Researcher of Faculty of Science\School of Aviation\Human Factors

Understanding miscommunication in commercial aviation between pilots and air traffic controllers

Presenter: Qiong Wu[1]

Recreational Pilot Licence (RPL)
PGDip (UNSW) Aviation Management
MSc (USYD) Biological Sciences

Co-Authors: **Brett R.C. Molesworth[1]**, **Dominique Estival[2]**

[1]School of Aviation, University of New South Wales, Sydney, NSW 2052
[2] MARCS Institute, Western Sydney University, NSW, Australia

Miscommunication in aviation

Miscommunications in Aviation

Causing congestion in radio communications and post risk to aviation safety

Major accidents where miscommunication is the leading factor:

- 1977 KLM and Pan Am crash at Tenerife *(take off clearance)*
- 1990 Avianca Flight 52, New York *(fail to declare emergency)*
- 2002 Überlingen mid-air collision, Zurich *(misunderstanding in flight level/direction)*
- 2018 US-Bangla Airlines Flight 211, Kathmandu *(approach direction)*

and miscommunication between ATC and pilot still happens on daily basis

The introduction of LPR by ICAO

With Safety being the ultimate objective, and in order to reduce risk communication errors posts to safety, in 2003, contracting states of ICAO introduced the guidelines in the Language Proficiency Requirements (LPR)[1]:

to ensure that all flight crew and ATC demonstrate an acceptable level of Aviation English proficiency during international aeronautical communication, **regardless of their language backgrounds.**

[1] *Alderson, 2009; Tiewtrakul & Fletcher, 2010; Barshi & Farris, 2013; Farris, 2016*

Aims *(Hypotheses)*

to investigate miscommunication in commercial aviation and examine differences based on language background

