Annotating Picture Description Task Responses for Content Analysis

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Abstract

My abstract ...

1 Introduction

Background, purpose of the corpus; (variability within NS and NNS groups; and these groups vary from each other?)

Motivate this for people who don't do this kind of work; measuring 'goodness' of responses; decomposing them into features; (this is not like grammatical error detection or parsing work); Getting a handle on variability, especially under different circumstances; is a response 'native-like'? in what ways (by which features?); breaking variability down into our features;

Cite previous work:

ours (King and Dickinson, 2013)

and others' (Somasundaran et al., 2015)

2 Picture Description Task

The PDT is built around 30 cartoon-like vector graphics. The images were modified to remove any non-essential detail or background. Two images contain numerals, two contain music notes, and one contains a question mark, but the rest are completely devoid of any text or symbols. Each image depicts an ongoing or imminent action, performed by a person or an animal. The images are divided evenly into intransitive, transitive and ditransitive actions.

Two main versions of the PDT were used. In each version, the first half contains "targeted" items, where questions take the form of *What is <subject> doing?*, where the subject (e.g., *the boy*, *the bird*) is provided. The second half contains "untargeted" items, where each question asks *What is happening?*. A roughly equal number of targeted and untargeted responses were collected for each item.

Each half (targeted and untargeted) is introduced with instructions including an example item and responses. The instructions ask participants to focus on the main event depicted in the image and to respond with one complete sentence. The PDT was presented as an online survey and all participants typed their own responses. Participants were instructed not to use any reference materials, but they were permitted to use browser-based spell checking.

In previous similar work (King and Dickinson, 2013, 2016), NSs were found to produce less variation than NNSs. Many NSs provided the same or very similar response with the most canonical way of expressing the main action. A primary purpose of the current corpus is to assess NNS response content by comparing against the NS responses, so NSs were asked to provide two nonidentical responses in the hopes that this would result in more variation among NS responses.

2.1 Data Collection

PDT versions;

NS vs NNS (1 vs 2 responses);

NNSs demographics (ELIP recruited);

NSs demographics and sources (known persons vs crowdsourced);

Response counts (types, tokens)

3 Annotation

The data were annotated with the aim of providing information that would be useful for the automatic assessment of NNS responses via comparison with the NS responses.

3.1 Scheme

The annotation scheme was developed through an iterative process of annotation, discussion and revision, with input from two annotators and multiple language professionals. The initial scheme

was planned as a three point scale, ranging from *accurate and native-like* to *accurate but not native-like* to *not accurate*. This proved problematic. *Accuracy* and *native-likeness* could not be adequately defined and applied to the data. Eventually, five binary features were settled on, with each feature having some relation to the original concepts of accuracy and native-likeness. A set of annotation guidelines were produced with definitions, rules and examples for each feature. The features and brief descriptions are listed here:

1. **Core Event**: Does the response capture the core event depicted in the image? Core events are not pre-defined but should be fairly obvious given the nature of the images. The response should link an appropriate subject to the event.

2. **Answerhood**: Does the response make a clear attempt to answer the question? This generally requires a progressive verb. For targeted items, the subject of the question must be used as the subject of the response; appropriate pronouns are also acceptable.

3. **Grammaticality**: Is the response free from errors of spelling and grammar?

4. **Interpretability**: Does the response evoke a clear mental image? Any required verb arguments must be present and unambiguous.

5. **Verifiability**: Does the response contain only information that is true and verifiable based on the image? Inferences should not be speculations and are allowed only when necessary and highly probable, as when describing a familial relationship between persons depicted in the image.

3.2 Agreement

Two annotators participated in the annotation. Both are native speakers of English and each has several years of language teaching experience with both children and adult learners. Annotator 1 (A1) annotated the complete corpus. Annotator 2 (A2) annotated only the development set and the test set.

Three items were used as a development set for creating and revising the annotation scheme. These items were also used as examples in the guidelines. They represent one intransitive, one transitive and one ditransitive item. Both annotators annotated the full development multiple times throughout the process, discussing and adjudicating disagreeing annotations before moving on to the test set, which was completed with consultation between the annotatorst.

