AusTalk Annotation report – 19th December 2014

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Scope

The original goal of the Big ASC project was to provide at least a base level of annotation for the corpus. Given a limited budget and the volume of data being collected (three hours of recording from each of 1000 speakers producing a set of read isolated words, sentences, passages and spontaneously produced map tasks, interviews and story), it was necessary to explore the use of automated processes while still providing high quality manual annotation for a subset of the data. The approach we took for the annotation task was to consider using forced alignment for automatic segmentation and annotation of read-speech and to explore the possibility of automatic orthographic transcription of spontaneous speech.

It was also important to create a storage environment that would facilitate the importation of newly created annotations (e.g. additional phonemic transcriptions, detailed phonetic transcriptions, intonation transcriptions, part-of-speech tagging) which could be contributed later by project partners or other researchers.

Training

To generate time-aligned phonetic annotations for this large dataset our goal was to make use of a forced-alignment tool. We chose to work with the Munich Automatic Segmentation System (MAUS) (Schiel et al. 2011) as we already had links to the authors of this tool and they were keen to work with us to improve the quality of their aligner and extend its functionality to Australian English (AusE)

A forced aligner is a speech recognition engine which matches a known orthographic transcription to an acoustic signal. The orthographic transcription limits the possible interpretations of the acoustic signal allowing the tool to align words and/or phonetic segments with the input waveform. To perform well, the acoustic models in the speech recogniser must be first trained on data similar to that which will ultimately be processed. The acoustic models must be tuned to accommodate the phonetic processes present in the language. MAUS was already trained on English but since there are distinct differences between the diverse varieties of English it was necessary to supply training data which would allow the models to be adapted for AusE. MAUS makes use of SAMPA *(*Speech Assessment Methods Phonetic Alphabet*)* as its phonemic transcription input in the training phase but SAMPA is dialect specific. We therefore had to create an AusE version of SAMPA (SAMPA-AUS – see Appendix A) which contained the phoneme set specific to our AusE corpus. Our first task in the annotation phase was to supply the MAUS development team with sufficient training data so that they could generate an AusE version of MAUS that could then be used to automate some of the data annotation.

A set of 100 diverse speakers from whom we had collected a complete data set was selected for the purpose of providing training data for MAUS, henceforth called the 'MAUS speakers'. These speakers would become the core set for the manual annotation work that would be conducted on the corpus. The first task was to generate canonical phonemic transcriptions for each of the 59 read sentences (Appendix Bi). Based on each sentence elicitation prompt, we generated idealised *citation-form phonemic transcriptions* in SAMPA-AUS. This allowed for the creation of a small lexicon that had coverage of all words included in the sentences. Secondly, we generated an additional set of *connected speech phonemic transcription templates* to

more closely reflect the connected speech used in the actual reading task for the 59 sentences. These connected speech transcription templates (Appendix Bii) were created in a format suitable for use in the Transcriber annotation tool (Barras et al. 2000). For each of the 100 MAUS speaker's sentences, the transcribe tool was populated with the connected speech phonemic transcription template which was then hand-corrected by our annotation team with reference to the speaker's actual production. In total, phonemic transcriptions for the 59 sentences for 96 speakers were checked and corrected. This was necessary to ensure that each speaker's individual sentence phonemic transcription accurately reflected the phonemes used in the actual speech data. In some cases participants had not properly read the prompt so it was necessary to introduce new words into the individual transcriptions and revisit the citation form transcriptions to supplement the lexicon. At this point, Transcriber was used only as a convenient way to listen to the speech signal while correcting the transcription. No time-alignment was undertaken.

The Transcriber format files were then converted to Praat TextGrid (Boersma & Weenink 2014) format as required by the MAUS team for training their system. The citation and spoken language generated transcription files along with the corresponding audio files were sent to the MAUS development team so that new models for AusE could be developed. A number of iterations of the model had to be generated based on corrections to the transcripts. The ultimate new AusE model was then made available via the MAUS web interface (https://clarin.phonetik.uni-muenchen.de/BASWebServices/index.html#/services/WebMAUSMultiple) and via downloadable distribution. The idea is that once the acoustic models had been created,

orthographic transcriptions would be able to form the input data rather than fully phonemically transcribed data.

Generating a lexicon

One requirement for running forced alignment based on orthographic transcriptions is a pronunciation lexicon. From the earlier work where the sentences were painstakingly transcribed, we had generated a small lexicon (of phonemically transcribed words) that included vocabulary contained within the sentence set. We extended this lexicon to include items from the isolated word and digits elicitation tasks as well as the key landmarks/lexical items from the Map Task (see appendix C and E). In order to use MAUS on the wider set of data we would need a broad coverage of the AusE lexicon. We investigated a commercial provider who could offer a lexicon for research purposes, but it was not clear whether the conditions of use would allow us to make 'derived' forms from the pronunciation lexicon (such as a trained set of letter-to-sound rules) publicly available. Instead, we were fortunate to discover the typesetting files for an out-of-print Australian English dictionary (Australian Learners Dictionary) and obtain permission from the copyright owner, Macquarie University, to publish the data for research use. The annotation team hand-corrected the dictionary phonemic transcriptions to reflect each word's pronunciation and ensure that the lexicon conformed to the transcription standards that had been adopted in the project. We were therefore able to extract a useful broad coverage pronunciation lexicon from the dictionary.

Simultaneous to our work with the Australian Learners Dictionary, our colleagues in Munich had been working on an Australian English lexicon based on the Unisyn Lexicon (http://www.cstr.ed.ac.uk/projects/unisyn/). This system uses a standard

English pronunciation lexicon combined with rules that define regional variation to generate a custom regional lexicon. We are currently investigating combining these two resources to generate a definitive open lexicon for Australian English. The MAUS team have used the Unisyn lexicon to train a set of letter-to-sound rules which are now built into the latest version of MAUS.

Correcting MAUS annotations

The next stage of the annotation process was to make use of MAUS to generate automatic phonemic transcriptions of our read-speech data. MAUS provides a web-based interface where audio files uploaded along with associated orthographic transcriptions are processed to generate Praat TextGrids containing time aligned phonemic transcriptions. This interface is convenient for single files but since we have many thousands of files we required an automated process. The first approach was to write a script to send the audio files to the web service and store the results. The corpus meta-data was used to determine the prompt for each recording allowing us to send all of the read-speech for a speaker to be processed. Unfortunately while this worked well it was very slow, taking a few days to process a batch of data. Fortunately, MAUS is also available as a downloadable package so we were able to run the task locally and get a much better throughput – around 10 minutes per speaker for about 800 files.

