

The Big Australian Speech Corpus (Big ASC): A large audiovisual corpus of Australian English collected with an economical, portable, replicable black box

NZILBB Workshop, 30/11/11 (updated 11/01/12)

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What is it?

The **Big ASC, the Big Australian Speech Corpus**, is:

- a project funded by the Australian Research Council
- to collect AV speech data from 1000 Australian English speakers
- with standardised equipment and speech & conversational contexts
- in locations all around the country

The resultant speech corpus is

AusTalk



<https://austalk.edu.au/>

Background

Difficult to get funding for collecting corpora - the *tools* to facilitate research rather than research per se

- 2006:** **ASSTA** (Australasian Speech Science & Technology Association **established mission** to fund an Australian English (AE) speech corpus via the Australian Research Council (ARC) Linkage Infrastructure & Equipment Fund (LIEF)
- 2007:** ASSI, Australian Speech Science Infrastructure → **not funded**
- 2008:** App improved, re-submitted → **not funded, on 'Reserve List'.**
- 2009:** App improved further + more investigators & institutions + name change to **The Big ASC (Big Australian Speech Corpus)** → **funded**
- 2010:** **Organisation:** Legals, contracts, ethics, planning meetings, protocol, software and hardware design
- 2011:** RA Training Meeting, **Roll-out** and Data Collection, Ongoing Testing, Data Management, Annotation...

Aims, Scope and Features

1. Design a **functional heuristic speech database**
 - (a) Wide acceptability
 - (b) Variability
 - (c) Standardisation
2. Establish state-of the-art **infrastructure** to collect AV Australian English speech data
 - (a) Recording Equipment - black boxes
 - (b) Data Collection Protocol
 - (c) Public domain access to centralised storage facility
 - (d) Standardised Annotation
3. **Collect** large amount of **speech data**
 - (a) Launch and advertising
 - (b) Co-ordination and RA Training
4. Provide an **extensible system** for further data collection
5. **Facilitate** Australian/international **speech science research**

1. Functional heuristic speech database

(a) Wide acceptability ensured by

 Including the views and expertise of Australian speech scientists with specific research skills in:

- Phonetics & Linguistics
- Cognitive Science & Psycholinguistics
- Language Technology & Computer Science
- Speech Engineering , Spoken Language Processing - ASR & TTS
- Speech Pathology
- Forensic Speech Science

 From a wide range of Locations and Institutions...

Wide Range of Institutions, Locations and Participants

U. Western Sydney (MARCS)	Estival, Fazio, Lei Jing, Drummond, Burnham, Best, Kuratate,	
UWS/Max Planck - Nijmegen	Cutler	
Macquarie U	Thierry Jossermoz, Tomas Krajca, Matthew Roberts, Cox, Dale, Cassidy, Buckley, Callaghan, Viethen, Palethorpe, Demuth, Johnson, Flannery	
Australian National U	Rose, Ishihara, Gosling, Collin	
Flinders U	Butcher, Powers, Lewis, Milne, Stoakes, Anderson	
U. Melbourne	Bird, Fletcher, Grayden, Hajek, Loakes, Stirling, Thieberger, Kelly, Clothier, Penry-Williams	
U. New South Wales	Ambikairajah, Epps, Morrison, Kurniawan	
U. Queensland	Ingram, Kwon	
U. Sydney:	Arciuli, Onslow, Croot, de Launey	
U. Western Australia	Bennamoun, Togneri, Pontifex, Haque	
U. Canberra	Tran, Chetty, Wagner, Göcke, Kinoshita, Alghowinem	
U. Tasmania	Kemp, Maunder	<ul style="list-style-type: none"> • 1 Project Manager • 6 Tech, Programming • 30 Chief Investigators • 17 Associates • 17 on-site RAs, Tech support
Latrobe U	Tabain	
RMIT	Cavedon	
Charles Sturt U	McLeod, Lockart	
U. New England	Schneider, Conroy	
U. Technology Sydney	McGregor	
Griffith U/ Aus. Nat. Corpus	Haugh	
Appen	Vonwiller	

Functional heuristic speech database

(b) Variability ensured in terms of:

- **Geography:** 1000 speakers, 17 capital city and regional locations from every state and territory of Australia
- **Dialectal variation:** Data from anyone who has done all schooling in Australia + sample of 48 Aboriginal English
- **Emotion:** Subset of data (Univ of NSW) collected in different emotions
- **Pathology:** Subset of data (Univ of Sydney) collected from stutterers
- **Age, Gender:** 3 age ranges - 18-30, 31-49, >50;
1/2 males / 1/2 females

