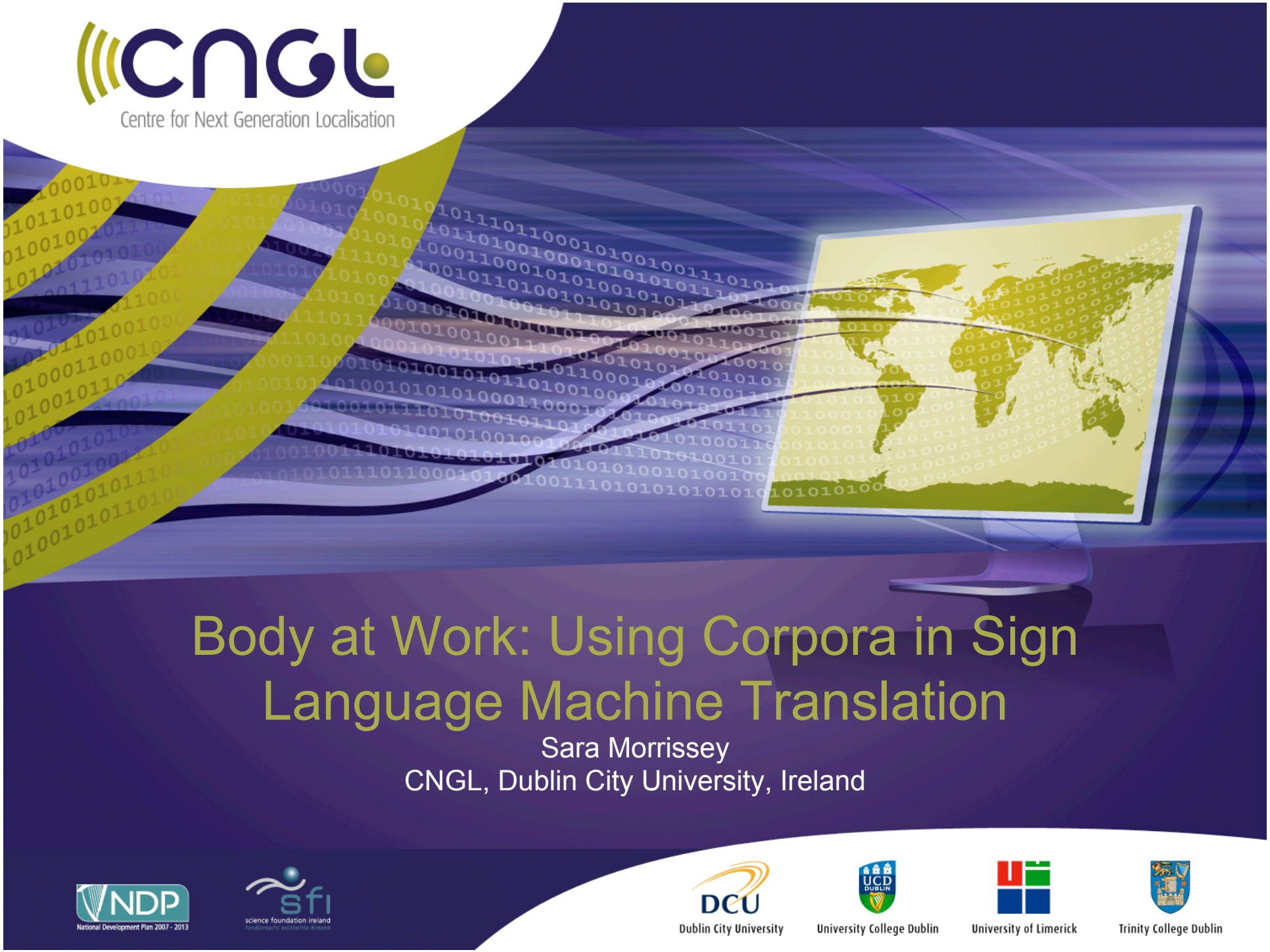


Body at Work: Using Corpora in Sign Language Machine Translation

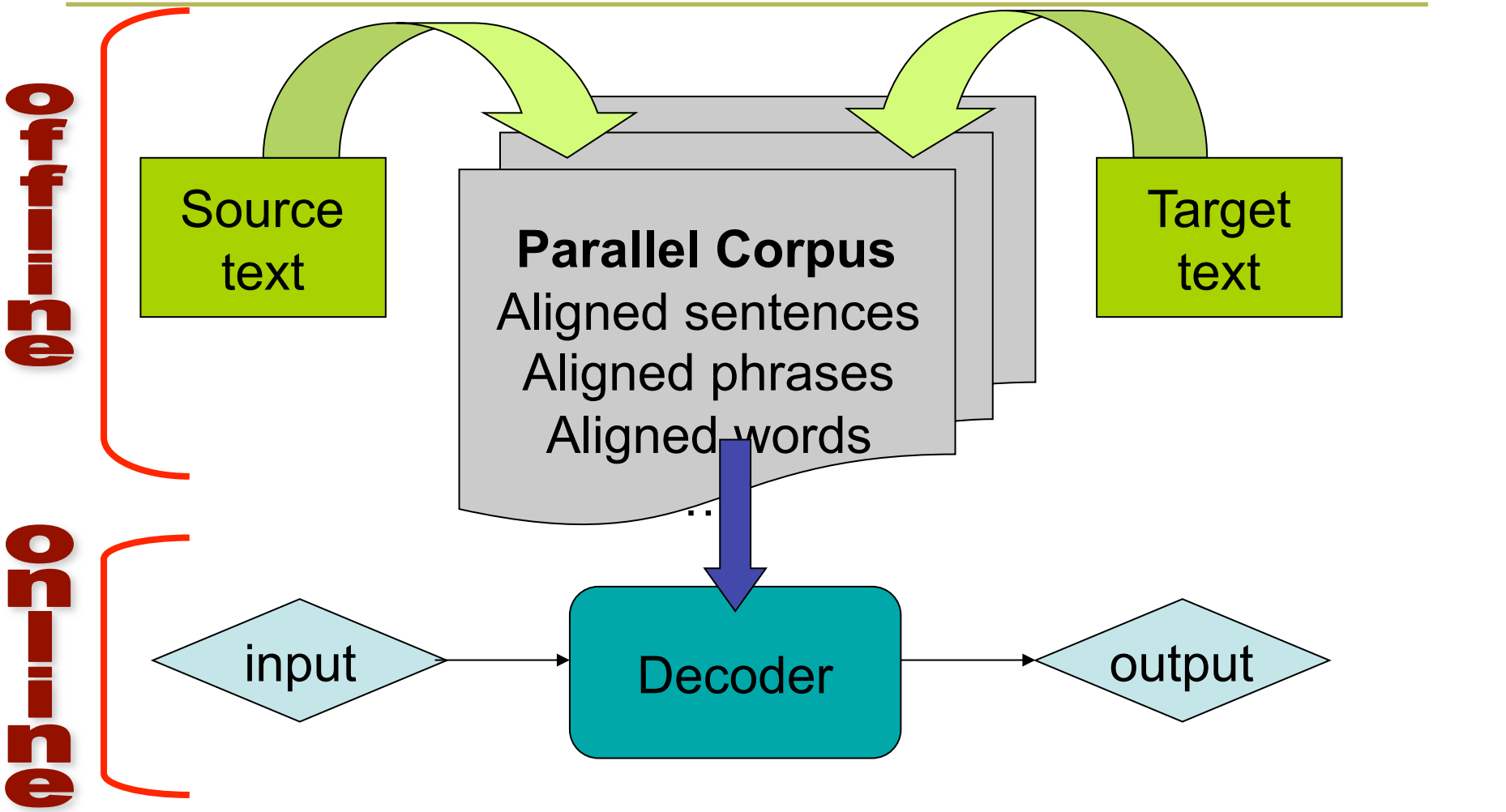
Sara Morrissey
CNGL, Dublin City University, Ireland

NDP National Development Plan 2007 - 2013
sfi science foundation ireland
DCU Dublin City University
UCD Dublin University College Dublin
University of Limerick
Trinity College Dublin

20 min presentation 50% own, 50% Qs

- **CHALLENGE 1: SYMBOLIC TRANSLATION**
- In this area we want to discuss possible approaches for translating a spoken language sentence (in its written form) to a signed utterance representation, e.g. a sequence of glosses.
- How much linguistics and lexicography is required?
- How much world knowledge is required?
- Do you use a corpus to inform the process, and how does the corpus have to look like?
- What triggers the use of sign-specific means of expression, such as productive signs and classifier constructions, or constructed action?
- What are good evaluation measures?
- How much detail must the target signed utterance representation contain?

Corpus-based approach: statistical/example-based



Early work: phase 1 (2004/2005)

- English → Sign Language of the Netherlands (Nederlandse Gebarentaal – NGT)
- ECHO project data (561 sentences)
- Glossing
- Hand-crafted basic example-based machine translation (MT) system
- Basic manual evaluations of gloss output

Preliminary experiments

The hare takes off

(Gloss RH English) (p-) running hare :
(Mouth) closed-ao :
(Mouth SE) /AIRSTREAM/ :
(Cheeks) p :
(Gloss LH English) (p-) running hare :
(Gloss RH) (p-) rennen haas :
(Gloss LH) (p-) rennen haas

Early work: phase 2 (2006-2008)