Once the results of forced alignment were available, the annotation team began the laborious task of checking and correcting the annotations. Since the output of MAUS uses the Praat TextGrid format, and since our annotation team was familiar with this tool, Praat was used for the task. The task involved opening each of the MAUS TextGrid files along with the associated audio file and checking then correcting both

the phonemic transcription and the positions of the segment boundaries. This is a very labour intensive task. However, it is significantly faster than annotating each file from scratch and so will ultimately enable us to have high quality annotations for a much larger subset of the data.

This initial test phase for the MAUS aligner was run with all of the data from a single recording site (University of Canberra). Later, when we were able to run MAUS locally, we processed all of the 100 MAUS speakers' read-speech recordings and the annotation team has worked through correcting a subset of these. While we have only been able to hand correct a small subset of the data, we will ultimately run MAUS over the entire corpus of the read-speech (words, sentences, digits) to generate automatic annotations for all the data we hold.

In addition to the checking/correcting of automatically generated data, a subset of data has been hand annotated from scratch to give us a set of data that could be directly compared with the automatically generated Textgrids. Because the MAUS automatic aligner was not ready to process data until quite late in the annotation process the annotators spent a large amount of time constructing time aligned annotations in Praat from scratch by hand. This has been one of the most time consuming components of the annotation process but has resulted in manually created phonemically aligned Textgrids for the full set of scripted Words, Sentences and the Arthur Story[1] reading task for five speakers (see Appendix D for orthographic and SAMPA_AUS transcription of the story). For these five speakers we have also manually created and time aligned orthographic transcriptions for the spontaneous speech Story Retell, Interview and Map Task. An additional 35 speakers have also had their full sentence

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[1] The Arthur Story was adapted from an original tale by Sellon (1876:52-5), cited by MacMahon (1991).

set manually annotated in Praat with time aligned phoneme boundaries. In order to ensure that all annotators were consistent within themselves and with each other, a set of annotation guidelines was created and continually updated throughout the process. These guidelines were used to ensure consistency for all Textgrid annotations and were used for both manual annotation and checking/correcting of automatically generated annotations.

The corpus will ultimately contain three different types of time aligned phonemic annotations: manually generated, MAUS automatically created but manually corrected, and MAUS generated but uncorrected. These will be differentiated from each other so that researchers are aware of the origin of the annotations they are using and will be able to take the necessary steps to ensure the integrity of the data they are working with.

Transcription of Spontaneous speech

The original goal of the project was to make use of automatic speech recognition technology to provide at least low-quality orthographic transcripts of the spontaneous speech tasks in the corpus: Interview, Retold Story, Map Task and Conversation. We originally started working with a European partner who suggested that they may be able to create orthographic transcriptions for us by adapting their speech recognition engine using some of our early transcribed data. We provided data from five speakers for this training task but the team were unable to achieve a usable performance from their engine. We then attempted to make use of a commercial desktop transcription system but again, the quality of the output was very poor and was judged not to be useful even as a low-quality transcription tool. A number of trials were undertaken to improve the quality of the output but none proved useful.

The eventual solution was to use a low cost commercial transcription service. They have been able to provide us with high quality transcriptions of spontaneous speech that include timestamps on every speaker turn. One problem with commercial transcription services can be that they typically produce text for human consumption whereas we are particularly interested in machine processing of our transcriptions. It was therefore important that speaker turns, timestamps and any non-lexical annotation added to the text were created in a consistent manner. We have been able to work with the company to ensure consistency of transcription for our purposes. Spontaneous speech data from the Interview and the Retold Story from 95 speakers has been processed this way.

An important component of the spontaneous speech data is the Map Task recordings. These involved two speakers playing an interactive game and will be of particular interest to dialogue researchers and those interested in spontaneous interactions. The annotators were able to manually complete 62 map task orthographic transcriptions (time-aligned by speaker turn) using the Transcriber tool.

Workflow

STEVE can you write something about the workflow e.g. synching, easy mercurial etc.

Summary of Completed Annotations

It is important to reiterate that time-aligned annotation is a laborious and challenging process. The great achievement of the annotation phase of the AusTalk project has been in the creation of a new model for AusE that allows for time aligned phonemic annotations to be returned in Praat Textrids upon presentation of orthographic and audio input. This facility means that AusE data can be efficiently and effectively processed automatically. Manual checking and correction is still required but is much more efficient that hand annotation from scratch. We have also provided a subset of data that has been fully manually annotated which can be used as a model for researchers wishing to replicate the process in a manner that is consistent with our techniques and we have provided a manual that can be used for the purpose.

Tables 1 and 2 summarise the completed annotations. We have **manually generated** and checked the phonemically aligned TextGrids for all Words, Sentences and Arthur Story reading tasks for five speakers. For these five speakers we have also **manually created** time aligned orthographic transcriptions for the Retold Story, Interview and Map Task.

96 MAUS speakers have had their sentences phonemically transcribed in Transcriber.

A further 30 speakers' data have had TextGrids for the 59 Sentences **manually phonemically annotated and checked**.

Nine speakers have had their **automatically generated** Sentence TextGrids **manually checked and corrected.**

Thirteen speakers have had their **automatically generated** Word TextGrids **manually checked and corrected.**

62 map tasks have been **manually orthographically transcribed** and time aligned by turn.

92 Arthur retellings have been **orthographically transcribed** by a third party.

95 interviews have been **orthographically transcribed** by a third party.

46 speakers have had their Words set 1 **automatically generated** by MAUS. 13 of these have been **manually checked and corrected**.

47 speakers have had their Words set 2 **automatically generated** by MAUS. 13 of these have been **manually checked and corrected**.

30 speakers have had their Words set 3 **automatically generated** by MAUS. 13 of these have been **manually checked and corrected**.

13 speakers have had their sentences **automatically generated** by MAUS. 10 of these have been **manually checked and corrected** including one whose data was also **manually created and checked**.

Table 1 Scripted-speech completed annotations - number of speakers

	Words 1 n=327	Words 2 n=327	Words 3 n=327	59 Sentences	Arthur Story
Manual and checked Textgrids	5	5	5	35	5
Automatic	13	13	13	9	

				96	
Textgrids corrected					
Manual Orthography				96	
MAUS generated unchecked	46	47	30		

Table 2 Unscripted-speech completed annotations - number of speakers

	Retold Story	Interview	Map Task
Manual Orthographic Transcriptions			62
3rd Party Orthographic Transcriptions	92	95	

References:

Barras, C., Geoffrois, E., Wu, Z. & Liberman, M. (2000). "Transcriber: development and use of a tool for assisting speech corpora production". *Speech Communication*, 33, 1–2.

