

Captions on Holodeck: Exploring Quality Implications of Augmented Reality

Dr. Minako O'Hagan

Translation Studies

School of Cultures, Languages and Linguistics

University of Auckland

Overview

- Summary of the Project Aim
- Research Context
 - Accessibility in New Zealand
 - Cross-Faculty Research Project
- Captions on Holodeck Project: Augmented Reality for accessibility captions
- Interim Findings
- Plans

Captions on Holodeck: Inter-faculty Project Summary

Background rationale:

- The university is investing in digital technologies to enhance students' learning experience
- An increasing number of hard-of-hearing students who do not seek assistance from Disability Services
- 2016 UoA Annual Report showed over 6,600 international students, (15% of the total number of students), of which 75% were from non-English speaking countries

Motivation:

- How can we enhance students' learning experience with technologies?
- How can we bring in an element of fun to the solution?
- Can Augmented Reality provide a different/better user experience in accessibility captions?

Research Context

- Film industry and technology
- Official languages of New Zealand
 - New Zealand Sign Language (NZSL) since 2006

©Wellington Airport



Research Context

- Only free-to-air news captioned:
 - One News (4 bulletins/day)
- Broadcasters with live captioning capabilities:
 - TVNZ, Prime
- Captions not available for on-demand content (TVNZOnDemand, 3Now)
- Audio Description available since 2011 for TVNZ One and Two for more than 40 hours/week

Current Levels of Captioning in New Zealand (2016/17)

Channels (free-to-air)	Captioned % of programmes
TVNZ One	57
TVNZ Two	73
Three	27
Prime	23

(Source: Able 2018)



Search

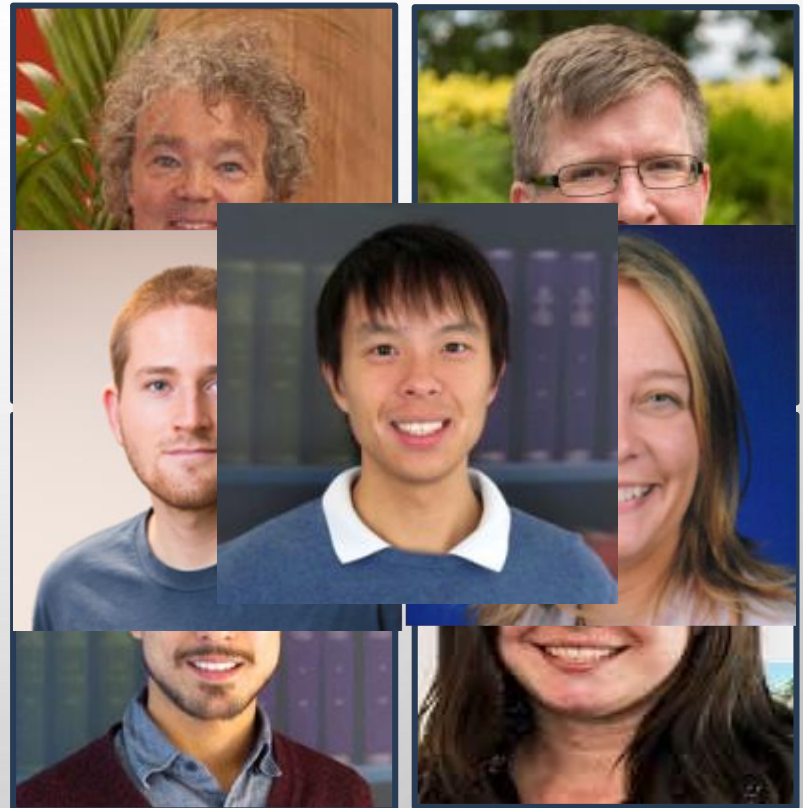


1.2m



Captions on Holodeck: Inter-faculty project

- Seed-funding for interdisciplinary research (Oct '17- Apr '18)
- Expertise across departments:
 - eResearch with Visualisation/AR expertise – incl. usability expert
 - Centre for Learning and Research in Higher Education
 - Bioengineering with machine learning
 - Able – industry partner



○ Captions on Holodeck: RQ

- Research Questions

1. What is the level of awareness of UoA students and staff for the need/use of same language captions (CC) for recorded lectures?

