



# ATC – Pilot Miscommunication

# Human Factors

Human Factors:

- “designed for human use”
- “Intuitive”

Risk defined:

“the effect of uncertainty on objectives” (ANZ/ISO 3100)

# Human Factors

Risk defined:

“the effect of uncertainty on objectives” (ANZ/ISO 3100)

- an effect may be positive, negative, or a deviation from the expected.
- an objective may be financial, related to health and safety, environmental or defined in other terms, and can apply at different organizational levels.
- risk is often described by an event(s), a change in circumstances, a consequence, or a combination of these and how they may affect the achievement of objectives.
- risk can be expressed in terms of a combination of the consequences of an event or a change in circumstances, and their likelihood.

# Miscommunication

## Background

- Miscommunication is common
- One factor in many accidents

## Controls

- Lingua Franca – Aviation English
- Standard phraseology
- ELP requirements
- Word selection (at take-off vs ready for take-off)
- ATC
- Task sharing (co-pilots in charge of radio)

# Miscommunication

Little is known (documented):

- ICAO recommends speech < 100 words per minute
- EUROCONTROL suggests limiting number of elements/items per transmission (supported by Barshi, 1997)
- ICAO suggests native English speakers should assist

“ICAO clearly states that, in Aviation English interactions, native English speakers share the responsibility of ensuring effective communication through the use of what could be considered accommodation strategies (see ICAO, 2010: 5.3.3.2)”

# General Aviation

Aim:

- Investigate **relationship** between **four** known factors and **communication performance**
  - **Prosodic features** (pauses)
  - **Information density** (# of items per transmission)
  - **Workload** (pilot workload)
  - **Frequency congestion**
- Is there a **native language** advantage?
- Is **experience** or **qualification** related to communication performance?

# GA – Pauses vs No Pauses

Native English pilots committed fewer communication errors (as a percentage) than non-native pilots (irrespective of flight)

|                  | Native Language Background |       |            |       |
|------------------|----------------------------|-------|------------|-------|
| Flight Condition | ESL (n = 9)                | SD    | NS (n = 8) | SD    |
| F1A (pauses)     | 48.61                      | 8.72  | 65.63      | 10.56 |
| F1B (no pauses)  | 49.31                      | 21.30 | 65.63      | 6.68  |