Boersma, P. & Weenink, D. (2014): Praat: doing phonetics by computer [Computer program].Version 5.3.51, retrieved 12 August 2014 from http://www.praat.org/

MacMahon, M. (1991) The woman behind Arthur, *Journal of the International Phonetic Association*, *21*, 29-31.

Schiel, F., Draxler, C. & Harrington, J. (2011): Phonemic Segmentation and Labelling using the MAUS Technique, Workshop 'New Tools and Methods for Very-Large-Scale Phonetics Research', University of Pennsylvania, January 28-31.

APPENDIX A

SAMPA_AUS

SAMPA_Aus	EXAMPLE	IPA
p	**p**en, s**p**in, ti**p**	p
b	**b**ut, we**b**	b
t	**t**wo, s**t**ing, be**t**, wa**t**er	t
d	**d**o, o**dd**	d
k	**c**at, **k**ill, **sk**in, **q**ueen, thi**ck**	k
g	**g**o, **g**et, be**g**	g

tS	chair, nature, teach	tʃ
dZ	gin, joy, edge	ʤ
f	fool, enough, leaf	f
v	voice, have, of	v
T	thing, breath	θ
D	this, breathe	ð
s	see, city, pass	s
z	zoo, rose	z
S	she, sure, emotion, leash	ʃ
Z	pleasure, beige	ʒ
h	ham	h
m	man, ham	m
n	no, tin	n
N	singer, ring	ŋ
l	left, bell	l
r\	run, very	ɹ

w	**w**e	w
j	**y**es	j
W	**wh**at (some accents, such as Scottish)	ʍ
6:	f**a**ther	ɐː
i:	s**ee**	iː
I	k**i**t	ɪ
e	b**e**d	e
3:	b**ir**d	ɜː
{	l**a**d, c**a**t, r**a**n	æ
6	r**u**n, en**ou**gh	ɐ
O	n**o**t, w**a**sp	ɔ
o:	l**aw**, c**au**ght	oː
U	p**u**t	ʊ
}:	s**oo**n, thr**ou**gh	ʉː
@	**a**bout, winn**er**	ə

{I	d**ay**	æɪ
Ae	m**y**	ɑe
oI	b**oy**	ɔɪ
@}	n**o**	əʉ
{O	n**ow**	æɔ
I@	n**ear**, h**ere**	ɪə
e:	h**air**, th**ere**	eː
U@	t**our**	ʊə (more usually ʉːə - dysyllabic)

APPENDIX B i)

SENTENCES ORTHOGRAPHY

1. He flew round in an instant to look his attacker square in the eye.

2. The kid gave a long moan when the milk was spilt.

3. The table is badly glued and made so sloppily that it tilts.

4. We're glad that the price range is smaller than any of us expected.

5. The grass was mown before the uncontrollable children came out to play.

6. He hurled several stones from the bridge whilst I quickly ran for cover.

7. Troy flicks through a yuppie magazine when he gets a chance.

8. Thank goodness it's Friday and time to go home!

9. Pete sat in the little boat with his bait and his fishing boots on the floor beside him waiting for the trout to bite.

10. Who says itches are always so tempting to scratch?

11. Actually, I'll hedge my bets and take no risks on this flutter.

12. Alan took a ham sandwich to school.

13. The length of her skirt caused the passers-by to glare.

14. I'll thrash out a draft and lodge those new proposals before the next mass meeting.

15. She'll think of an excuse why she overslept if given enough time and space.

16. Helen picked a good spot near the water and spent the morning surfing and relaxing in the sun.

17. Unfortunately, the bath plug is missing so you'll have to take a shower.

18. The group asked if I wanted to come along on the barge trip.

19. You ought to brush your teeth and wash your face before you go to bed.

20. The earth used to be flat, but now it's a sphere ... isn't it?

21. I wish he'd either grow a beard or shave his scruffy moustache.

22. Melvin's cat was slowly rolling the can.

23. Judith found the three manuscripts waiting for her on the piano.

24. The dwarf's throne was in a huge castle encircled by a deep moat.

25. Isn't it odd how cobwebs slowly find their way into every nook and cranny!

26. Mr Boyd says these practical jokes have been taken much too far.

27. I said she couldn't do it but she can.

28. This year I shall paint this room mauve with a splotch of beige dots.

29. It can be quite risky changing gear whilst half way up a steep hill.

30. There'll be big trouble if you dare to touch that stretched surface.

31. Amongst her friends at the Glebe Baths she was considered beautiful.

32. The truth is, I wish I lived a little bit nearer to the supermarket.

33. Don't breathe a word of this, but the topic of Jeff's speech is beginning to annoy me.

34. This new glove and shoe display attracts more customers than ever!

35. We'd be hard pushed for the whole squad to catch the bus to Springwood tonight.

36. The nurse tended the fierce-looking flesh wound on Paul's scalp.

37. Bill could have sat on the train like a zombie but chose to stand.

38. Most of the scenes filmed on location in the Alps were breathtaking.

39. The flag ceremony overwhelmed me and I was moved to tears.

40. Was it the blue globe that broke when he switched on the light?

41. Don't you think her evening gown was a trifle too garish for the occasion?

42. He glimpsed the badge of the traffic cop out of the corner of his eye.

43. He grabbed a towel and then answered the phone by the clock.

44. Sharon vowed never again to sneer at tourists buying souvenir dolls.

45. It seems as if Susan does all the floor cleaning for this frugal household.

46. John could supply him with the latest draft of his work to proof-read.

47. The dear old bishop was thrust into trouble with the self-absorbed mayor.

48. I've just seen that rogue, Charles, tearing off in a hurry to his maths exam.

49. My mother gets cross when they say "yeah" instead of "yes".

50. A squirt of this ointment will soothe the graze on your heel.

51. Isn't it common knowledge that the kangaroo has a pouch in front?

52. Apparently, bulldog terriers yap almost as much as chows.

53. Surely, if you leave the record by the fire it will warp.

54. Enjoying her freedom, Amelia went to the zoo and saw a rare giant sloth.

55. Please, I feel too lethargic to wash up tonight.

56. The plane flew down low over the runway, then increased speed and circled the airfield a second time.

57. After a gaffe like that, it is futile to offer any further resistance, isn't it?

58. The chill wind caused the twins to shiver violently in their threadbare clothes.

59. Sharon watched the helicopter as it lifted off the deck hovered for a couple of seconds and then landed once more.

APPENDIX Bii)