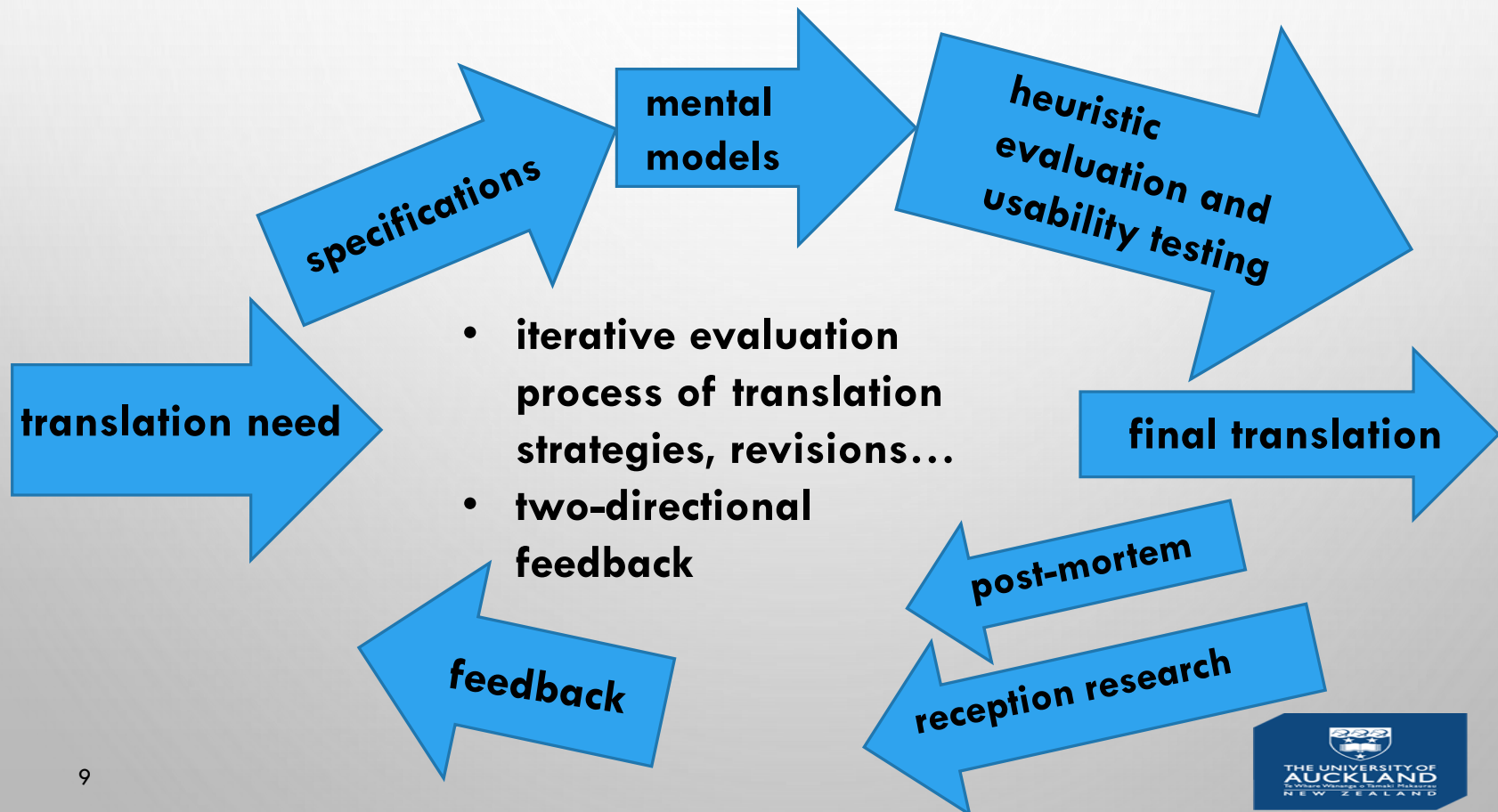
2. What is the user perception of the CC projected in AR?

2a: How does it compare with CC presented on the screen in conventional settings or no CC?

2b: How do three different user groups compare?

Captions on Holodeck: Approach

User-Centered Translation (UCT process ©Ami Otava in Suojanen et al. 2015:4)



○ Captions on Holodeck: Research Design

- Lab-based user experience study with three groups with three conditions:
 - (G1) Native speaker of English with no hearing impairment
 - (G2) Non-native speaker of English with no hearing impairment
 - (G3) Any language speaker with hearing impairment
 - (Clip1) A clip with no captions
 - (Clip2) A clip with captions
 - (Clip3) A clip with captions projected in AR
- MOOCs courses with ready-made closed captions

Captions on Holodeck: HoloLens

HoloLens specs

Display See-through holographic lenses (waveguides) 2x HD 16:9 light engines; Automatic pupillary distance calibration:

