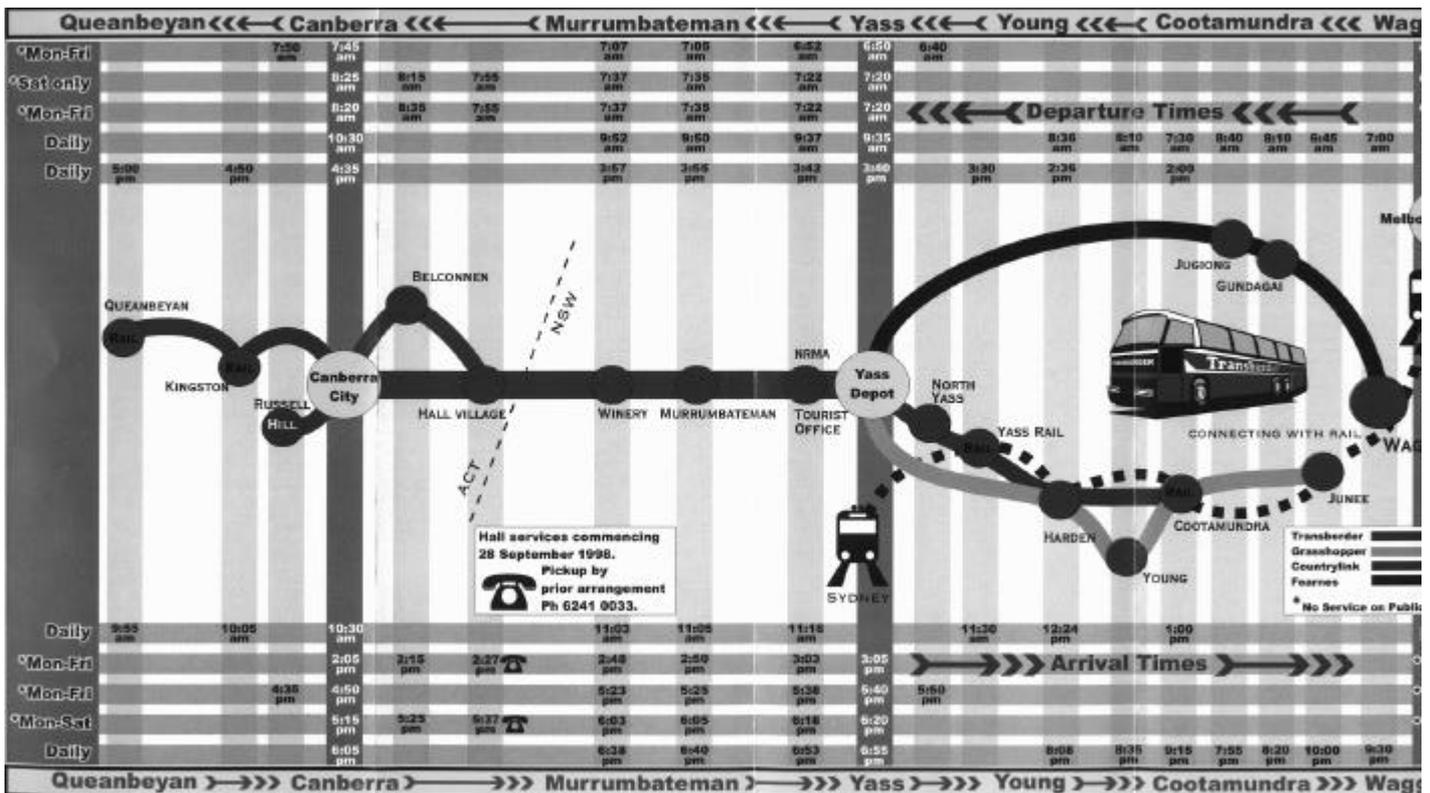
they are visiting different towns en route from Wagga and Junee to Yass and return. For example the daily service ex Canberra at 1805 arriving at Yass at 1855 connects with the Express and Grasshopper services. The times for both services are shown on the same row, i.e. Harden at 2008 and Cootamundra at 2115 for the Grass-

hopper followed by the 1955 arrival at Jugiong for the Express service which seems a little confusing.

From the TT (without referring to the notes) is not easy to decipher from the TT diagrams that Transborder operates a Countrylink service from Quean-

beyan – Canberra – Yass – Harden and Cootamundra.

In conclusion, Transborder has taken somewhat of an innovative approach to its timetable design and it certainly caught my eye when I picked up some copies at the Yass Tourist Centre.



From the editor

A few notes from the editor: **GEOFF LAMBERT.**

This is the second issue I have edited, but the first where I have been able to squeeze in anything other than the feature articles. You will have noticed some changes in style that came about with the changes in editor. These include changes in lay-out and the incorporation of images electronically, rather than by paste-up of material. Illustrations now include photographs and material directly captured from Web sites. In beginning as new editor, I inherited from Graham Duffin, the previous editor, about 20 articles that had already been submitted to The Times, but not yet printed, including four of my own. This is almost enough for 8 16-page issues of the Times and so I have timetabled(!) them to appear between November 1999 and June 2000. I hope authors will be tolerant of the long waits between when they submit material and when their articles finally appear. And I hope readers will be tolerant that future issues will feature so many of my own articles- it's not a case of self-nepotism. Despite the abundance of articles already scheduled, more are needed and I would encourage everybody to write and submit articles that will be of interest to members and readers. Articles may be about any topic of interest to AATTC members: reviews of particular timetables, historical surveys, dissertations on "time-table science", the schedules and services that timetables describe, timetables as a collector's hobby, timetables as communication devices, etc. Details of how to submit articles are on page 2.