SENTENCES SAMPA_AUS

1. /hi: fl}: r\{Ond In @n Inst@nt t@ lUk hIz @t{k@ skwe:r\ In Di: Ae/

2. /D@ kId g{Iv @ lON m@}n wen D@ mIlk w@z spIlt/

3. /D@ t{Ib@l Iz b{dli: gl}:d @n m{Id s@} slOp@li: D{t @t tIlts/

4. /we: gl{d D@t D@ pr\Aes r\{IndZ @z smo:l@ D@n eni: @v @s @kspekt@d/

5. /D@ gr\6:s w@z m@}n b@fo: Di: 6nk@ntr\@}l@b@l

tSIldr\@n k{Im {Ot t@ pl{I/

6. /hi: h3:ld sevr\@l st@}nz fr\@m D@ br\IdZ wAelst Ae

kwIkli: r\{n f@ k6v@/

7. /tr\oI flIks Tr\}: @ j6pi: m{g@zi:n wen i: gets @ tS{ns/

8. /T{Nk gUdn@s @ts fr\Aed{I @n tAem t@ g@} h@}m/

9. /pi:t s{t In D@ lIt@l b@}t wIT hIz b{It @n hIz fISIN

b}:ts On D@ flo: b@sAed hIm w{ItIN f@ D@ tr\{Ot t@

bAet/

10. /h}: sez ItS@z @r\ o:lw{Iz s@} temptIN t@ skr\{tS/

11. /{ktS@li: Ael hedZ mAe bets @n t{Ik n@} r\Isks On DIs

fl6t@/

12. /{l@n tUk @ h{m s{nwItS t@ sk}:l/

13. /D@ leNkT @v h@ sk3:t ko:zd D@ p6:s@z bAe t@ gle:/

14. /Ael Tr\{S {Ot @ dr\6:ft @n lOdZ D@}z nj}:

pr\@p@}z@lz b@fo: D@ nekst m{s mi:tIN/

15. /Si:l TINk @v @n Ikskj}:s wAe Si: @}v@slept If gIv@n

@n6f tAem @n sp{Is/

16. /hel@n pIkt @ gUd spOt nI@ D@ wo:t@ @n spent D@

mo:nIN s3:fIN @n r\@l{ksIN In D@ s6n/

17. /6nfo:tS@n@tli: D@ b6:T pl6g Iz mIsIN s@} j}:l h{f t@

t{Ik @ S{O@/

18. /D@ gr\}:p 6:skt If Ae wOnt@d t@ k6m @lON On D@

b6:dZ tr\Ip/

19. /j}: o:t t@ br\6S j@ ti:T @n wOS j@ f{Is b@fo: j@ g@}

t@ bed/

20. /Di: 3:T j}:s t@ bi: fl{t b@t n{O @ts @ sfI@ Iz@nt @t/

21. /Ae wIS hi:d AeD@ gr\@} @ bI@d o: S{Iv hIz skr\6fi:

m@st6:S/

22. /melv@nz k{t w@z sl@}li: r\@}lIN D@ k{n/

23. /dZ}:d@T f{Ond D@ Tr\i: m{nj@skr\Ipts w{ItIN f@ h3:

On D@ pi:{n@}/

24. /D@ dwo:fs Tr\@}n w@z In @ hj}:dZ k6:s@l @ns3:k@ld

bAe @ di:p m@}t/

25. /Iz@n @t Od h{O kObwebz sl@}li: fAen De: w{I Int@

evr\i: nUk @n kr\{ni:/

26. /mIst@ boId sez Di:z pr\{ktIk@l dZ@}ks h@v bi:n t{Ik@n

m6tS t}: f6:/

27. /Ae sed Si: kUd@nt d}: @t b6t Si: k{n/

28. /DIs jI@r\ Ae S{l p{Int DIs r\}:m m@}v wID @ splOtS

@v b{IZ dOts/

29. /It k@n bi: kwAet r\Iski: tS{IndZIN gI@ wAelst h6:f w{I

6p @ sti:p hIl/

30. /De:l bi: bIg tr\6b@l If j@ de: t@ t6tS D{t str\etSt

s3:f@s/

31. /@m6Nkst h@ fr\endz @t D@ gli:b b6:Dz Si: w@z

k@nsId@d bj}:t@f@l/

32. /D@ tr\}:T Iz Ae wIS Ae lIvd @ lIt@l bIt nI@r\@ t@ D@

s}:p@m6:k@t/

33. /d@}nt br\i:D @ w3:d @v DIs b6t D@ tOpIk @v dZefs

spi:tS Iz b@gInIN t}: @noI mi:/

34. /DIs nj}: gl6v @n S}: d@spl{I @tr\{ks mo: k6st@m@z

D@n ev@/

35. /wi:d bi: h6:d pUSt f@ D@ h@}l skwOd t@ k{tS D@

b6s t@ spr\INwUd t@nAet/

36. /D@ n3:s tend@d D@ fI@s lUkIN fleS w}:nd On po:lz

sk{lp/

37. /bIl kUd @v s{t On D@ tr\{In lAek @ zOmbi: b@t tS@}z

t@ st{nd/

38. /m@}st @v D@ si:nz fIlmd On l@}k{IS@n In Di: {lps

w@ br\eTt{IkIN/

39. /D@ fl{g ser\@m@}ni: @}v@welmd mi: @n Ae w@z

m}:vd t@ tI@z/

40. /wOz @t D@ bl}: gl@}b D@t br\@}k wen i: swItSt On

D@ lAet/

41. /d@}nt j@ TINk h@r\ i:vnIN g{On w@z @ tr\Aef@l t}:

ge:r\IS f@ Di: @k{IZ@n/

42. /hi: glImpst D@ b{dZ @v D@ tr\{fIk kOp {Ot @v D@

ko:n@r\ @v Iz Ae/

43. /hi: gr\{bd @ t{Ol @n Den {ns@d D@ f@}n bAe D@

klOk/

44. /S{r\@n v{Od nev@r\ @gen t@ snI@r\ @t t}:r\@sts

bAeIN s}:v@nI@ dOlz/

45. /@t si:mz @z If s}:z@n d6z o:l D@ flo: kli:nIN f@ DIs

fr\}:g@l h{Osh@}ld/

46. /dZOn kUd s@plAe hIm wIT D@ l{It@st dr\6:ft @v Iz

w3:k t@ pr\}:fr\i:d/

47. /D@ dI@r\ @}ld bIS@p w@z Tr\6st Int@ tr\6b@l wIT

D@ self@bzo:bd me:/

48. /Aev dZ6st si:n D{t r\@}g tS6:lz te:r\IN Of In @ h6r\i: t}:

