Informal Dialectal Arabic Data

- Arabic dialects are not written or standardized → challenges for both morphological annotation and morphological analyzer
- Scarcity of normalized written Arabic dialectal resources
- Ad hoc orthography often used: significant degree of noise and high level of inconsistency in spelling, whether in Arabic script or in a Romanized representation
- Previous experience showed that Arabic dialects have to be treated as new and separate languages

Egyptian Arabic Linguistic Features

- **Phonology**: Egyptian is characterized specifically by /t/ and /d/ being replaced by glottal stop /ʔ/ and /g/
- **Morphology**: Egyptian has future proclitics h+ and ħ+ (as opposed to the MSA equivalent s+)
- **Lexicon**: Significant lexical differences between Egyptian Arabic and MSA, with no etymological or cognate relationship
- **Syntax**: Overall syntactic structures are available in both MSA and Egyptian Arabic

Development of specialized Egyptian Arabic Morphological Annotation Guidelines

Development of Egyptian Morphological Analyzer (CALIMA)

- CALIMA was bootstrapped using the LDC Egyptian Colloquial Arabic Lexicon (ECAL) and the CALLHOME Egyptian Arabic (CHE) corpus, developed in the 1990s
- ECAL entries (66K entries) converted into diacritized Arabic script words & lemmas (from phonological form & undiacritized orthography)
- Finite-state transducer (FST) implemented to map phonological form to multiple possible diacritized Arabic script forms
- Manual linguistic mapping rules followed by manual checking and correction
- Converted ECAL examples used to construct databases of morphological analyzer
- Manually specified orthographic variants of prefixes & suffixes used to add entries automatically

FEEDBACK LOOP

**Goal** = making the analyzer and treebank annotation in sync as much as possible; morphological solutions in the annotation should exactly match a solution in CALIMA

1. **Interface: Annotation Process & Analyzer**

   - Reorganization of CALIMA tables to allow bidirectional matching of POS tags → modified tables to translate CALIMA into a FST
   - Generation of wildcard solutions for annotation of solutions not (yet) in CALIMA
   - Stem not in CALIMA → wildcard solutions, in which the stem for an open-class word (noun, etc.) would be unvoicized, but the prefixes and suffixes exactly matched the possibilities elsewhere in CALIMA
   - Closed-class items and morphemes (pronouns, etc.) should not have missing solutions
   - Restrict annotators’ entry for missing solutions

2. **CALIMA Revision**

   - Some annotated solutions did not match CALIMA after initial annotation. Non-matching solutions included both wildcard solutions and fully manual solutions
   - Arbitration (sometimes requiring further joint discussion by the treebank and analyzer teams) and normalization, before entering new solutions into the CALIMA tables
   - Feedback/collaboration between LDC annotation team & CALIMA development team

3. **Treebank Revision and Further Annotation**

   - New CALIMA version → integrated into POS/morphological annotation stage of treebank annotation process
   - Fewer “holes” in each new CALIMA version → improved annotation process, more often the desired solution was available for the annotator, reducing wildcard or manual solutions
   - Cycle repeats, as remaining new solutions are sent to the analyzer team, which creates a new version of the analyzer, which is sent back to the treebanking team, and so on...

Conclusions

- Developing the morphological analyzer and the treebank annotation in parallel was successful, showing improvement from one segment to the next for both the analyzer and the annotation
- Contacts between the CALIMA team and the LDC Treebank team were crucial to solving naging issues and meeting common goals
- Collaboration on this type of challenge, where tools and resources are limited, proved to be remarkably synergistic, and opens the way to further fruitful work on Arabic dialects

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