Seinfeld's girlfriends: let the A-train decide

The path of true love- and of the A-train- never run smooth. From **GEOFF LAMBERT**

Mr Seinfeld lives in mid-town Manhattan and has two girlfriends— one up-town and one down-town. He is equally fond of these two girls and has difficulty choosing between them when he wants to visit. So he lets the A-train decide for him. He arrives at Times Square station at an entirely random time and takes either the up-town or the down-town train, whichever happens to arrive first. Both up-town and down-town trains run regularly, every ten minutes throughout the day. Yet he finds himself visiting his up-town girl-friend nine times as often as his down-town girlfriend. Why?

Answer next month.

Answer to November's "Bus waiting paradox".

If buses were to arrive at a bus stop at random intervals, with a mean interval of $T = 10$ min, then a person arriving at the bus stop at an arbitrary time might be supposed, on the average, to have to wait 5 min for the next bus. In fact, the true average waiting time would be 10 min. 5 min would be the right answer if the buses arrived regularly not randomly, so that all intervals were exactly 10 min. But in a random process, all intervals are not equal.

These assertions, which surprise most people at first, can be proved mathematically. The solution of this problem is not mathematically trivial, and we can take more than one approach. The simplest approach is to accept some of the formulas of statistics and apply them to our problem. The statistics of random processes produce the following general formula for the waiting time to the next event, when the starting point of the waiting period can be selected anywhere in the interval:

$$W = \frac{T^2 + s}{2T}$$

where T is the average interval between events and s is the variance (a measure of variability) of that value. Where T is not variable, $s=0$ and the buses run regularly, then this formula reduces to $\frac{1}{2}T$, which is what you would expect. But, for the route 400 buses, where the waiting times are randomly, or "Poisson distributed", it can be shown that $s=T^2$ and the formula then reduces to exactly T .

Yet it seems 'obvious' that, since the arbitrarily selected time is equally likely to fall anywhere in the interval between two events, the average waiting time from the selected time to the next event must be $\frac{1}{2}T$. The subtle flaw in the argument for a waiting time of $\frac{1}{2}T$ lies in the implicit assumption that the interval in which an arbitrarily selected time falls is a random selection from all intervals. In fact, longer intervals have a better chance of covering the selected time than shorter ones, and it can be shown that the average length of the interval in which an arbitrarily selected time falls is not the same as the average length of all intervals, T , but is actually $2T$. Since the selected time may fall anywhere in this interval, the average waiting time is half of $2T$,

i.e. it is T , the average length of all intervals, as originally supposed. This means that a person arriving at the bus stop at an arbitrary time would, on average, arrive in a 20-min interval. On average, the previous bus would have passed 10 min before his arrival (as long as this was not too near the time when buses started running) and, on average, it would be another 10 min until the next bus.

Lest people think that this problem and its solution are artificial ones of academic interest only, let me assure you that Route 400 buses do in fact run this way. Now, of course there isn't a despatcher at each end of the line randomly choosing when to despatch a bus. Rather it is the road traffic conditions and the heavy passenger loadings which conspire to force upon the buses a randomising process that results in a random distribution of their passing intervals by the time that they are about half-way along their route. At Sydney airport, for instance, the average *waiting time* (I have spent many hours waiting for my wife's plane to arrive) is 9.2 minutes, whereas the average *interval* between buses is 10 minutes.

Graphic Insight

By **CHRIS BROWNBILL**

Graphic Insight this month continues its series of articles on peak hours by looking at how the timing and intensity of peak hour has changed over the years. We focus again on Melbourne's Belgrave, Lilydale and Alamein train lines and look at services documented in the following timetables: Hillside Trains Belgrave & Lilydale Lines train timetable 4th July 1999; The Met 'Your Travel Guide' Belgrave & Lilydale Lines 24 August 1992; Vic Rail Ringwood timetable undated but effective from the opening of the city loop (late 1981); Victorian Railways Metropolitan Time Table Alamein, Belgrave, Lilydale etc lines March 17 1964 and Bradshaw's Guide to Victoria November 1936. As an aside, it's interesting to observe that every one of these timetables is produced by a different organisation!

Our graph uses the same 60-minute rolling total number of trains departing Flinders Street station for the Alamein, Lilydale and Belgrave lines as described last month, however we focus only on the Evening Peak, and have graphed Down services (ie peak direction) only. For clarity the lines have been smoothed by taking the 7 minute centred moving average (each point is the average of the value for seven consecutive points).

You will notice that as we move forward through the years, the height of the peak increases, and surprisingly occurs earlier in the day - except for the 1999 timetable which has a slightly lower and later peak than the 1992 and 1981 timetables. Interestingly, again broken only by the 1999 timetable, there is a strong pattern of the width of the peak being increased by bringing forward the commencement of the peak whilst retaining a very consistent and sharper reduction in services after the peak.

Notice also the striking similarity in profile between the 1981 and 1999 timetables - the only difference of any significance being the higher level of services in 1999 in the late peak between 18:30 and 20:15

In summary, it seems that at least in Melbourne's Eastern suburbs, evening peak services have been increasing over the years, and have been getting earlier. However, the 1999 timetable breaks this trend by reverting to a pattern very similar to 1981 and also by providing increased shoulder post-peak services breaking a very stable pattern to peak 'wind-down' services stretching back to the start of our analysis.