Processor Custom Microsoft Holographic Processing Unit HPU 1.0, Intel 32-bit architecture; RAM:2GB; Storage: 64GB;

Camera 2MP photos, HD video; Audio External speakers, 3.5mm audio jack

Human Understanding: spatial sound, gaze tracking, gesture input, voice support



Captions on Holodeck: Setting



Captions on Holodeck: Survey results snapshot

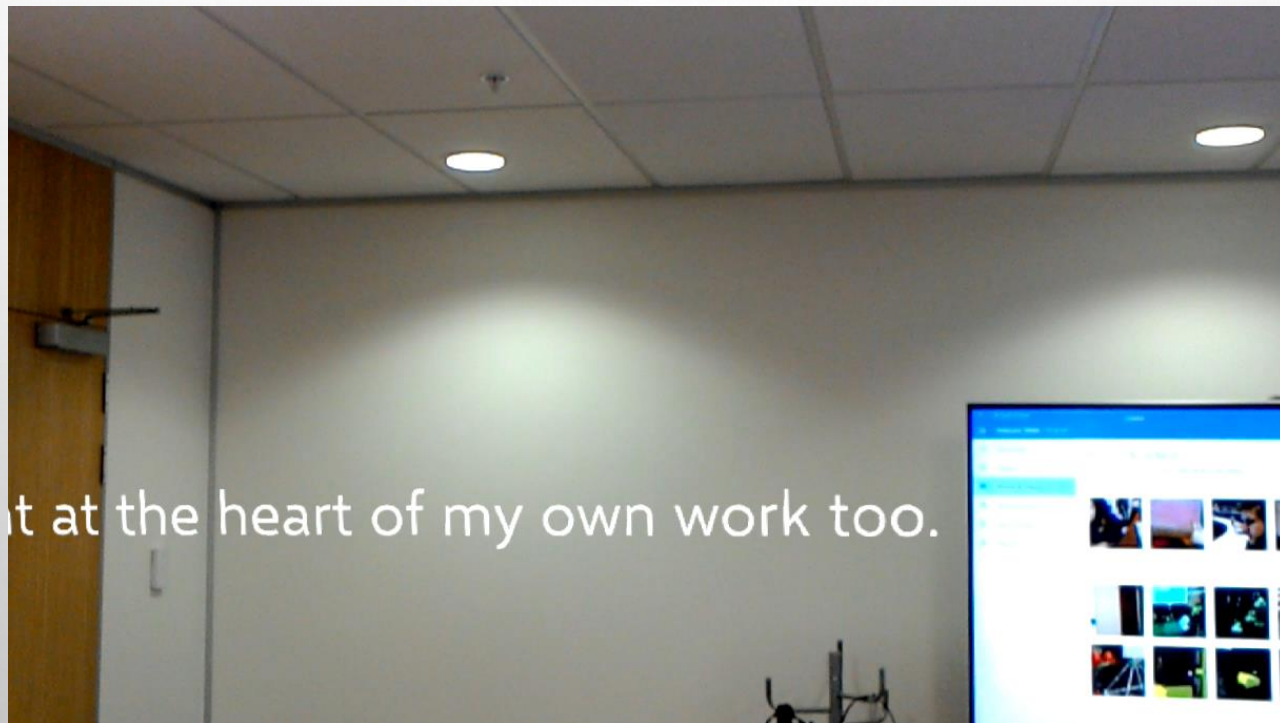
Type	Setting/Tool	Participants
Online Survey	Qualtrics	N=152 (students=113; staff=39)
User Studies Video recordings; pre- and post-task questionnaires; Comprehension test	In-lab sessions	Hearing Eng = 21
		Hearing non-Eng = 21
		Hearing impaired = 5

Captions on Holodeck: Survey results snapshot

- Q3.7 - Why do you watch lecture recordings?

#	Answer	%	Count
1	I missed the live lecture	19%	29
2	I missed important information in the live lecture	20%	30
3	Lecture recordings help me review and remember the lecture	23%	35
4	Seeing it again helps me to understand lecture material	21%	32
5	I can watch the lecture at my own pace	16%	25
6	Other	1%	2
	Total	100%	153

Captions on Holodeck: User Study



Captions on Holodeck: User study

Please rate the importance of providing accurate English captions ($n = 47$)

Question	Extremely important	Very important	Moderately important	Slightly important	Not at all important
How important do you feel is the accuracy of English captions for enhancing the learning experience of students with hearing impairment?	68% (32)	23% (11)	9% (4)	0% (0)	0% (0)
How important do you feel is the accuracy of English captions for enhancing the learning experience of students who are non-native English speakers?	72% (34)	28% (13)	0% (0)	0% (0)	0% (0)
How important do you feel is the accuracy of English captions for enhancing your learning experience?	47% (22)	26% (12)	17% (8)	9% (4)	2% (1)