1. Compare the communication performance between pilots with different language backgrounds *NS pilots commit fewer communication errors than EL2 * pilots*
2. Message length and complexity *A positive relationship will exist between complexity of transmission (information density) and communication errors*
3. Workload: Departure Phase Vs Approach Phase of flight *Does the phase of flight have an effect on communication errors*

** Accented pilot=EL2 Native Sounding pilot= NS*

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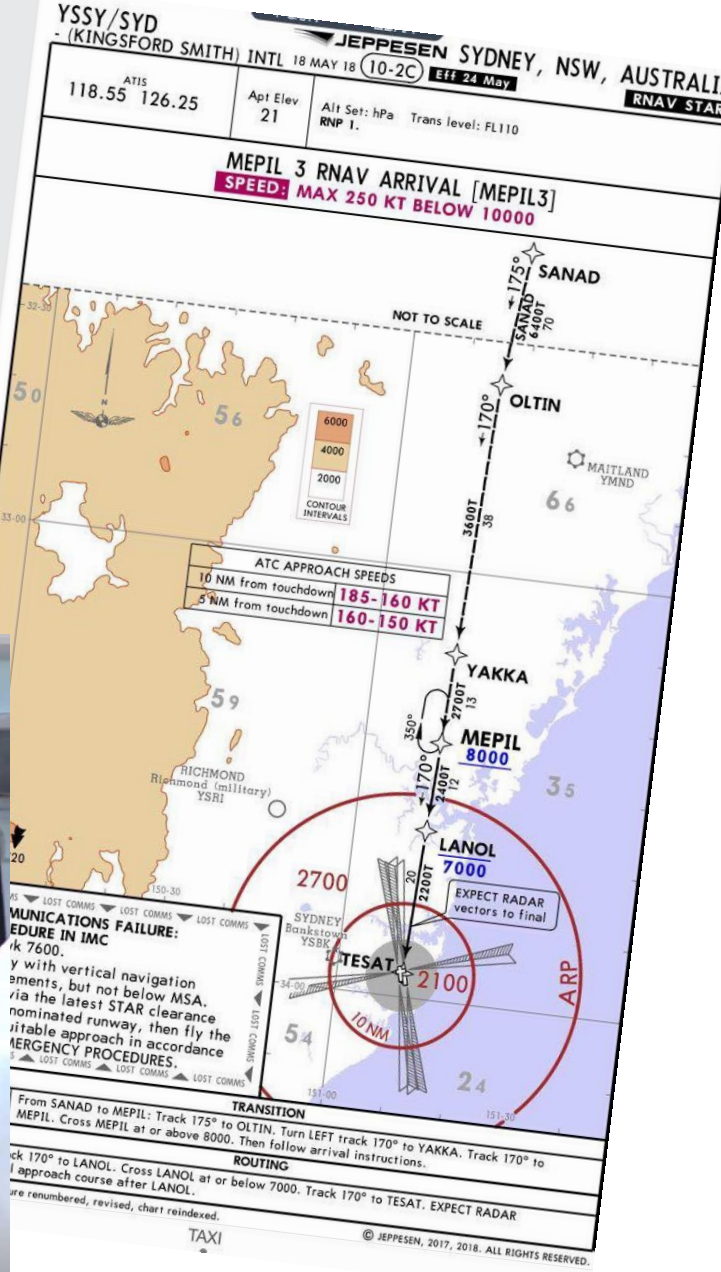
YSSY/SYD
(KINGSFORD SMITH) INTL 18 MAY 18 (10-2C) Eff 24 May
JEPPESEN SYDNEY, NSW, AUSTRALI
RNAV STAR
ATIS 118.55 126.25
Apt Elev 21
Alt Set: hPa
RNP 1.
Trans level: FL110
MEPIL 3 RNAV ARRIVAL [MEPIL3]
SPEED: MAX 250 KT BELOW 10000
NOT TO SCALE
SANAD
OLTIN
YAKKA
MEPIL 8000
LANOL 7000
TESAT 2100
EXPECT RADAR vectors to final
MAITLAND YMND
RICHMOND Richmond (military) YSRI
SYDNEY Bankstown YSBK
ATC APPROACH SPEEDS
10 NM from touchdown 185-160 KT
5 NM from touchdown 160-150 KT
CONTOUR INTERVALS
6000
4000
2000
ARP
10NM
MUNICATIONS FAILURE:
EDURE IN IMC
k 7600.
y with vertical navigation
ements, but not below MSA.
via the latest STAR clearance
nominated runway, then fly the
itable approach in accordance
MERGENCY PROCEDURES.
TRANSITION
From SANAD to MEPIL: Track 175° to OLTIN. Turn LEFT track 170° to YAKKA. Track 170° to MEPIL. Cross MEPIL at or above 8000. Then follow arrival instructions.
ROUTING
k 170° to LANOL. Cross LANOL at or below 7000. Track 170° to TESAT. EXPECT RADAR approach course after LANOL.
re renumbered, revised, chart reindexed.
TAXI
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Methods