- English, German, Irish Sign Language (SL), German SL (Deutsche Gebärdensprache - DGS),
- Air Traffic Information System corpus (595 sentences)
- Manually glossed using ELAN (lacked NMF detail)
- Bidirectional MT using MaTrEx
- Avatar database of pre-created videos using Poser software – also addressed lack of NMF detail in glosses
- Manual and automatic evaluations
- Automatic scores: broadly comparable with contemporaries: 35-50% correct
- Manual evaluations: generally well received, but subjective, only 4 people

Example

English input: `I'd like a flight`

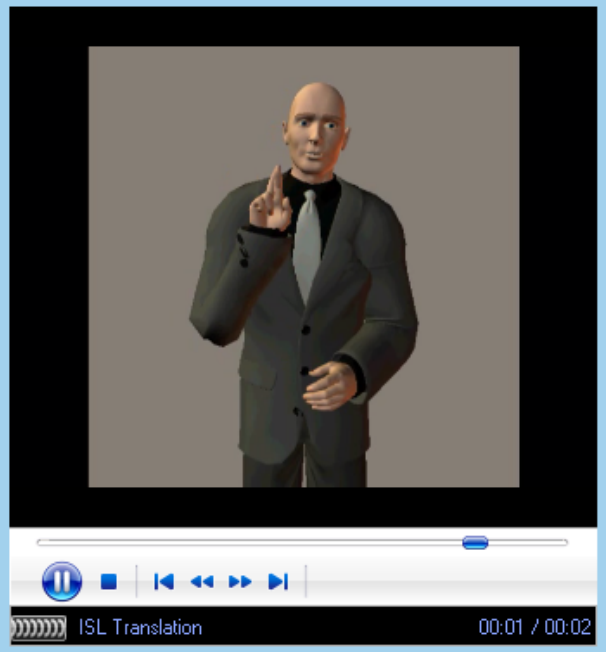
ISL Gloss output: `LIKE FLIGHT`

Evaluation Webpage

Sign Language Translation

Sentence 4

Sentence 4: Initials: SM



Intelligibility: How would you rate this video sentence in terms of understandable and correct ISL?

- Understood and correct
- Understood but somewhat incorrect
- Difficult to understand but I grasp the gist of it
- Incorrect or too confusing to grasp the meaning

Fidelity: How would you rate the video sentence as a translation of the English?

Please click on the box below to view the original English sentence. English sentence...

- Excellent translation, no errors
- Good translation, a few things incorrectly translated or missing
- Basic concepts are correct but mostly incorrect or information missing
- Completely incorrect translation

Submit

Early Attempts: what we learned

- Detailed, multi-level transcriptions
  - cause difficulty with alignments in training and for the evaluation process
  - Are labour intensive to create
  - Few standards, subjective
- Using glossing is ‘cheating’
  - Using one language to represent another is not adequate (Pizutto & Pietrandrea, 2001)
  - Pidgin form of spoken language
  - Becomes computer-assisted translation rather than MT (ambiguity resolved, lexical gaps filled subjectively…)
- Individual pre-made videos don’t make for natural sign transition
- EBMT showed no significant improvement

Current Work

- Patients with Limited English (2008 – present)
- English →Irish Sign Language
- Multimodal patient—medical-receptionist appointment booking corpus (396 sentences)
- Manual transcription using HamNoSys
- Animated avatar using software of University of East Anglia
- Corpus collection complete, exploratory MT beginning
- ~~**The results are amazing! The problem is solved and we can all go home now!**~~

Example

- Question: how do we maintain expressibility and content in the SL but keep text to minimum for MT?

- English: **`hello, can i make an appointment.`**
- ISL: **`sid5 sid14 sid117 sid27 sid118 sid7`**

Transcription of utterance in SiGML

<utterance spoken="1.26 Hello, can I make an appointment.">
<sign gloss="HELLO_AS_2" signid="5"><mouth>hIUUUO</mouth><src editable="false"/><gol editable="false"/><loc editable="false"/><hand/><limbs/><facialexpression/>

<hamnosys>hamflathand,hamextfingerul,hampalmdr,hamforehead,hamlrbeside,hamseqbegin,hamtouch,hamindexfinger,hamseqend,hamreplace,hamfinger2345,hamfingerbendmod,hambetween,hamflathand,hamextfingerol,hambetween,hamextfingeru,hampalml,hamshoulders,hambetween,hamshoulders,hamlrat,hamarmextended</hamnosys>

</sign>

<sign gloss="GST-GET_ATTENTION" signid="43"><mouth/><src editable="false"/><gol editable="false"/><loc editable="false"/><hand/><limbs/><facialexpression/>

<hamnosys>hamflathand,hamthumboutmod,hambetween,hamfinger2345,hamextfingeruo,hamextfingerol,hambetween,hamextfingero,hampalmd,hamshouldertop,hamarmextended,hamparbegin,hamnodding,hamfingerplay,hamparend,hamrepeatfromstart</hamnosys>