Iz m{Ts @gz{m/

49. /mAe m6D@ gets kr\Os wen D{I s{I je: Insted @v jes/

50. /@ skw3:t @v DIs oIntm@nt w@l s}:D D@ gr\{Iz On jo:

hi:l/

51. /Iz@nt @t kOm@n nOlIdZ D@t D@ k{Ng@r\}: h{z @

p{OtS In fr\6nt/

52. /@p{r\@ntli: bUldOg ter\i:@z j{p o:lm@}st @z m6tS @z

tS{Oz/

53. /So:li: If j@ li:v D@ r\eko:d bAe D@ fAe@ It w@l wo:p/

54. /endZoIIN h@ fr\i:d@m @mi:li:@ went t@ D@ z}: @n

so: @ r\e: dZAe@nt sloT/

55. /pli:z Ae fi:l t}: l@T6:dZIk t@ wOS 6p t@nAet/

56. /D@ pl{In fl}: d{On l@} @}v@ D@ r\6nw{I Den INkr\i:st

spi:d @n s3:k@ld Di: e:fi:ld @ sek@n tAem/

57. /6:ft@ @ g{f lAek D{t @ts fj}:tAel t@ Of@r\ eni: f3:D@

r\@zIst@ns Iz@nt @t/

58. /D@ tSIl wInd ko:zd D@ twInz t@ SIv@ vAel@ntli: In

De: Tr\edbe: kl@}Dz/

59. /S{r\@n wOtSt D@ heli:kOpt@r\ @z @t lIft@d Of D@

dek hOv@d f@r\ @ k6p@l @v sek@nz @n Den l{nd@d

w6ns mo:/

APPENDIX C

Single Words - SAMPA_AUS phonemic transcriptions

Word	Sampa Transcription	Variations
abandon	/@b{nd@n/	
adapt	/@d{pt/	

adjust	/@dZ6st/
Al	/{l/
Alan	/{l@n/
album	/{lb@m/
alfalfa	/{lf{lf@/
alibi	/{l@bAe/
alien	/{Ili:@n/
alimony	/{l@m@ni:/ /{l@m@}ni:/
alligator	/{l@g{It@/
aluminium	/{lj@mIni:@m/ /{l@mIni:@m//{l@mInj@m/
amphibian	/{mfIbi:@n/
anaemia	/@ni:mi:@/
anatomy	/@n{t@mi:/

apple	/{p@l/		
Australia	/@str\{Ili:@/	/@str\{Ilj@/	/Ostr\{Ilj@/
	/Ostr\{Ili:@/		
avocado	/{v@k6:d@}/		
axle	/{ks@l/		
bad	/b{d/		
balcony	/b{lk@ni:/		
ballot	/b{l@t/		
ban	/b{n/		
band	/b{nd/		
banish	/b{nIS/		
banner	/b{n@/		
bant	/b{nt/		
barrack	/b{r\@k/	/b{r\Ik/	

bassinet	/b{s@net/
bat	/b{t/
battle	/b{t@l/
bazooka	/b@z}:k@/
bed	/bed/
Ben	/ben/
bend	/bend/
bent	/bent/
bet	/bet/
bullock	/bUl@k/
butler	/b6tl@/
button	/b6t@n/
cabin	/k{b@n/

camel	/k{m@l/
carol	/k{r\@l/
carriage	/k{r\IdZ/
caterpillar	/k{t@pIl@/
cauliflower	/kOli:fl{O@/
chew	/tS}:/
chicken	/tSIk@n/
closet	/klOz@t/
coal	/k@}l/
Col	/kOl/
cold	/k@}ld/
colt	/k@}lt/
comply	/k@mplAe/

conspicuous	/k@nspIkj}:@s/	
constellation	/kOnst@l{IS@n/	
corridor	/kOr\@do:/	
cousin	/k6z@n/	
coyote	/kAe@}ti:/	
cube	/kj}:b/	
cult	/kOlt/	/k6lt/
curl	/k3:l/	
curriculum	/k@r\Ikj@l@m/	
dabble	/d{b@l/	
dance	/d{ns/	/d6:ns/
delete	/d@li:t/	
dew	/dZ}:/	/dj}:/

diabetes	/dAe@bi:ti:z/	
do	/d}:/	
dole	/d@}l/	
doll	/dOl/	
dormitory	/do:m@tr\i:/	/do:m@to:r\i:/
draw	/dr\o:/	
drawing	/dr\o:IN/	/dr\o:r\IN/
drew	/dr\}:/	
due	/dZ}:/	/dj}:/
elbow	/elb@}/	
Elle	/el/	
Ellen	/el@n/	
epidemic	/ep@demIk/	

epilepsy	/ep@lepsi:/
Ethan	/i:T@n/
evaporate	/@v{p@r\{It/
facial	/f{IS@l/
fashion	/f{S@n/
fatigue	/f@ti:g/
feel	/fi:l/
flounder	/fl{Ond@/
gallop	/g{l@p/
gavel	/g{v@l/
gazelle	/g@zel/
giant	/dZAe@nt/
girl	/g3:l/

golf	/gOlf/	/g@}lf/
graph	/gr\{f/	
guitar	/g@t6:/	
gulf	/gOlf/	/g6lf/
had	/h{d/	
hade	/h{Id/	
haggle	/h{g@l/	
hah	/h6:/	
hail	/h{Il/	
hair	/he:/	
haired	/he:d/	
Hal	/h{l/	
hall	/ho:l/	