Captions on Holodeck: User study

Please rate the following from prefer a great deal to do not prefer (n = 47)

#	Question	A great deal	A lot	Moderate amount	Slightly	Do not prefer
1	How much would you prefer to have this kind of technology available during lectures?	15% (7)	30% (14)	36% (17)	15% (7)	4% (2)
2	How much would you prefer to have recorded lectures with English captions?	51% (24)	36% (17)	4% (2)	4% (2)	4% (2)
3	How much would you prefer to have verbatim captions as opposed to condensed captions?	45% (21)	26% (12)	17% (8)	2% (1)	10% (5)

○ Captions on Holodeck: Interim results

- Importance of the quality of captions in educational settings was highlighted by all three groups
- Users overestimate the usefulness of the AR technology for other types of users than themselves
- Despite some usability issues students indicated favourably for the scope of the usefulness of AR technology towards enhancing their learning process
- Users appreciated the personalisation aspect most of the AR technology in viewing captions

Captions on Holodeck: Further work

- Explore quality expectations
 - Educational settings go hand in hand with expectations for high quality and trustworthy captions
- Explore personalisation functions
 - Scope to kinetically manipulate captions by use of hand gestures or gaze
 - Understanding of optimum default parameters (cf some students speed up when replaying the video)
- Explore potential for collaborative captioning with users
 - Applying UCT (User-Centered Translation)
- Explore philosophical issue
 - Posthumanist concepts of human co-evolution with tools

Research Context: University of Auckland

Programme enrolments (by faculty)	2014	2015	2016
Arts	8,178	7,667	7,327
Auckland Bioengineering Institute	79	89	87
Business and Economics	7,173	7,225	7,248
Creative Arts and Industries	1,878	1,835	1,838
Education	3,741	3,554	3,327
Engineering	4,106	4,298	4,328
Law	1,789	1,790	1,854
Liggins Institute	42	42	46
Medical and Health Sciences	5,769	5,971	6,360
Science	8,517	8,905	8,943
University Programmes	2,588	2,826	2,584
Total	43,858	44,200	43,939

Note: - Conjoint degrees, PhD and other doctorate enrolments are reported with their sponsoring faculty. For example, a student enrolled in BA/BSc will be distributed between Science and Arts at a ratio of 50/50.
 - University Programmes includes inter-faculty offerings as well as University Certificates and TFC
 - Students enrolled in more than one programme during the year are counted in each programme

Student enrolment by qualification (EFTS)	2014	2015	2016
Doctor of Philosophy	1,808	1,915	1,949
Other doctoral degree	84	82	82
Master degree	2,079	2,095	2,262
Bachelor honours	790	865	838
Postgraduate certificate/diploma	2,120	2,046	2,061
Bachelor degree	25,132	24,972	24,511
Undergraduate diploma	255	203	184
Certificate	1,180	1,293	1,216
Total	33,448	33,472	33,102

Completions by qualification	2014	2015	2016
Doctor of Philosophy	367	350	338
Other doctoral degree	24	27	27
Masters degree	1,297	1,551	1,511
Bachelor honours	553	647	682
Postgraduate certificate/diploma	2,309	2,154	2,476
Bachelor degree	5,749	5,260	5,634
Undergraduate diploma	202	167	131
Certificate	453	469	492
Total	10,954	10,625	11,291

Note: - Formal qualifications only are included for EFTS and completions

RANKED 1 IN NEW ZEALAND
 NUMBER FOR GRADUATE EMPLOYABILITY*

\$143.1 Million 
 Public good research income 2016

\$107.0 Million 
 Private good research income 2016

Research income	2014	2015	2016
Public good research income (NZ and international) (\$m)	113.0	133.0	143.1
Private good research income (NZ and international) (\$m)	121.7	119.9	107.0
Total research income	234.7	252.9	250.1

 **60** research centres and institutes across the University create knowledge that benefits our social, cultural, economic and environmental future.

2016 research commercialisation (Auckland UniServices Ltd.)

- Revenues of \$114 million
- 50+ licences for intellectual property
- 11 businesses to commercialise University research

Contact

Email: studentinfo@auckland.ac.nz
 Phone: 0800 61 62 63
 Fax: 0800 61 62 64.



Research Context: AR applications



(AR at the National Theatre in London – Boyle, E. 2017)

○ Captions on Holodeck: Inter-faculty project