Variation: Geography, Dialects, Pathology, Emotion

STATE	UNI	N	REGIONAL	N	OTHER	N	TOTAL
NSW	UWS		TOWNSVILLE	48			48
	MQ		ARMIDALE	48			48
	UNSW	48			EMOTION	36	84
	USYD	48			DISORDERED	16	64
QLD	UQ	120					120
VIC	MELB	120	GEELONG	48			168
SA	FLINDERS	96	AS/DARWIN	48	AUSAB	48	192
WA	UWA	96					96
TAS	UTAS	48					48
ACT	UC	36	BATHURST	48			84
	ANU	48					48
TOTAL		660		240		100	1000

Functional heuristic speech database








(b) Variability ensured in terms of:

- Geography: 1000 speakers, 17 capital city and regional locations from every state and territory of Australia
- Dialectal variation: Data from anyone who has done all schooling in Australia + sample of 100 Aboriginal English
- Emotion: Subset of data (Univ of NSW) collected in different emotions
- Pathology: Subset of data (Univ of Sydney) collected from stutterers
- Age, Gender: 3 age ranges - 18-30, 31-49, >50;
½ males/ ½ females
- **Social status:** A range of social spheres due to wide advertising and high visibility of project
- **Temporal variation:** For each speaker, 3 separate 1-hour sessions at intervals of at least 1week
- **Context:** wide variety of speech and communicative contexts (see protocol, coming soon)





Functional heuristic speech database

 (c) Standardisation ensured by:

-  12 identical portable, self-contained, cost-effective recording stations (Black Boxes)
-  Fixed Standard Speech Collection Protocol (SSCP)
-  Automation of SSCP data acquisition, starting, stopping, synchronising hardware to minimise error risk
-  2-day central training session for all Research Assistants
-  Central monitoring of incoming data quality

2. State-of-the-art Infrastructure

 **Good quality data collection and access both now and in the future ensured by good quality:**

-  **(a) Recording Equipment - black boxes**
-  **(b) Standard Speech Collection Protocol (SSCP)**
-  **(c) Public domain access to centralised storage facility**
-  **(d) Standardised Annotation**

(a) Recording Equipment - Black Boxes

Standard Speech Science Infrastructure Black Box

- Standardised equipment, configuration, setup at all locations
- Portability:** Packed in reinforced box, folds out to a table + integrated shelving
- Low cost:** \$AUD12K per unit

Basic components

- Computer, digital audio acquisition device, desktop microphone, head-worn microphones, stereo cameras



Recording Equipment - Black Boxes

Black Box

- Mixer Rack Workstation: the 'Black Box' for storing and transporting items; unpacks into 2 tables & computer rack

Computing

- Capture Computer: PC for protocol display and recording.
- External hard drive: Samsung STORY Station 2TB.

Audio recording:

- M-Audio FastTrack Ultra8R.

Microphones and Headphones

- Head worn mic (x2): AudioTechnica AT892c.
- AT8539 Phantom Power XLR adapter to connect mic.
- Far-Field mic: Shure MX391/O. On table, ~ 60cm from speaker.
- Stereo mic (x2): Behringer C-2. On table ~ 60 cm from speaker, to record hands-free voice interaction
- Operator Head Phones: KOSS UR-20, for the RA

Cameras

- Stereo Cameras BumbleBee2 (x2). Mounted ~50cm from speaker. Dual bus firewire card.
- Tripod mount for camera (x3): Manfrotto 700RC2 tripod

AV

- Custom-made GPIO 2 audio Sync Cable. A/v synch: camera sends strobe signal → M-Audio DAQ to record waveform

Monitors:

- 17inch Monitors 4:3 (x2): Dell E170S 17 inch Flat Panel Monitor. To display prompts to speaker and for RA.
- Monitor arm / stand: Atdec Visidec Focus MICRO LCD Single Arm, VF-M. To hold monitor and camera.

Lighting

- 2 x (Soft Umbrella, Umbrella Reflector, Tripod, Dual lamp adapter, 2 x 65W lamps)

Pull-up backdrop (x2) to provide uniform background.

Chairs (x2) to ensure standardisation of video capture.