</sign>

<sign gloss="I_VS_3" signid="117"><mouth>m</mouth><src editable="false"/><gol editable="false"/><loc editable="false"/><hand/><limbs/><facialexpression/>

<hamnosys>hamfinger2,hamthumbacrossmod,hambetween,hamfinger2,hamthumbacrossmod,hamfingerstraightmod,hamindexfinger,hamextfingeril,hampalmr,hamshoulders,hamclose,hammovei,hamsmallmod</hamnosys>

</sign>

<sign gloss="BOOK_appointment" signid="7"><mouth>@pOm@</mouth><src editable="false"/><gol editable="false"/><loc editable="false"/><hand/><limbs/><facialexpression> FU </facialexpression>

<hamnosys>hamsymmpar,hamflathand,hamparbegin,hamextfingeru,hamplus,hamextfingeror,hamparend,hampalmu,hamparbegin,hamlips,hamclose,hamplus,hamchest,hamparend,hamparbegin,hamseqbegin,hamreplace,hamextfingero,hampalmd,hamchest,hamseqend,hamplus,hamnomotion,hamparend</hamnosys>

</sign>

<sign gloss="CAN" signid="52"><mouth>k}n</mouth><src editable="false"/><gol editable="false"/><loc editable="false"/><hand/><limbs/><facialexpression> RB WB </facialexpression>

<hamnosys>hamfinger23,hamextfingeru,hampalmd,hamshoulders,hamclose,hamparbegin,hamreplace,hamextfingerdo,hamparend</hamnosys>

</sign>
</utterance>

Encapsulating data

<sign gloss="HELLO_AS_2" signid="5">
<mouth>hlUUUO</mouth><src editable="false"/><gol
editable="false"/><loc editable="false"/><hand/><limbs/
><facialexpression/>

<hamnosys>hamflathand,hamextfingerul,he
ad,hamlrbeside,hamseqbegin,hamtouch,se
qend,hamreplace,hamfinger2345,hamfingwe
en,hamflathand,hamextfingerol,hambetweam
palml,hamshoulders,hambetween,hamsharm
extended</hamnosys>

</sign>

Current Work Considerations

- Do we maintain expressibility and content of the SL?
- Need to better investigate the MT process, the corpus and see how we can encode and transfer this information across
- Linguistic information will not come through via ID tags, may need to alter this to encode the information for EBMT
- HamNoSys offers a more comprehensive, faithful description of an SL than glossing
- Using the UEA avatar tool, MT can now be performed on-the-fly and without pre-loaded videos that can be unrealistic.
- Don’t yet know what we’re missing in terms of sign-specific linguistic information…let the fun begin!

Addressing the Challenges in the Context of Corpus-based Machine Translation

- The corpus, its form (notation) and what we can glean from it

- Output format and evaluation

The corpus, its form (notation) and how we can exploit it

- A corpus is a highly valuable linguistic resource
  - For linguistic analysis and collection, for seeding data-driven MT
  - But the problem is getting enough AND in the same format
  - It can take aaaaaaaaaaaages to create one
  - Solution: central repository and standards?

- Do we take advantage of glossing and how it makes MT easier?
- Or do we consider it potential misrepresentation and choose an alternative format?

Detail of Output Representation

- How much detail must the target signed utterance representation contain?
  - Consider representation as transcribed, text-based annotation:
    - Less detail = easier translation
    - More detail = better animation
  - Consider representation through an avatar.
    - animated representation should be fully articulate, human-like, competently use non-manual features and the signing space accurately.
    - realism of avatars in relation to the ‘uncanny valley’, how realistic can an avatar be before it gets disconcertingly real? Where is the line of acceptability?
- Is perfect output necessary?
  - Mainstream MT
  - Gisting
  - Not perfect, but maybe helpful
  - Not trying to replace interpreters, and it shouldn’t!

Evaluation

- What are good evaluation measures?

- Automatic evaluation
  - Not yet possible for avatars
  - BLEU and error rates used in mainstream spoken language MT can be adopted for transcription-based output
  - Internal progress of the MT can be compared

- Human evaluation
  - Artificial for transcriptions
  - imperative – evaluate actual signing
  - Evaluates system as a whole
  - Subjective evaluation

Conclusions

- We all need corpora – the more the better
  - Wouldn't a central repository be great?
- Transcription should faithfully represent the SL…but:
  - The simpler it is, the less faithful it is?
  - The more complex it is, the more difficult it is for MT?
- Evaluation is imperative
  - Automatic and manual
  - Whole pipeline or individual components
  - Guidelines/rules set out
- Lots done, more to do!

Thank you/ Go raibh maith agaibh

Questions/Ceisteanna?

This research is supported by the Science Foundation Ireland (Grant 07/CE/I1142)
as part of the Centre for Next Generation Localisation (www.cngl.ie) at Dublin City University