Halloween   /h{l@wi:n/

han   /h{n/

hane   /h{In/

happen   /h{p@n/

hard   /h6:d/

harl   /h6:l/

harn   /h6:n/

hat   /h{t/

hate   /h{It/

hay   /h{I/

he   /hi:/

head   /hed/

hear   /hI@/

heared	/hI@d/	
heart	/h6:t/	
heat	/hi:t/	
heathen	/hi:D@n/	
heed	/hi:d/	
heel	/hi:l/	
heen	/hi:n/	
height	/hAet/	
helicopter	/heli:kOpt@/	/hel@kOpt@/
hell	/hel/	
hen	/hen/	
her	/h3:/	
herd	/h3:d/	

het	/het/
hi	/hAe/
hid	/hId/
hide	/hAed/
hile	/hAel/
hill	/hIl/
hin	/hIn/
hine	/hAen/
hinges	/hIndZ@z/
hit	/hIt/
hod	/hOd/
hode	/h@}d/
hoe	/h@}/

hoil	/hoIl/
hoin	/hoIn/
hoit	/hoIt/
hole	/h@}l/
holl	/hOl/
hon	/hOn/
hone	/h@}n/
hood	/hUd/
hooll	/hUl/
hoon	/h}:n/
hoot	/h}:t/
hoott	/hUt/
horde	/ho:d/

hore	/ho:/
horn	/ho:n/
hort	/ho:t/
hot	/hOt/
hote	/h@}t/
how	/h{O/
howd	/h{Od/
howl	/h{Ol/
hown	/h{On/
howt	/h{Ot/
hoy	/hoI/
hoyd	/hoId/
hud	/h6d/

hull	/h6l/
hun	/h6n/
hunger	/h6Ng@/
hunter	/h6nt@/
hurl	/h3:l/
hurn	/h3:n/
hurrah	/h@r\6:/
hurt	/h3:t/
hut	/h6t/
imagine	/@m{dZ@n/ /Im{dZ@n/
influenza	/Infl}:enz@/
June	/dZ}:n/
kangaroo	/k{Ng@r\}:/

kazoo	/k@z}:/
kitchen	/kItS@n/
law	/lo:/
leaf	/li:f/
lighthouse	/lAeth{Os/
listen	/lIs@n/
lonely	/l@}nli:/
lore	/lo:/
lure	/l}:@/
macaroni	/m{k@r\@}ni:/
Mal	/m{l/
Malcolm	/m{lk@m/
mallow	/m{l@}/

manufacture	/m{nj@f{kS@/	/m{nj}:f{kS@/	/m{n@f{ktS@/
	/m{nj@f{ktS@/		
mascara	/m{sk6:r\@/	/m@sk6:r\@/	
masquerade	/m{sk@r\{Id/		
Mel	/mel/		
melancholy	/mel@nkOli:/		
Melbourne	/melb@n/		
mellow	/mel@}/		
methane	/mi:T{In/		
methyl	/meT@l/		
mill	/mIl/		
miller	/mIl@/		
million	/mIlj@n/		
mills	/mIlz/		

mirror	/mIr\@/
museum	/mj}:zi:@m
music	/mj}:zIk/
new	/nj}:/
Nigel	/nAedZ@l/
Ninjas	/nIndZ@z/
noose	/n}:s/
onion	/6nj@n/
only	/@}nli:/
oven	/6v@n/
own	/@}n/
pad	/p{d/
paddle	/p{d@l/

palace	/p{l@s/
pan	/p{n/
pand	/p{nd/
panel	/p{n@l/
panned	/p{nd/
pant	/p{nt/
paranoia	/p{r\@noI@/
Paris	/p{r\@s/
parish	/p{r\IS/
parrot	/p{r\@t/
pat	/p{t/
paw	/po:/
pearl	/p3:l/

ped	/ped/	
pen	/pen/	
pend	/pend/	
pent	/pent/	
pet	/pet/	
pew	/pj}:/	
pill	/pIl/	
pillar	/pIl@/	
pillion	/pIlj@n/	
pillow	/pIl@}/	
pills	/pIlz/	
plant	/pl{nt/	/pl6:nt/
pole	/p@}l/	

polish	/pOlIS/
Polish	/p@}lIS/
poodle	/p}:d@l/
pool	/p}:l/
poor	/po:/
porcupine	/po:kj@pAen/
pour	/po:/
puffin	/p6f@n/
pull	/pUl/
pure	/pj}:@/
pyjamas	/p@dZ6:m@z/
pyramid	/pIr\@mId/
raffle	/r\{f@l/

ran	/r\{n/	
raw	/r\o:/	
recipe	/r\es@pi:/	
relish	/r\elIS/	
roar	/r\o:/	
roaring	/r\o:r\IN/	/r\o:IN/
Rosa's	/r\@}z@z/	
roses	/r\@}z@z/	
rude	/r\}:d/	
satchel	/s{tS@l/	
saw	/so:/	
sawing	/so:r\IN/	/so:IN/
school	/sk}:l/	

scorpio	/sko:pi:@}/
serenade	/ser\@n{Id/
Shaw	/So:/
sheriff	/Ser\@f/
shore	/So:/
shrew	/Sr\}:/
shudder	/S6d@/
shutter	/S6t@/
silhouette	/sIl@wet/
slow	/sl@}/
slowly	/sl@}li:/
sore	/so:/
souvenir	/s}:v@nI@/

spider	/spAed@/	
sterile	/ster\Ael/	
stew	/stS}:/	/stj}:/
strew	/str\}:/	
sudden	/s6d@n/	
sure	/So:/	
syrup	/sIr\@p/	
tackle	/t{k@l/	
tangerine	/t{ndZ@r\i:n/	
tassel	/t{s@l/	
taw	/to:/	
than	/D{n/	
then	/Den/	

threw	/Tr\}:/	
thunder	/T6nd@/	
tiger	/tAeg@/	
to	/t}:/	
tomato	/t@m6:t@}/	
tore	/to:/	
tour	/t}:@/	
triumph	/tr\Ae6mf/	/tr\Ae@mf/
true	/tr\}:/	
tuna	/tS}:n@/	/tj}:n@/
tune	/tS}:n/	/tj}:n/
tuner	/tS}:n@/	/tj}:n@/
vaccine	/v{ksi:n/	

vegemite	/vedZ@mAet/	/vedZi:mAet/
view	/vj}:/	
vision	/vIZ@n/	
voodoo	/v}:d}:/	
wagon	/w{g@n/	
war	/wo:/	
who	/h}:/	
who'd	/h}:d/	
who'll	/h}:l/	
whore	/ho:/	
Wran	/r\{n/	
wren	/r\en/	
you	/j}:/	

APPENDIX D

ARTHUR THE RAT – ORTHOGRAPHIC TRANSCRIPTION

1. Once upon a time, there was a young rat named Arthur who couldn't make up his mind. Whenever the other rats asked him if he would like to go out hunting with them, he would answer in a soft voice, "I don't know." And when they said, "Would you rather stay inside?" he wouldn't say yes or no either. He'd always avoid making a choice.

2. One fine day, his aunt Zelda appealed to him, "Now look here! No one is going to care about you if you carry on like this. You have no more mind of your own than a greasy old blade of grass!" Arthur coughed and looked wise as usual, but said nothing. "Don't you think so?" said Zelda, stamping her foot, for she couldn't bear to see the poor little rat so coldblooded. "I don't know," was all he ever answered, and then he'd walk off to think for an hour or more about whether he would stay in his hole in the ground or go up into the loft.