Audio Transmission: total 1080 minutes (30 min x 36 blocks) between Feb-Apr 2016 AEST 08:00 - 10:30 and 21:00 - 21:30 from LiveATC.net Live Air Traffic — From Their Headsets to You.

Analyse transmissions (initiated by ATC and request readback) between Pilots and ATC from Sydney Airport

Pilots were classified to two Groups:

- Accented pilots (EL2)
- English Sounding (Native Speaking) pilots (NS)

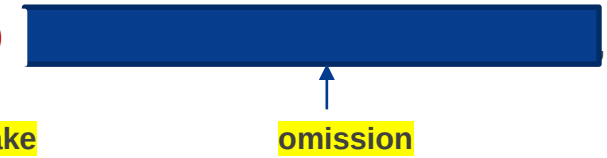
Methods (marking)

Items such as **Callsign, Heading, Altitude, Frequency, Transponder code, etc.** which the pilot must acknowledge, as per the AIP manual (AirServices Australia, 2014).

communication error = incorrect item / omissions

i.e.

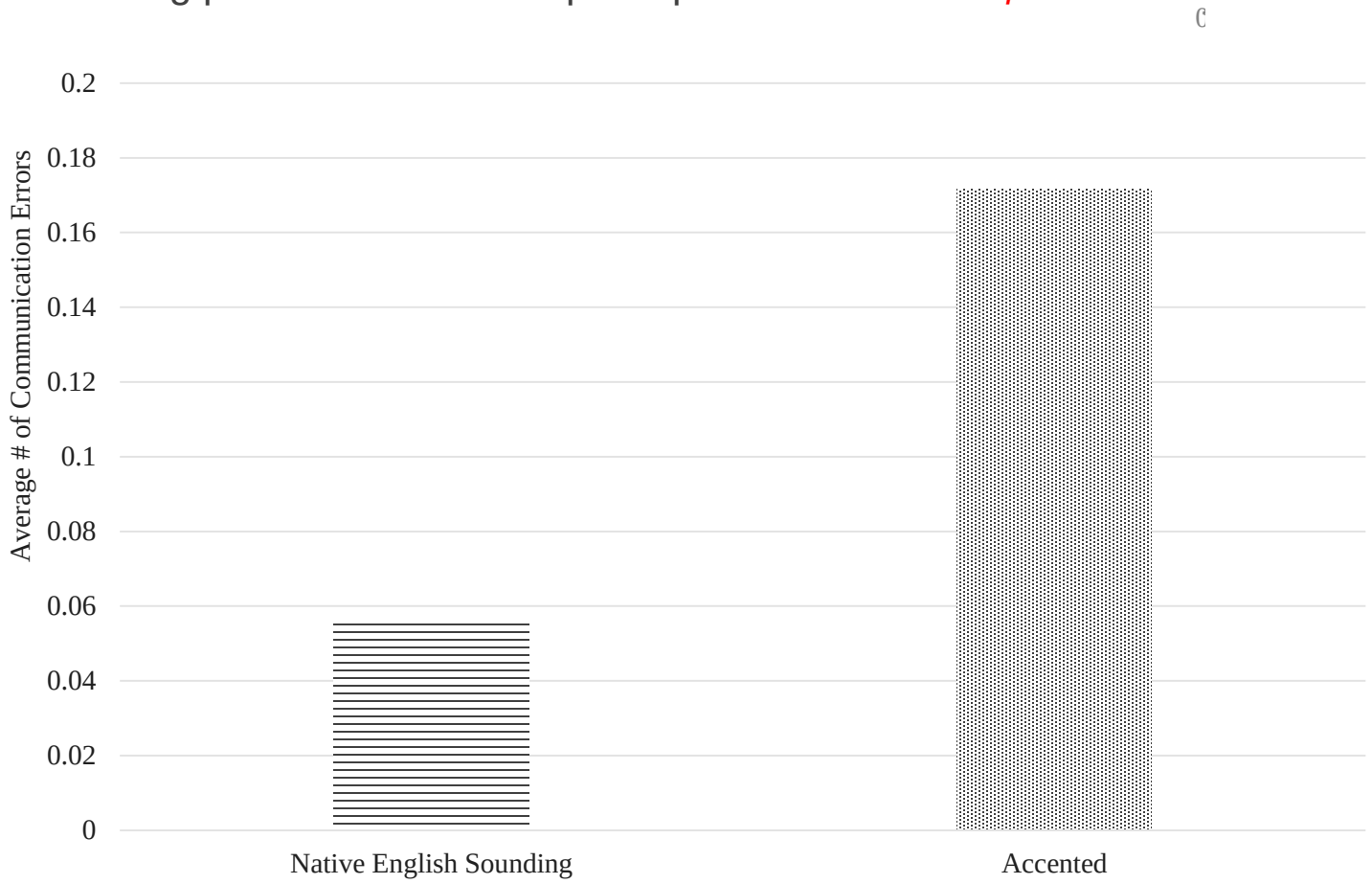
ATC: "All Nippon 879, Turn right heading 170, intercept localiser RWY 16 left".

Pilot should read back: "Turn right heading 180  All Nippon 879".

The data pertaining readback performance were analysed using SPSS

Results

Average number of **communication errors** committed by native English sounding pilots and accented pilots per transmission. *p=0.009*



Results

Error under different item types

Error Type	Item Type	Native English Sounding Pilot			Accented Pilot		
		Category of Error		# of Errors	Category of Error		# of Errors
		Numeric	Word		Numeric	Word	
Omissions	Altitude	-	-	0	3	-	3
	Approach type	-	-	0	-	1	1
	Callsign	-	-	0	1	-	1
	Heading	-	-	0	2	-	2
	Radio frequency	-	-	0	2	-	2
	Runway assignment	-	-	0	-	1	1
	Taxi way assignment	-	-	0	-	-	0
	Approach type	-	-	0	-	1	1
Total Mistakes		-	-	0	5	3	8