Basic components

• Computer

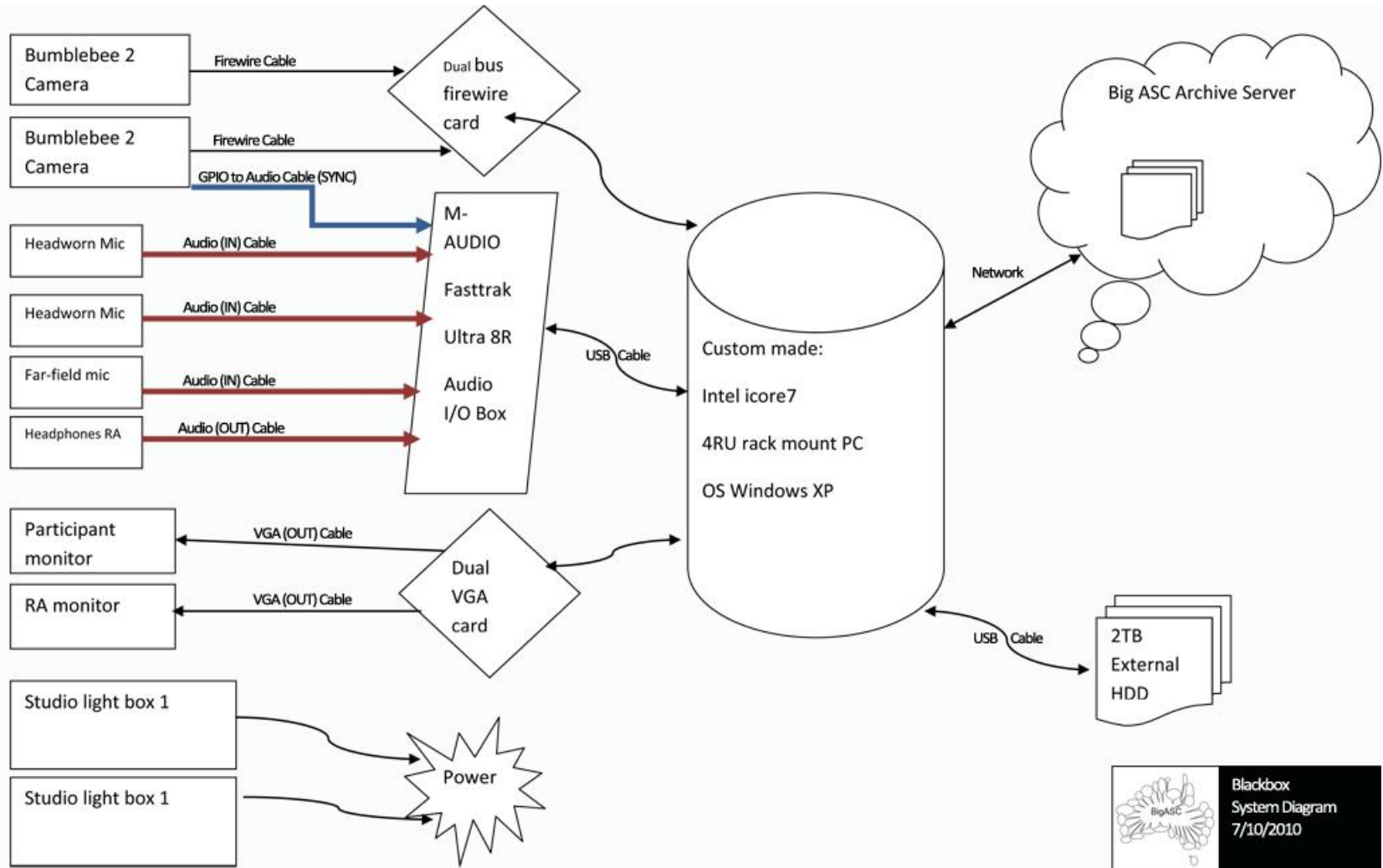
• Digital audio acquisition device

• Mikes: desktop, head-worn

• Stereo cameras

• Backdrop, chairs, lighting

The Black Box: System Diagram





Easy Assembly

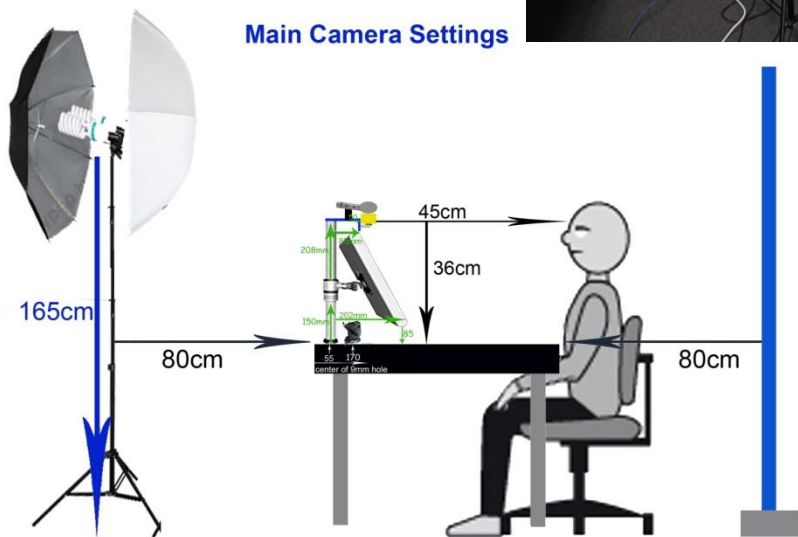


40-45 minutes





Main Camera Settings



Final setup



(b) Standard Speech Collection Protocol SSCP

Components

 1 minute of recording silence

Read Speech

- Isolated Words
- Digits
- Sentences
- Story: reading/retelling

Spontaneous Speech

- Interview
- Story: reading/retelling
- Map Task
- Yes/No

 (Emotions)

Schedule across the Three Sessions



Session 1		Session 2		Session 3	
Task	Time	Task	Time	Task	Time
Calibration (+ 3D face)	10	Calibration	3	Calibration	3
Opening Yes/No	3	Opening Yes/No	2	Opening Yes/No	2
Words	10	Words	10	Words	10
Read Narrative	5	Interview	15	Map Task (First run)	20
Re-told Narrative	10			Switch Sp.A and Sp.B	5
Read Digits	5	Read Digits	5	Map Task (Second run)	20
		Read Sentences	8	Conversation	5
				Words	10
Closing Yes/No	2	Closing Yes/No	2	Closing Yes/No	2
	44		45		77

Calibration

Camera setup

-  Ensure face of speaker is within the red square
-  Check light level; adjust brightness.

3D & Facial calibration

-  Speaker face recorded (5s at each) from -90° (left profile) then every 15° to $+90^\circ$ (right profile)
-  While the speaker repeats vowel sequences, checks on M-Audio display that the levels are within the limits.

Setting audio levels

-  Levels adjusted for each microphone so within required levels

Silence

-  Record 1 min of silence for record of the ambient noise

Read Speech -Digits

- 👂 Designed for speaker verification applications
- 👂 12 4-digit sequences