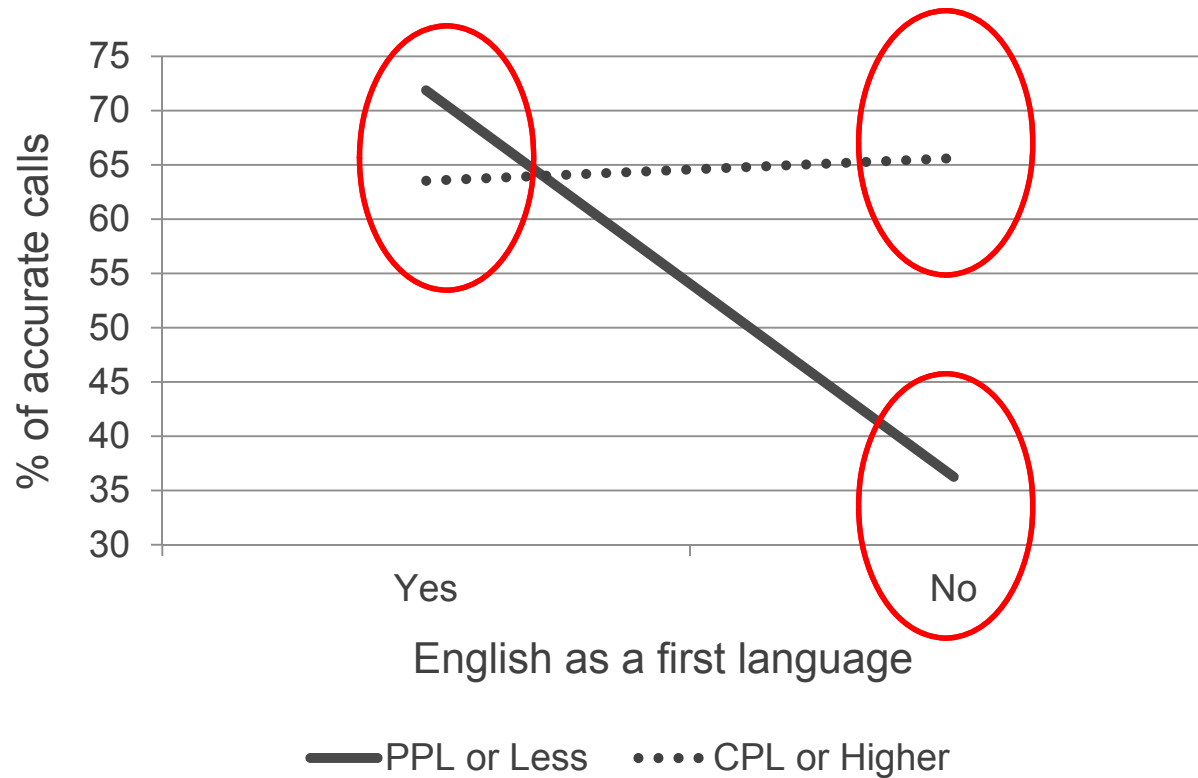
# GA – Pauses vs No Pauses

Pilots with a CPL or higher licence qualification committed fewer communication errors (as a percentage) than pilots with a PPL or lower qualification (irrespective of flight)

|                  | Licence Type         |       |                        |       |
|------------------|----------------------|-------|------------------------|-------|
| Flight Condition | PPL or lower (n = 7) | SD    | CPL or higher (n = 10) | SD    |
| F1A (pauses)     | 50.00                | 10.21 | 61.25                  | 12.77 |
| F1B (no pauses)  | 46.43                | 20.68 | 64.38                  | 11.43 |



# GA – Pauses vs No Pauses



Percentage of accurate transmissions distributed across native language background (NS vs. ESL) and licence type (PPL or lower vs. CPL or higher) for flight with no pauses.

# GA – Information Density

Fewer communication errors (as a percentage) were present in flight condition with 3 or less items than in flight with 4 or more items.

|                       | Native Language Background |       |            |       |
|-----------------------|----------------------------|-------|------------|-------|
| Flight Condition      | ESL (n = 9)                | SD    | NS (n = 8) | SD    |
| F2A (3 or less item)  | 50.62                      | 22.29 | 65.28      | 13.53 |
| F2B (4 or more items) | 36.67                      | 24.75 | 46.88      | 13.61 |

Irrespective of language background or flight qualification, increasing the number of items in a transmission significantly affected pilots' communication performance.

# GA – Workload (fuel calculation)

Fewer communication errors (as a percentage) were present in the low workload flight compared to the high workload flight.

|                     | Native Language Background |       |            |       |
|---------------------|----------------------------|-------|------------|-------|
| Flight Condition    | ESL (n = 9)                | SD    | NS (n = 8) | SD    |
| F3A (Low Workload)  | 53.85                      | 14.90 | 62.50      | 17.17 |
| F3B (High Workload) | 39.32                      | 15.12 | 57.69      | 7.12  |

**Irrespective of language background or flight qualification,** increasing pilots workload adversely affects their ability to communicate effectively.

# GA – Congested Radio Frequency

**No difference** based on flight, language background, or pilot qualification.

|                             | Native Language Background |       |            |       |
|-----------------------------|----------------------------|-------|------------|-------|
| Flight Condition            | ESL (n = 9)                | SD    | NS (n = 8) | SD    |
| F4A (no radio congestion)   | 61.62                      | 18.62 | 76.14      | 13.69 |
| F4B (high radio congestion) | 66.67                      | 14.38 | 70.45      | 16.65 |

# General Aviation

## Summary:

- Pauses in transmissions improve communication
- Pauses more advantageous for ESL pilots
- Pauses more advantageous for PPL or lower licence holders
- Reducing the number of items in a transmission improves communication (irrespective of language or licence)
- Reducing pilots' workload improves communication (irrespective of language or licence)
- Pilots are good at ignoring irrelevant communication