3. One night the rats heard a loud noise. They lived in a very dark and dreary old place. The roof let the rain come washing in, making shallow pools on the muddy floor. The beams and rafters were all rotten through, so eventually the whole structure was quite unsafe. At last, one of the joists gave way and the beams fell down. The walls shook and the ceiling collapsed with a loud bang. The rats shrieked and their fur stood on end with fear and horror. "This won't do," said their leader with a scowl. "We can't stay cooped up here any longer." So he sent out scouts to search for a new home.

4. A little later in the evening they came back, having found an old-fashioned barn near a stone house where there would be room, board and food for all of them. There, they saw a kindly mare named Alberta, a cow, and some birds in the garden with an elm tree in the middle. The leader gave the order at once, "Company, fall in!". The rats crawled out of their holes right away and the sad mob stood on the floor in a long line.

5. Just then, the old rat caught sight of young Arthur. He wasn't in the line, and he wasn't exactly outside it; he stood just nearby, ears pricked. "Come on, get in line!" growled the old rodent, unamused. "You are coming too, aren't you?" I don't know," said Arthur calmly. "Why, the idea of it! You don't think it's safe here anymore, do you?" "I'm not certain," said Arthur, undaunted. "The roof may not fall down yet." "Well," said the old rat, "you would be stupid not to join us." Then he turned to the assembled group and shouted, "Right about face! March!" and the long line marched out of the barn while the young rat watched them.

6. "I think I'll go tomorrow," he said to himself, "but then again, perhaps I won't - it's so nice and snug here. I guess I'll go back to my hole under the log for a while before I make up my mind."

7. But during the night there was a big crash. Down came beams, rafters, joists — the whole business— in a pile of rubble.

Next morning, there was a foggy dew. Some boys and girls ran to the barn and a man in boots came to view the damage. It seemed odd that the old building was not haunted by rats. But at last one of the children happened to nudge a board and he saw

a puny rat, quite dead, tail half in and half out of his hole. Thus the coward got his due, and there was no mourning him.

ARTHUR THE RAT – SAMPA_AUS

1.

/w6ns @pOn @ tAem De: w@z @ j6N r\{t n{Imd 6:T@ h}: kUd@nt m{Ik 6p hIz mAend

wenev@ Di: 6D@ r{ts 6:skt hIm If hi: w@d lAek t@ g@} {Ot h6ntIN wIT Dem

hi: w@d {ns@r\ In @ sOft voIs

Ae d@}nt n@}

@n wen D{I sed wUd j@ r\6:D@ st{I InsAed

hi: wUd@nt s{I jes o: n@} i:D@

hi:d o:lw{Iz @voId m{IkIN @ tSoIs/

2.

/w6n fAen d{I hIz 6:nt zeld@ @pi:ld t@ hIm

n{O lUk hI@ n@} w6n Iz g@}IN t@ ke:r\ @b{OtS}: If j@ k{r\i: On

lAek Dis

j}: h{v n@} mo: mAend @v j@r\ @}n D@n @ gr\i:zi: @}ld bl{Id

@v gr\6:s

6:T@ kOft @n lUkt wAez @z j}:Z}:@l b@t sed n6TIN

d@}nt j}: TINk s@} sed zeld@ st{mpIN h@ fUt

f@ Si: kUd@nt be: t@ si: D@ po: lIt@l r\{t s@} k@}lbl6d@d

Ae d@}nt n@} w@z o:l hi: ev@ {ns@d

@n Den hi:d wo:k Of t@ TINk f@r\ @n {O@r\ o: mo: @b{Ot weD@

hi: w@d st{I In hIz h@}l In D@ gr\{Ond o: g@} 6p Int@ D@ lOft/

3.

/w6n nAet D@ r\{ts h3:d @ l{Od noIz D{I lIvd In @ ver\i: d6:k @n

dr\I@r\i: @}ld pl{Is

D@ r\}:f let D@ r\{In k6m wOSIN In m{IkIN S{l@} p}:lz On D@

m6di: flo:

D@ bi:mz @n r\6:ft@z w@r\ o:l r\Ot@n Tr\}: s@} @ventS@li: D@

h@}l str\6ktS@ w@z kwAet 6ns{If

{t l6:st w6n @v D@ dZoIsts g{Iv w{I {n D@ bi:mz fel d{On

D@ wo:lz Suk {n D@ si:lIN k@l{pst wIT @ l{Od b{N

D@ r\{ts Sr\i:kt @n De: f3: stUd On end wIT fI@r\ @n hOr\@

Dis w@}nt d}: sed De: li:d@ wIT @ sk{Ol

wi: k6:nt st{I k}:pt 6p hI@ eni: lONg@

s@} hi: sent {Ot sk{Ots t@ s3:tS f@r\ @ nj}: h@}m/

4.

/@ lIt@l l{It@r\ In Di: i:vnIN D{I k{Im b{k h{vIN f{Ond @n @}ld

f{S@nd b6:n nI@r\ @ st@}n h{Os we: De: w@d bi: r\}:m bo:d {nd

f}:d f@r\ o:l @v Dem

De: D{I so: @ kAendli: me: n{Imd {lb3:t@ @ k{O {n s@m b3:dz In

D@ g6:d@n wIT @n elm tr\i: In D@ mId@l

D@ li:d@ g{Iv Di: o:d@r\ @t w6ns k6mp@ni: fo:l In

D@ r\{ts kr\o:ld {Ot @v De: h@}lz r\Aet @w{I {n D@ s{d mOb

stUd On D@ flo:r\ In @ lON lAen/

5.

/dZ6st Den Di: @}ld r\{t ko:t sAet @v j6N 6:T@

hi: wOz@nt In D@ lAen {n hi: wOz@nt egz{ktli: {OtsAed @t

hi: stUd dZ6st nI@bAe I@z pr\Ikt

k6m On get In lAen gr\{Old Di: @}ld r\@}d@nt 6n@mj}:zd

j}: 6: k6mIN t}: 6:nt j}:

Ae d@}nt n@} sed 6:T@ k6:mli:

wAe Di: AedI@r\ @v @t j}: d@}nt TINk Its s{If hI@ eni: mo: d}: j}:

Aem nOt s3:t@n sed 6:T@ 6ndo:nt@d D@ r\}:f m{I nOt fo:l d{On jet

wel sed Di: @}ld r\{t j}: wUd bi: stj}:p@d nOt t@ dZoIn @s

Den hi: t3:nd t@ Di: @semb@ld gr\}:p @n S{Ot@d r\Aet @b{Ot f{Is

m6:tS

{nd D@ lON lAen m6:tSt {Ot @v D@ b6:n wAel D@ j6N r{t wOtSt

Dem∕

6.