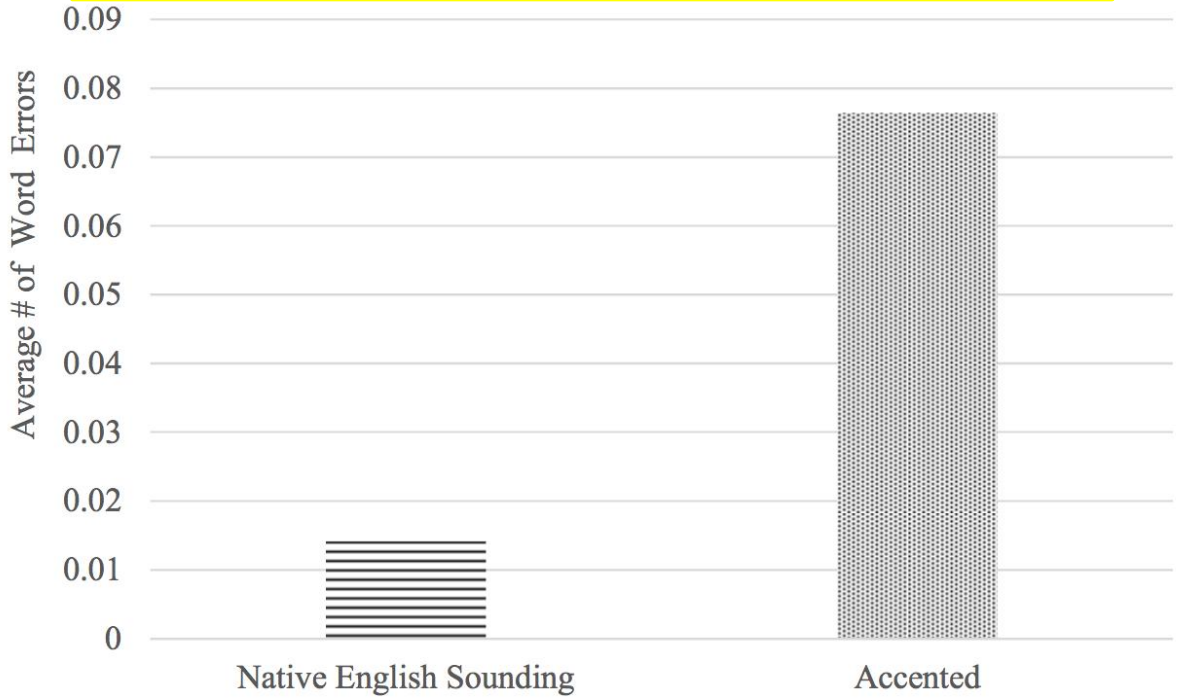
- Omissions: insignificant
- Mistakes: *p=0.004*

NS pilot: NIL error

EL2 pilot: 0.0597 (SD=0.24)

Results

- Numeric items: insignificant
- Words: *p=0.016*



Average number of word errors per transmission committed by native English sounding pilots and accented pilots.

Results

Message Complexity Vs Error Rate

- **NS pilot:** No correlation existed between information density and error rate

  $r(151) = 0.151$, $p = 0.073$

- **EL2 pilot:** a **weak positive relationship** existed between these two variables for accented pilots,

  $r(132) = 0.236$, $p = 0.006$.

EL2 pilots readback performance deteriorates with increased information density

Results

Error rates Vs Phase of flight

Readback performance **does not vary** between two phases (Approach and Departure)

NS and EL2 pilots demonstrate similar readback performance between different phase of flight

Conclusion

1. All pilots regardless of language background commit communication errors

2. High workload during Landing/approach phases does not efficiently induce higher communication error rate comparing to Departure phase.

   - may due to the precision needed for landing phase – higher prioritisation in communication comparing to other phase

   - PNF effectively manage air traffic communications and reduce readback errors

   - in GA, pilot perform all duties and therefore the result is at the opposite[1]

1. Estival and Molesworth, 2016

Conclusion

Challenges and training recommendations

1. **NS pilot:** error in omissions reflect workload pressure shortening read back time or not adhere to protocol – Airline Training: focus on compliance of relevant protocol

2. **EL2 pilot:**
   - committed more word errors comparing to numeric: Lack of aviation phraseology
   - reduced readback accuracy when message length increases

   improve mastery of aviation phraseology for EL2 due the range of lexical items > numbers

Recommendations

- ATC shall transmitting less items (< OR = 3 items) per exchange (ICAO 2003)
- using alternative format communication media: i.e. CPDLC and DataComm

Acknowledgements

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Any Questions

Pilots were classified as ‘accented English’ if a non-native English accent could be detected and if the aircraft was registered in a country where English is not one of the official languages (e.g., Japan, Korea, China, Chile).

Pilots with an English sounding accent, but who were on an aircraft that was registered in a country where English is not the official language or is one of several official languages (e.g., Hong Kong, Singapore, Malaysia, Fiji) were excluded, as it was less certain whether their native language was English.

A random sample (ten per cent) of the recordings were independently verified by a second coder (male Native English Speaker with a Commercial Pilot Licence) to ensure accuracy of the ‘native English sounding / accented English’ coding.