# Commercial Aviation – SYD

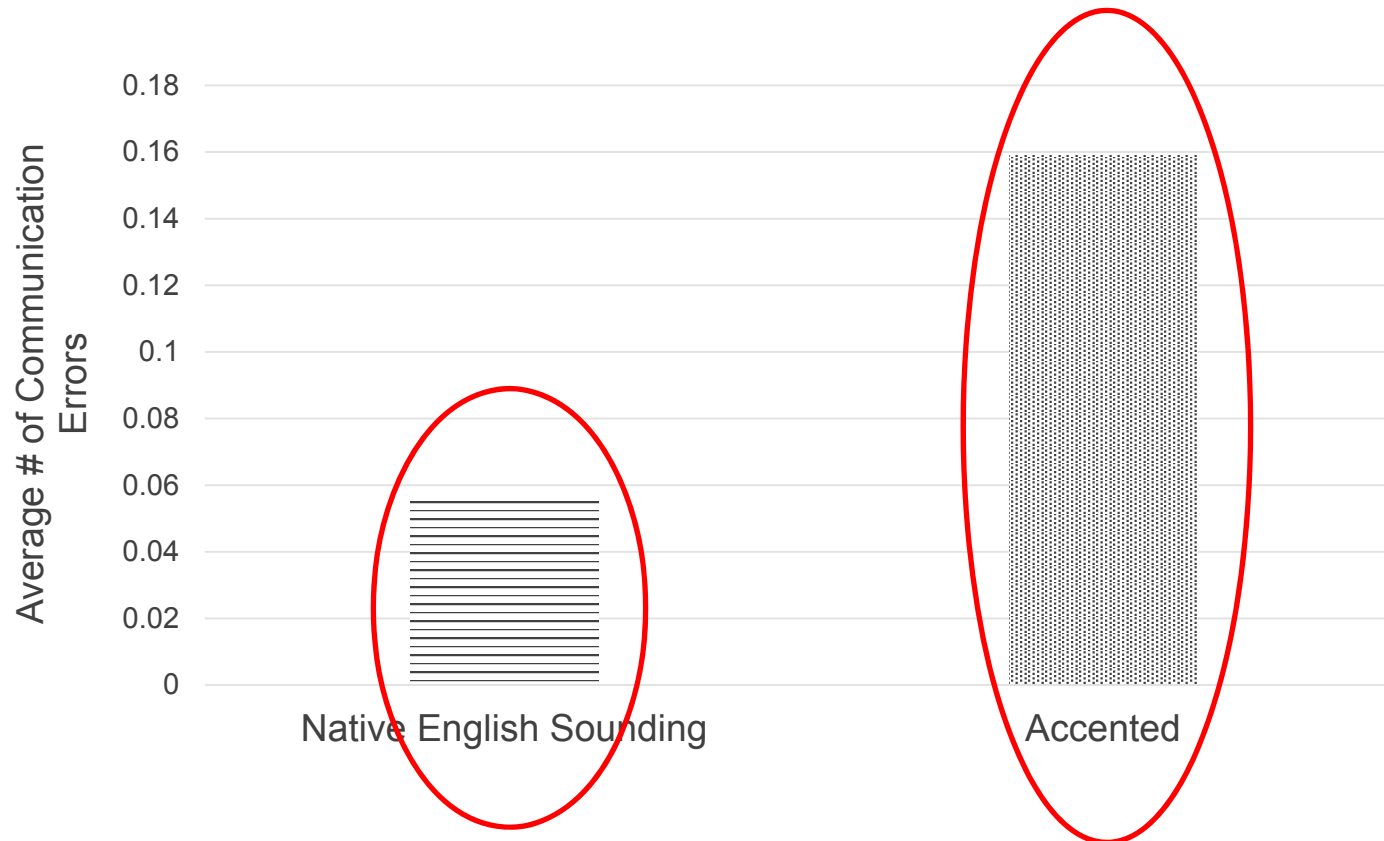
## Aim

- Investigate **miscommunication** between **native English sounding** and **accented pilots**
- Relationship between **information density** and **communication error**
- Investigate if:
  - type of communication error (**omission or mistake**) varies based on **phase of flight** or **language background**
  - category of communication error (**number of word**) varies based on **phase of flight** or **language background**