- 👂 Sequences selected to ensure each of the 10 digits occurs at least once in each serial position to:
 - 👄 capture co-articulatory variations and
 - 👄 Provide acoustic-phonetic variation








👂 Eg

2837 → “two eight three seven”

Read Speech -Isolated Words


- 👂 322 Words randomly presented via computer screen
- 👂 3 word types:
 - 👂 77 monosyllabic words comprising the stressed vowels of AE in the standard hVd, hVt, hV, hVl, hVn contexts,
 - 👄 E.g., hid, head, het
 - 👄 Standard format allows controlled acoustic examination of vowel systems across speakers and dialects; required for socio-phonetic and forensic work on variation in AusEng.
 - 👂 167 words to address specific AE phonetic features
 - 👄 E.g., album, elbow, Ellen, Alan
 - 👄 Added scope for comparing across contexts not represented in the standard format; allows capture of contextually variable realisation of consonants
 - 👂 68 polysyllabic words to sample variations in lexical stress
 - 👄 E.g., corridor, coyote, kangaroo
 - 👄 For fine-grained acoustic analyses of stress contrast within & across words.

Read Speech - Sentences

-  **58** sentences designed to elicit connected speech in a standard format
-  **50** from phonetically-rich list of the more limited 1995 **ANDOSL**, based on the **SCRIBE** sentences
 -  E.g., ‘Who says itches are always so tempting to scratch?’
 -  sample all vowels and consonants in a range of connected permutations with varying prosodic characteristics
 -  will allow direct comparison of connected speech processes (CSPs) across the Austalk corpus and previously collected AE speech in ANDOSL migrant varieties.
-  **8** sentences designed to elicit additional processes, e.g., AE **diphthongal** features
 -  E.g., ‘Isn’t it common knowledge that a kangaroo has a pouch in front?’

