Spoken and Sign Languages
A Cross Modal Study

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Overview

- Introduction - Research in SLs
- Framework Adopted
- The Indian Sign Language
- Cross-modal Systems - Challenges
- INGIT – Issues and Solutions
- Summing Up
- Future Directions

Introduction

- Language – a multimodal construct
- Evolution of Sign Languages
  - Origin – ‘Deaf’ communities
  - Evolution – linguistic aspects
- Sociolinguistic Aspects - ISL
  - Geographical Variation
  - Status as a Minority Language
  - ISL in Education [Deshmukh96]

Introduction

- **Past Research in SLs**
  - **Neuro-physiological**
    - **[Damasio86], [Gordon04]**
  - **Multi-modal [Petitto04]**
  - **Descriptive**
    - **[Stokoe60], [Sexton99]**
  - **Cross-modal**
    - **[Wray *et al* 04], [Zhao *et al* 00], [Speers02]**
  - **The case of ISL**
    - **[Vasishta *et al* 86], [Zeshan00]**

The Present Project

- **Issues in cross-modality**
  - **Representations**
  - **Mappings**
- **Part of a larger endeavour**
  - **A description of ISL**
  - **A cross-modal translation system**

Framework Adopted

- **Construction Grammars [Kay, 2002]**
  - **The fly is buzzing.**
  - **What is the fly doing in my soup?**
  - **. . . fly in the ointment. . .**
- **Constructions**
  - **form – meaning maps at various levels**
  - **morphological, lexical, syntactic**
- **Unification based approach**

Framework Adopted

- **Fluid Construction Grammar (FCG)**
  - **Computational model of CG [De Beule and Steels, 2006]**
  - **Paired syntactic and Semantic Structures**
  - **Bidirectional rules, unification based approach**
- **Why Construction Grammars?**

The Indian Sign Language

- Spatial Modality
- Extensive use of space
  - Iconic signs
  - Role play
  - Use of person and space deixis
  - Directional verbs
  - Non-manual markers

Ram gave Sita a cat

Does Ram love Sita ?

Cross-Modal Issues

- **Levels of Mapping**
  - **Constituent Level**
    - **Complete**
      - गाडी सात बजे जाएगी → **{train time seven go}**
    - **Partial**
      - **Constituent Deletion**
      - राजधानी रात में चलती है → **{rAjdhAni night go}**
      - **Constituent Insertion**
      - आप दस रुपये दीजिए → **{money ten give {you me}}**

Cross-Modal Issues

- **Levels of Mapping**
  - **Construction Level**
    - **Compositional**
      - **टिकट नहीं मिलेगा क्योंकि वेटिंग है →@neg {ticket get neg} {Q-why} {waiting-list}**
    - **Non-Compositional**
      - **X में Y वेटिंग है → {x waiting-list y}**

Cross-Modal Issues

- **Visuo-spatial nature of ISL**
  - **Yes-no Question vs. corresponding affirmative**
  - **Spatial Morphology – aspect, classifier**
- **Polysemous Expressions**
  - **attributive and existential senses of 'है'**
  - **alienable vs. inalienable possession as in मेरी किताब and मेरा भाई**
  - **transactional and non-transactional senses of the verb 'ले'**

Cross-Modal Issues

- **Elided Expressions**
  - दस रुपये दीजिए → **{ten rupees give {you me}}**
  - **Event semantics in ISL**
- **Anaphoric expressions**
  - **May be resolved to saturate event semantics**
  - **May be replaced with deictic signs**

INGIT – Issues and Solutions

- Elided Expressions
  - Semantically mediated route
  - HPSG, CG …
- Mapping Levels
  - Morphological, lexical, sentential
  - Hybrid formulaic expressions
- … Construction Grammars

INGIT – Issues and Solutions

- Ellipsis and Anaphora
  - Ellipsis resolution module
    - Participants in transactional events
    - Subject in monadic/dyadic events
  - Some instances passed on to ISL using unit constructions
- Polysemous expressions: unit constructions

INGIT – Issues and Solutions

- **Mapping Level problem**
  - **Complete constituent mapping: word-constituent mappings**
  - **Partial constituent mapping**
    - **Deletion: word-constituent mapping**
    - **Insertion: indeterminate process, unit constructions used**
  - **Constructional Mapping: unit and compositional constructions**

INGIT – Issues and Solutions

- **Visuo-Spatial Nature of ISL**
  - **Output formatted in a manner so as to enable the rendering module to bring out directionality**
  - **Output String tagged for visual markers and deictics**

Summing Up

- **Semantically mediated procedure**
- **CG adapted to specific objectives**
- **Working implementation developed ***

*** Purushottam Kar, Madhusudan Reddy, Amitabha Mukerjee and Achla M Raina, "INGIT: Limited Domain Formulaic Translation from Hindi to Indian Sign Language", Proceedings of ICON-07, Hyderabad (To appear).**

Future Directions

- Describe ISL in terms of a framework allowing parallel processing
  - Define such a framework and develop formalisms for the same
- Further explore representational and mapping issues
- Develop robust graphical front end
- Add support to take speech as an input

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