# Commercial Aviation – SYD

- 18 hours of ATC-Pilot Recording - liveATC  
<http://www.liveatc.net>
- Sydney Tower, Approach and Departure frequency
- 14 February to 29 April 2016
- Between 0800-1030 and 2100-2130
- Native English sounding pilots vs. Accented pilots
- Approach (Tower & Approach) vs. Departure

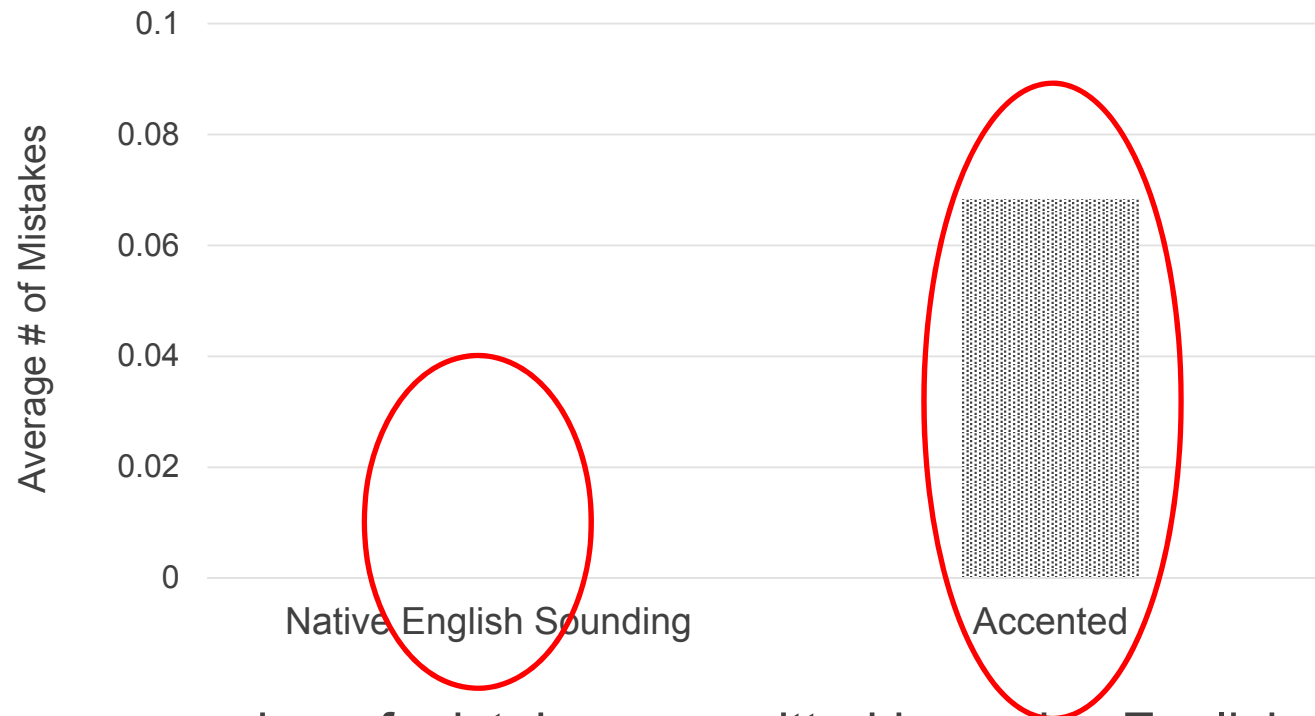
# Commercial Aviation – SYD



Average number of communication errors committed by native English sounding pilots and accented pilots per transmission ( $t(205.27) = 2.53, p = .012$ ).