Read Speech - Read Story

 Version of tried and tested **‘Arthur the Rat’**

 **phonetically balanced** text **Australianised** to include more local lexical and grammatical features and CSPs for AE; also samples prosodic parameters: pausing, breathing

 **Dual purpose:**

-  Comparison of speech styles within & between speakers
-  A launch pad for a spontaneous narrative (retold story)

Spontaneous Speech - Retold story

- 👂 Speakers asked to **re-tell 'Arthur the Rat'**
 - 👄 Allows within- and between-speaker speech style comparison.
 - 👄 For a re-told text, duration is about 15% shorter than the original (range = 45% shorter to 30% longer)
- 👂 Prompts for retelling of story used if necessary

Spontaneous Speech - Interview

- 👂 **Spontaneous, engaged, narrative talk**, i.e. ‘story telling’ in the vernacular style
- 👂 Different topics suggested for discussion, subject to speakers’ preferences
 - 👄 E.g., A dangerous or exciting episode in my life: Something I’m never likely to forget...

Spontaneous Speech - Map Task

- 👂 Data gathering game to collect spontaneous speech in a dialogic setting
- 👂 Two people: instruction giver (IG), instruction follower (IF)
- 👂 Two maps of the same environment, but with small difs:
 - 💋 IG's map has a route marked to some target location
 - 💋 IG must communicate route to IF so IF can mark route on their map
- 👂 **New Map Task created for the Big ASC (by Jette Viethen)**
 - 💋 Contain 2 types of landmarks:
 - PHON (**labels** forcing participants to utter exact words and CSPs of interest)
 - REG (depictions of buildings distinguishable visually but **no labels**)
 - 💋 Aims:
 - Sample phonological segmental and CSPs in truly spontaneous speech which can be compared to the more formal speaking tasks
 - Collect corpus of object descriptions to allow study of various discourse phenomena, e.g., negotiation over reference.

WATER AVENUE

TOUR START

SHAW APARTMENTS

BLUEBIRD DELI

APPLE TREE AVENUE

GIRL'S SCHOOL

HANDMADE FENCE

AUSTRALIA ESTATE

COTTON GROVE

THRIFTY BANK

JET THEATRE

DANCE SHOP

FOUR OAKS HOTEL

FOOTBALL FIELD

ALPINE HEIGHTS








FINISH

COBBLESTONE DRIVE

BUTTON FACTORY

[illegible]

Spontaneous Speech - Discussion After Map Task

-  Participants asked to **talk to each other** about:
-  whether they enjoyed the task,
 -  how difficult it was,
 -  what part of the instructions at the beginning helped them understand the task,
 -  what they liked or didn't like about the other participant's directions,
 -  what features of the landmarks helped or hindered,
 -  what they found useful.

Spontaneous Speech - Yes/No

- 👂 Useful for **forensic** applications
- 👂 **Expressions meaning 'Yes' or 'No' and all their variations**
- 👂 Elicited from naturally-occurring conversations in sessions
- 👂 Recorded in all 3 sessions to capture within-speaker variability
- 👂 RAs use list of prepared questions at start & end of sessions
 - 💋 *So let's see, for the record, you are [Animal ID], right?*
 - 💋 *And is this your first recording session for the project?*
 - 💋 *Is there anything unclear with the instructions so far?*
 - 💋 *Would you like me to explain the process again?*
 - 💋 *Do you have any questions about what you need to do?*
 - 💋 *Can you see the screen?*
 - 💋 *Are you comfortable with the position of the chair and the microphone?*
 - 💋 *Shall we start then?*

(c) Centralised storage facility







Data upload

- Data at sites automatically saved to disk
- 1 minute of recording = 1 Gb of data, so
- Conversion and Compression of vdo (not audio!) data on site (54:1)
- Typical 45 minute session, compressed = ~2Gb
- Data copied onto 2TB HDD, RAs send HDDs to central location
- Data check, back-up → RAs told to delete raw data from hard drive

Storage

- Audio and video data stored on web accessible server
- Corpus meta-data and annotations stored in DADA annotation store
- Support import/export of annotation data in formats supported by many annotation and analysis tools.