∕Ae TINk Ael g@} t@mOr@} hi: sed t@ hImself

b@t Den @gen p@h{ps Ae w@}nt Its s@} nAes @n sn6g hI@

Ae ges Ael g@} b{k t@ mAe h@}l 6nd@ D@ lOg f@r\ @ wAel

bi:fo:r\ Ae m{Ik 6p mAe mAend∕

7.

/b@t dZ}:r\IN D@ nAet De: w@z @ bIg kr\{S d{On k{Im bi:mz

r\6:ft@z dZoIsts D@ h@}l bIzn@s In @ pAel @v r\6b@l/

/neks mo:nIN De: w@z @ fOgi: dZ}: s@m boIz @n g3:lz r\{n t@

D@ b6:n {nd @ m{n in b}:ts k{Im t@ vj}: D@ d{mIdZ/

/It si:md Od D@t Di: @}ld bIldIN w@z nOt ho:nt@d bAe r\{ts/

/b@t @t l6:st w6n @v D@ tSIldr\@n h{p@nd t@ n6dZ @ bo:d/

/{n hi: so: @ pj}:ni: r\{t kwAet ded t{Il h6:f In @n h6:f {Ot @v hIz

h@}l/

/D6s D@ k{O@d gOt hIz dZ}: @n De: w@z n@} mo:nIN hIm/

APPENDIX E

MAP TASK LANDMARKS – SAMPA_AUS

MAP A

Water Avenue   wo:t@ {v@nj}:

                                      wo:t@r\ {v@nj}:

Water Road	wo:t@ r\@}d
Australia Estate	@str\{Ili:@ @st{It
	@str\{Ili:@r\ @st{It
	@str\{Ilj@ @st{It
	@str\{Ilj@r\ @st{It
Koala Estate	k@6:l@ @st{It
	k@6:l@r\ @st{It
Four Oaks Hotel	fo: @}ks h@}tel
	fo:r\ @}ks h@}tel
Shaw Apartments	So: @p6:tm@nts
	So:r\ @p6:tm@nts
Button Factory	b6t@n f{ktr\i:
	b6t@n f{kt@r\i:
Cotton Grove	kOt@n gr\@}v
Apple Tree Avenue	{p@l tr\i: {v@nj}:

Cobblestone Drive	kOb@lst@}n dr\Aev
Cobblestone Path	kOb@lst@}n p6:T
Dance Shop	d{ns SOp
Handmade Fence	h{nm{Id fens
Thrifty Bank	Tr\Ifti: b{Nk
Thrifty Cashier	Tr\Ifti: k{SI@
Jet Theatre	dZet TI@t@
Football Field	fUtbo:l fI@ld
Alpine Heights	{lpAen hAets
Bluebird Deli	bl}:b3:d deli:
Seagull Deli	si:g6l deli:
Girls' School	g3:lz sk}:l

MAP B

Melba Avenue	melb@ {v@nj}:

	melb@r\ {v@nj}:
Manor Apartments	m{n@ @p6:tm@nts
	m{n@r\ @p6:tm@nts
Manta Apartments	m{nt@ @p6:tm@nts
	m{nt@r\ @p6:tm@nts
Law Offices	lo: Of@s@z
	lo:r\ Of@s@z
Star Academy	st6: @k{d@mi:
	st6:r\ @k{d@mi:
Wooden Pole	wUd@n p@}l
New East Tunnel	nj}: i:st t6n@l
Battle Street	b{t@l str\i:t
Noodle Bar	n}:d@l b6:
Sandy Arena	s{ndi: @r\i:n@
Trendy Avenue	tr\endi: {v@nj}:

Trendy Mile	tr\endi: mAel
Shortcut Alley	So:tk6t {li:
Downtown Alley	d{Ont{On {li:
Doll's Lane	dOlz l{In
Boy Scout Hall	boI sk{Ot ho:l
Milk Dairy	mIlk de:r\i:
Cheese Dairy	tSi:z de:r\i:
Wool Store	wUl sto:
Knitting Store	nItIN sto:
Owl Square	{Ol skwe:

ADDITIONAL LANDMARKS

Fire Station	fAe@ st{IS@n
Town Square	t{On skwe:
Fashion Area	f{S@n e:r\i:@
Sports Arena	spo:ts @r\i:n@

Railway Avenue	r\{Ilw{I {v@nj}:
Doctors Rooms	dOkt@z r\}:mz
Mystery Alley	mIstr\i: {li:
	mIst@r\i: {li:
Finish	fInIS
Tour Start	tU@ st6:t
Drug Store	dr\6g sto:
Cocktail Bar	kOkt{Il b6:
Wattle Street	wOt@l str\i:t
Flag Pole	fl{g p@}l
Paper Factory	p{Ip@ f{ktr\i:
	p{Ip@ f{kt@r\i:
Shoe Shop	S}: SOp
Gum Tree Café	g6m tr\i: k{f{I
Three Carts Hotel	Tr\i: k6:ts h@}tel

Capital Bank	k{p@t@l b{Nk
Spencer Avenue	spens@ {v@nj}:
	spens@r\ {v@nj}:
Sycamore Avenue	sIk@mo: {v@nj}:
	sIk@mo:r\ {v@nj}:
City Theatre	sIti: TI@t@
Newington Drive	nj}:INt@n dr\Aev
High School	hAe sk}:l
Clark Apartments	kl6:k @p6:tm@nts
Factory	f{ktr\i:
	f{kt@r\i:
Castle	k6:s@l
Building	bIldIN
Church	tS3:tS
Clock Tower	klOk t{O@

House	h{Os
Storey	sto:r\i:
Steeple	sti:p@l
Chimney	tSImni:
Corner	ko:n@
Straight	str\{It
East	i:st
Across	@kr\Os
West	west
North	no:T
Up	6p
Down	d{On
Along	@lON
End	end
Road	r\@}d

Street	str\i:t
Apartment	@p6:tm@nt
Block	blOk
Back	b{k
Yellow	jel@}
Orange	Or\IndZ
Red	r\ed
Green	gr\i:n
Blue	bl}:
Purple	p3:p@l
Windows	wInd@}z
One	w6n
Two	t}:
Three	Tr\i:
Tower	t{O@

No   n@}

Go   g@}