The test set parallels the development set and consists of one intransitive, one transitive and one ditransitive item, and is shown in Table 1. Agreement and Cohen's kappa scores are given in Table 2.

3.2.1 Intransitives, transitives & ditransitives

Comparisons of the intransitive, transitive and ditransitive items reveal an association between lower item complexity and higher agreement. The highest raw agreement and Cohen's kappa scores are found with the intransitive item, and the lowest are found with the ditransitive item.

This is as expected, as ditransitive sentences are longer with more verb arguments, meaning there are a greater number of opportunities for responses to vary, and thus more opportunities for annotators to disagree on a given response. This trend also matches annotator feedback; both ranked the ditransitive item as the most difficult to annotate (for all features) and the intransitive as the easiest.

3.2.2 Targeted & untargeted

When the annotations are grouped into targeted and untargeted sets, the raw agreement scores are comparable: 94.9% for targeted and 95.2% for untargeted items. However, despite a greater degree of response variation, the untargeted group has a higher kappa score: 87.2% compared to 82.3%. This may appear counterintuitive, but can most likely be attributed to the stricter annotation rules for targeted items. For example, *answerhood* does not allow targeted responses to modify the subject provided in the question in any way. The untargeted questions elicit a greater degree of variation, but the annotation scheme accommodates this.

When asked to compare the annotation of targeted and untargeted responses, A2 noted that targeted responses require more concentration and closer consultation of the guidelines. Both A1 and A2 describe the annotation of untargeted items as less restrictive.

3.2.3 Features

Grouped by feature, the annotations all show raw agreement scores above 91% and Cohen's kappa

LK: A type-token ratio table would be helpful here.

are kappa scores percentages?

scores above 74%. For the future use of this corpus in content assessment, these kappa scores are comfortably above the 67% commonly suggested as a baseline for meaningful, reliable agreement [CITATION].

Core event This feature is the most relevant of the five for content assessment. All five features are skewed toward *yes* annotations, but with an average *yes* rate of 72.5%, core event is the least skewed; i.e., more responses receive a *no* annotation for core event than for any other feature.

Core event has the second lowest inter-annotator agreement kappa score, at 80.8%. This is somewhat lower than expected, as it is lower than the pre-adjudication development set score (88.9%). This appears to be largely attributable to the difficulty of the ditransitive item, which was challenging for both participants and annotators. The development set item depicts a man delivering a package to a woman, and many participants were familiar with the appropriate vocabulary and constructions. The test set item shows a man giving directions to a woman, and this resulted in a greater degree of variation, as many NNSs did not describe this in a canonical way. Rather than constructions like *asking X for directions* or *giving directions to X*, many NNSs describe the item with phrases like *pointing*, *guiding*, *helping a lost person* or *reading a map*, and most disagreeing core event annotations involve such responses, with A2 more likely than A1 to accept these less specific descriptions.

To a lesser extent, the transitive item, which shows a woman hugging a dog, resulted in disagreements where A2 accepts the word *pet* as the object, but A1 rejects such responses as too vague. Despite the acceptable scores for core event agreement, the fact that many disagreements hinge on particular word choice or annotators having minor differences in interpretation of the event suggest that greater agreement could be easily achieved by providing annotators with suggestions about the acceptable content for each response.

Answerhood This feature was added largely as a way to identify responses that do not follow the instructions. Such responses tend to fall into three categories: responses that simply do not directly answer the given question; responses that are gibberish or very low-effort and entered only so the participant can proceed to the next item;

and "troll" responses that attempt to be funny or obscene at the cost of attempting a direct answer.

The majority of participants do attempt to follow the instructions and answer the question, however, and it is unsurprising that this feature skews strongly toward *yes* annotations and results in the highest raw agreement (98.2%) and kappa (93.6%) scores among the five features.