(d) Standardised Annotation

-  Done centrally
-  Automated as much as possible; forced alignment used where appropriate
-  Initial annotation limited to:
 -  word segmentation for Read Speech
 -  transcription aligned at the phrase or sentence level for Spontaneous Speech.
-  New annotations, e.g. detailed phonetic transcription, can be contributed by project partners or other researchers and integrated into the existing annotation store.

3. Collect a large amount of speech data

(a) Launch and Advertising

-  Launch of project on Australia Day (26 Jan) 2011
-  ~ 20 Radio and TV interviews
-  Simultaneous website launch
-  Immediate reaction in sign up -
we now have 1689 expressions of interest (11/01/12)

(b) Co-ordination and RA Training

-  RA Manual on Wiki
-  2-day Central Joint Training Session

The Big ASC Recording Assistant's Manual



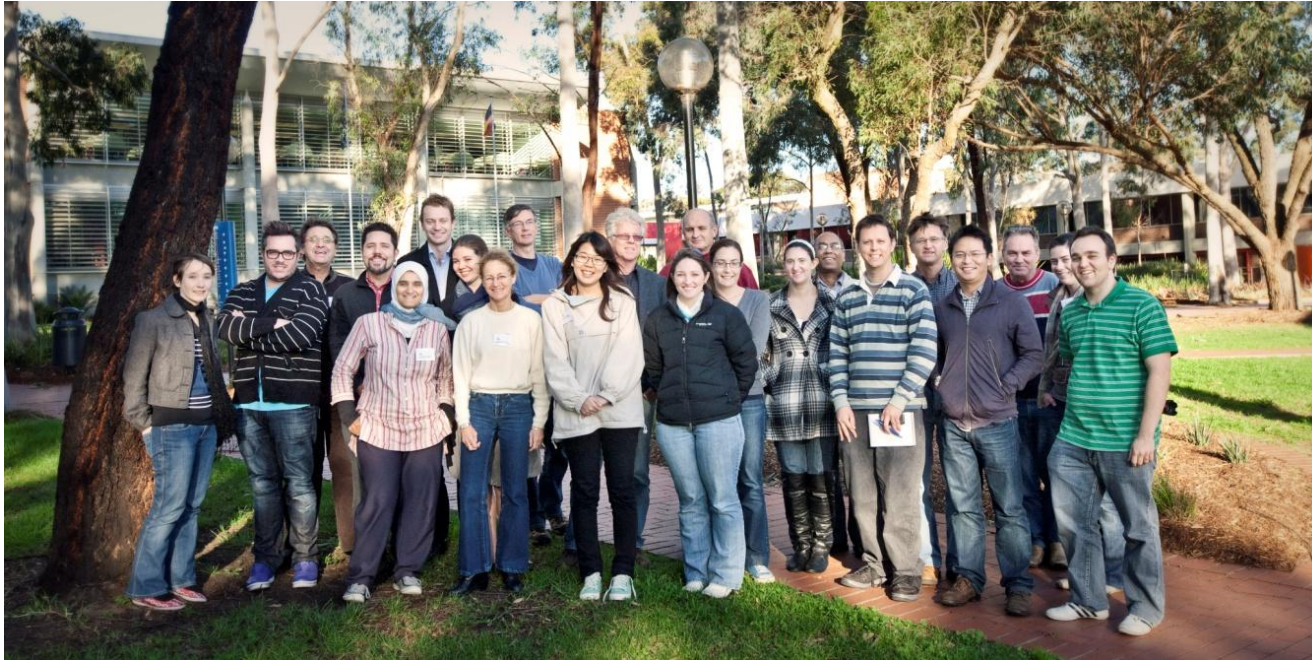
<https://austalk.edu.au/>



(b) 2-day Central Training Session



AusTalk RAs - Training at MARCS, UWS



<https://austalk.edu.au/>



Recording at U Sydney



Progress

Recorded and uploaded so far (11/01/12)

☞ 48/48 at CSU (Bathurst)

☞ 36/36 at U Canberra

☞ 48/48 at U Tasmania

☞ 43/120 at UQ

☞ 23/48 at U Sydney

☞ 15/48 at ANU

☞ 29/96 at Flinders.....