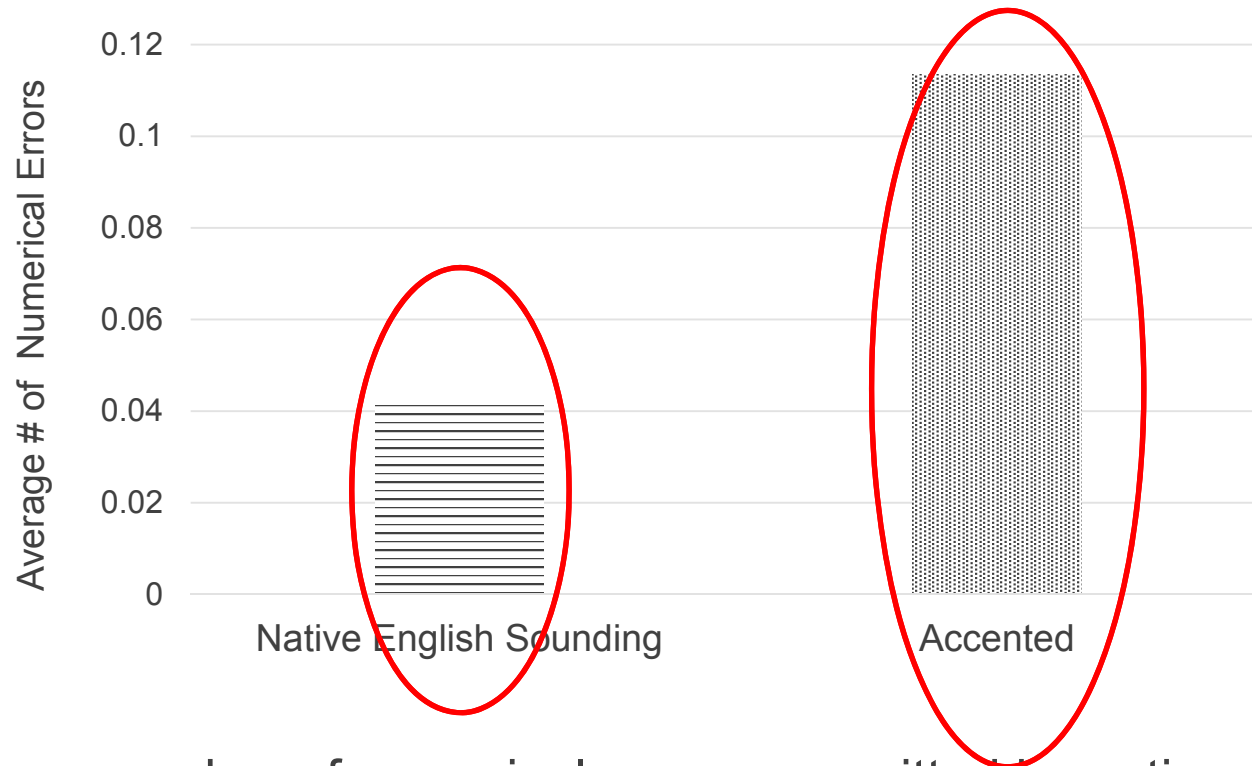


# Commercial Aviation – SYD



Average number of mistakes committed by native English sounding pilots and accented pilots per transmission ( $t(131.00) = 3.10, p = .002$ ).

# Commercial Aviation – SYD



Average number of numerical errors committed by native English sounding pilots and accented pilots per transmission ( $t(219.50) = 2.18, p = .03$ ).

# Commercial Aviation – SYD

No difference based on:

- Phase of flight (Approach vs Departure)
- Omissions (native English sounding vs accented)
- Words (native English sounding vs accented)

# Commercial Aviation – SYD

## Summary:

- Native English sounding piloted - fewer communication errors compared to accented pilots
- Native English sound pilots – fewer mistakes (not omissions) than native English sounding pilots
- Mistakes predominately with numbers (not words)

# Conclusion

## Summary:

- Accurate and error free communication elusive
- Proficiency in English language remains a challenge
- # of items in a transmission should be limited
- Qualification not flight experience results in improved communication performance
- Nature of the error differs based language background
  - Mistakes (not omissions) higher with non-native speakers
  - Numbers (not words) more difficult for non-native speakers

# Thank you

Questions?

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