Of 23 disagreements, seven stem from an annotator failing to enforce the requirement that a targeted response subject be either an appropriate pronoun or the exact subject given in the question, without adjectives, relative clauses or other modifiers. (This rule separates the task of verifying information from the task of identifying an attempt to answer the question.) Given the question *What is **the woman** doing?*, for example, the responses *The **lady** is running* and *The woman **who in pink** is running* were incorrectly accepted by one annotator. Another 10 disagreements involve responses lacking a progressive verb, which is generally required here as an indication that the response refers to the specific action in the image and does not merely describe a state or a general truth. This suggests that a annotator fatigue accounts for more the majority of answerhood disagreements.

Grammaticality This is the most heavily skewed feature, with an average *yes* rate of 83.3%.

Grammaticality has a raw agreement score of 93.0% and a kappa of 82.7%. Among 52 disagreements, annotators agreed in discussion that 19 involve an avoidable annotator error. These are primarily responses with typos, misspellings, subject-verb disagreement and bare nouns, which are all rejected by the annotation rules. Such cases are likely attributable to annotator fatigue.

The remainder reflect an unavoidable level of disagreement. Many of these stem from differing interpretations of bare nouns as either errors or as acceptable mass nouns, as in *The man is giving **direction** to the tourist*. In several disagreements, annotators could not agree on the acceptability of prepositions, as in *The girl is asking for help **to** the man* and *The girl is hugging **with** her cat*.

Interpretability

Verifiability Relevant tables:
Types, Tokens, TypeTokenRatio
(for targeted vs. untargeted;

Need to back this up with some numbers!

3

What is the woman doing? [Intrans.]	A1	A2
The woman is running.	1	1
She is wearing a red shirt.	0	0
Trying to run from her bad decisions.	1	0

What is the woman doing? [Trans.]	A1	A2
She's holding a puppy & looks happy.	1	1
She is happy with the dog.	0	0
The woman is loving her dog.	0	1

What is the man doing? [Ditrans.]	A1	A2
giving directions to a woman.	1	1
The man is reading a map.	0	0
The man is is telling her where to go.	1	0

Table 1: Test sample items and example responses with Core Event annotations from Annotators 1 and 2.

NS response 1 vs. NS response 2)

4 Discussion

4.1 Annotator feedback

Annotators' impressions of the task;
what is difficult? what is easy?

4.2 Agreement & Disagreement Trends

(Do trends align with annotator feedback?)
What kinds of items & responses were challenging?
Are the trends for individual features? Recurring disagreements?

4.3 Limitations

what we'd do differently:
which images are problematic and why (symbols, ambiguity);
Which features are problematic; useful/not useful;

4.4 Potential Uses

Use of corpus in the next phase of my work;
Suggestions of other projects and research questions for this corpus.

Acknowledgments

(Advisors, annotators)

References

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Swapna Somasundaran, Chong Min Lee, Martin Chodorow, and Xinhao Wang. 2015. Automated scoring of picture-based story narration. In *Proceedings of the Tenth Workshop on Innovative Use of NLP for Building Educational Applications*, pages 42–48, Denver, Colorado. Association for Computational Linguistics.

Set	Total	A1Yes	A2Yes	AvgYes	Chance	Agree	Kappa
intrans	2155	0.863	0.855	0.859	0.758	0.978	0.910
trans	2155	0.780	0.774	0.777	0.653	0.949	0.880
ditrans	2155	0.812	0.786	0.799	0.678	0.924	0.764
Target	3390	0.829	0.818	0.824	0.709	0.949	0.823
Untarg	3075	0.806	0.790	0.798	0.678	0.952	0.872
Core	1293	0.733	0.717	0.725	0.601	0.923	0.808
Answer	1293	0.834	0.831	0.833	0.721	0.982	0.936
Gramm	1293	0.861	0.872	0.866	0.768	0.960	0.827
Interp	1293	0.818	0.787	0.802	0.682	0.919	0.744
Verif	1293	0.845	0.817	0.831	0.719	0.968	0.884

Table 2: Agreement scores for different groupings of the test set, showing total annotations, *yes* annotations for Annotator 1 and 2, average *yes* annotations, total expected chance agreement (*yes* + *no*), actual raw agreement and Cohen's kappa.