Currently working on automatic quality control checks

4. Extensible system for further data

 This data collection exercise:

- ☛ Only adults with all schooling in Australia

 Infrastructure (12 BBs around Australia and central storage facility) and standard software and protocol will afford extensions to:

- ☛ New Zealand English (ARC would not support NZ study in original application)
- ☛ Child data
- ☛ Migrant populations and ethno-cultural variations
- ☛ More forensically-relevant situations
- ☛ Etc....

5. Facilitate speech science research

Dialectal studies for:

- Linguistics/phonetics research
- Forensic applications

Robust ASR and Speech in Noise (SpIN)

- No speech noise samples can be later added to speech recordings at different SNRs to create noisy hostile environments

Audio-Visual ASR: Stereo camera recording setup → multimodal corpus analysis

- AV ASR using 3D face model data
- Face recognition and liveness detection in biometrics
- Facial expression recognition in affective sensing
- Face synthesis in computer graphics and ECRs

Speaker Verification

Isolated digit corpus component → speaker verification via still-common use of 4-digits PINs

And more

Issues...

- 👂 Due to varied locations and need for compactness, computer must be in room with participants
 - ambient noise. Unavoidable...
- 👂 Funds for ongoing upkeep and maintenance, addition of further data etc...
 - 💋 But note, just submitted application for \$1.7M to NeCTAR (National eResearch Collaboration Tools and Resources) for:
 - a Virtual Laboratory in the Cloud which would
 - House the AusTalk corpus
 - Ensure corpus upkeep and maintenance
 - Provide a user-friendly workflow environment

Extra Material in case of Qs

Prompts for retelling of story

- Well, what did you think of the story of 'Arthur the rat'?
- If they answer 'a bit weird', ask: In what way did it seem weird or odd?
- If they 'liked the story', ask: What did you like about it?
- Stories often convey a 'moral' or a lesson. What was the moral of this story, Arthur the Rat? And did you agree with it?
- Most kids like being told stories. Why do you think that is so?
- What sorts of stories used to appeal to you as a kid?
- Stories are often used to educate the young about their heritage or their identity. How did this apply to you, or to your age group when you were growing up? What stories were you brought up with?
- Can you recall a particular story that made a strong impression on you when you were young?
- Where do you mainly get your stories from nowadays? From books, from movies, from yarns told by friends? From the TV?
- What story caught your attention recently?

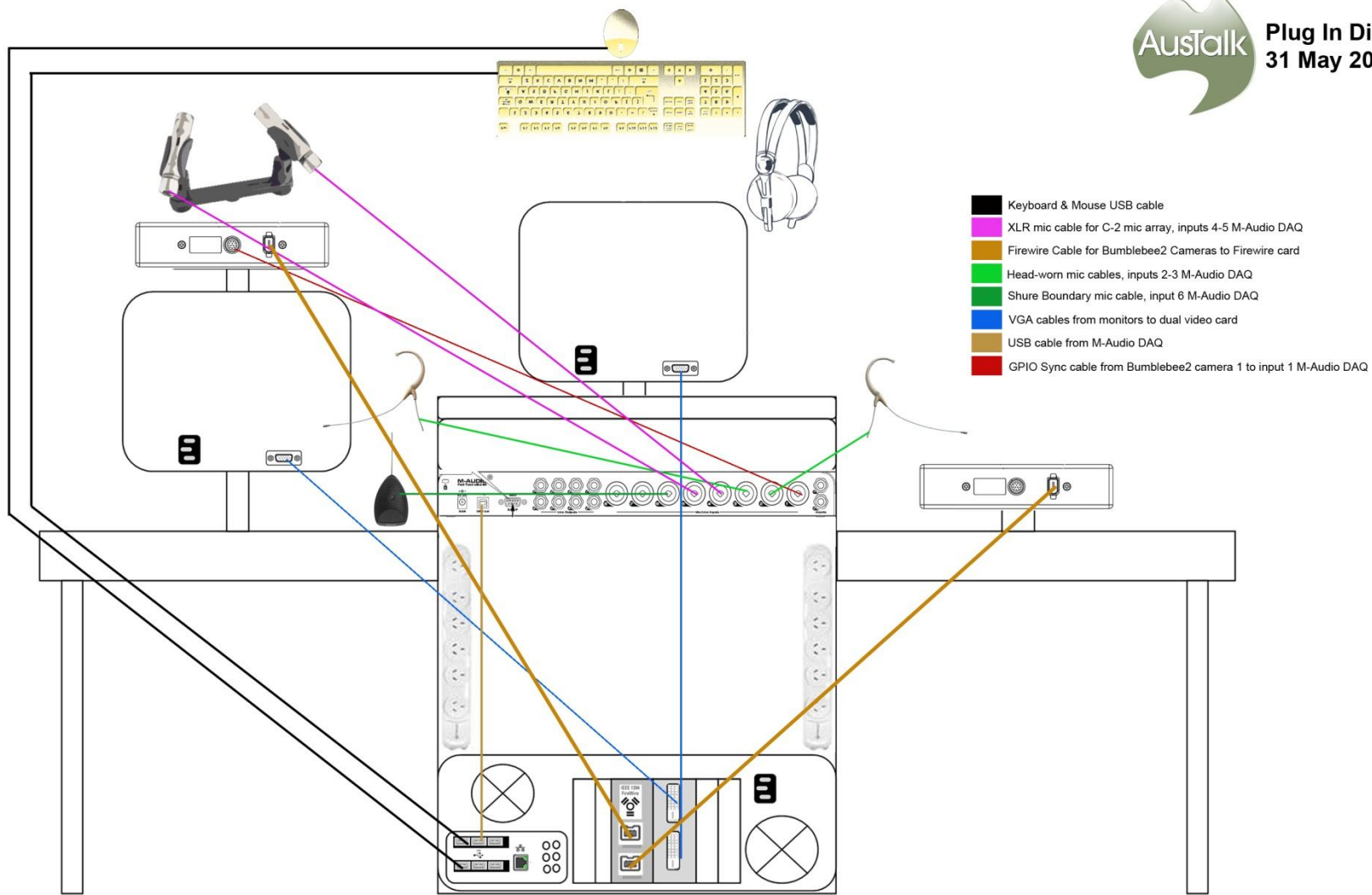
Narrative - full list of suggestions

Different topics suggested for discussion, subject to speakers' preferences

- E.g., A dangerous or exciting episode in my life: Something I'm never likely to forget...
- A topic that I feel quite strongly about: Something that really gets on my goat... something that really ought to be changed...
- My best holiday ever was when ...
- A most embarrassing incident ...
- Changes in the district: How this place has changed over the years; what it used to be like around here compared with the way things are now...
- What we used to get up to as kids: Ways that we used to entertain ourselves, but are perhaps not so available to kids today ...
- One of the most interesting characters that I have ever met ...



Plug In Diagram
31 May 2011



Synchronisation

 3 microphones + 2 stereo cameras

→ possible data synchronisation problems.

But we have solutions:

 **Hardware:** Audio devices hardware synchronized and the 2 stereo cameras synchronized via the PointGrey MultiSync software.

 **Software:**

- Audio and video streams synchronized via 'sync' cable directly connecting the main camera to M-Audio device as an audio input.
- Output signal (strobe pulse) fired for every frame captured by the camera
 - record 4 synchronous 'audio' inputs with the audio device and, by starting the audio recording first, align the audio and video frames with high accuracy during subsequent analysis.

Compression Protocol

- Record RAW16 output from bumblebee2 camera to disk
- After recording session has finished
- De-interlace left-right images
- Color-process (demosaic) from the Bayer coded image to RGB coded image using PointGrey High Quality Linear algorithm
- Rectify the images to remove camera distortion
- Save to uncompressed AVI format
- Compress the video using ffmpeg with the following options
- -vcodec: "mpeg4": which encodes the video as MPEG-4 Part 2, Advanced Simple Profile (roughly akin to H.263v)
- -b, "20000000": encodes video at a bit-rate of 20,000kbps (very high bit rate)
- -r, "48.04": frame rate that matches the output of the bumblebee2 camera

hun

sounds like fun

Arthur the Rat

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.

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.

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.

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. 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. "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." 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.

(Emotions)

 Collected at 1 site (UNSW) only

- Replaces the Spontaneous Speech Tasks for 36 speakers
- In all 3 sessions, **view randomly-ordered blocks of affective pictures (International Affective Picture System) for 30s** to induce different arousal patterns.
- Participants asked to **verbalise thoughts, feelings and memories about each picture**
- In final session also asked to
 - **view and respond to a small number of video clips** from well-known TV shows or films (e.g. Bill Cosby or 'Silence of the Lambs')
 - **relate a time when they felt, e.g., sad**, in order to elicit natural conversational speech coloured by real emotional experiences.