



On the Road to Conventionalization: Analyses of Nominal Coercion

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Introduction

Coercion

- During language comprehension we can redeem apparently anomalous word combinations via semantic adjustments referred to as COERCION [2,8]
- Coerced interpretations are considered non-compositional because they involve interpolation of meaning not attributable to the words in isolation
- NOMINAL COERCION is a subtype of coercion referred which involves a conflict between a noun and its determiner (e.g., "a," "the," "some") [7]
- We focus on MASS-to-COUNT coercions wherein a conflict between a mass noun and an article preferring count nouns is resolved by imposing a unit (portion or variety) construal on the noun:
 - Andy asked the bartender for a beer. *conventionalized*
 - McDonald's now charges 25 cents for a ketchup. *intermediate*
 - She considered her options at the spa and chose a mud. *novel*

Conventionalization

- Not all instances of coercion are the same
- Coercive determiner-noun combinations vary widely in frequency
- In novel cases like (3) we may resolve the semantic conflict between "a" and "mud" by creating an innovative meaning (a type or brand of mud)
- In conventionalized cases like (1) the adjusted interpretation (a portion of beer) has become so entrenched that we may not recognize it as being non-compositional
- Coercion may be more frequent within certain semantic frames (e.g., within the RESTAURANT frame we often refer to portions and varieties of mass nouns)
- Processing a coercion instance may be strongly shaped by frequency and therefore conventionalized instances may be easy to process and integrate

Previous Research

- Although nominal coercion appears to be a widespread phenomenon, we know of no previous studies that examine its prevalence in natural language
- Previous neurophysiological and psycholinguistic studies have examined other classes of coercion phenomena (complement coercion, aspectual coercion) and have shown that they are more costly to process than compositional combinations [3, 5, 6, 10, 11]
- However, none of these studies have examined whether this processing effect is modulated by conventionalization

Questions

- When we encounter an apparent determiner-noun mismatch like "a mud," does the brain interpret it as a syntactic anomaly or a semantic anomaly?
- Are novel instances processed differently than conventionalized ones?

Goals

- Understand the distributional properties of nominal coercion in natural language via a corpus analysis in order to inform our ongoing ERP study of the processing of nominal coercion

References

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Corpus Analysis

Questions

- What are the distributional properties of MASS-to-COUNT nominal coercion in natural language?
- Is the distribution bimodal (i.e., is there one set of words that tends to be coerced and another that is rarely if ever coerced?) or is it continuous?
- Is there any clear semantic distinction(s) between words that are commonly coerced and those that are rarely or never coerced? (e.g., Are food items more likely to be coerced than other mass nouns?)

Methods

Target Words We selected ~200 common mass nouns that represent an array of mass type including foods (pasta), liquids (beer), malleable substances (metal), aggregates (rubble), and abstract concepts (freedom)

Dependency-Parsed Input Corpora

- English Gigaword [1]: 2.1B words
- Reuters Corpus Volume 1 [4]: 170M words
- TIPSTER: 260M words

These corpora are almost exclusively drawn from the news domain, making them less than ideal for assessing a predominantly informal phenomenon, however they are the only large-volume dependency-parsed corpora of natural language currently available

The Boulder Coercion Corpus (BoCoR)

- Collection of all sentences from the input corpora containing target words
- 4.8 million words
- Average instances per target word: 66,293

Automatic Coercion Identification

Coercion tokens were automatically identified via pattern matching (i.e., a nominal form of a target word governing a COUNT-NOUN-selecting determiner)

Relative Coercion Frequency (RCF)

The RCF for each target word was calculated as the number of instances automatically identified as Coerced divided by the total number of instances of that target word within the Boulder Coercion Corpus

Annotation

- ~12,000 instances (80 of each target word) were randomly selected and hand annotated as either Coerced, Not Coerced, or Other (e.g., non-nominal forms, a sense of the word clearly unrelated to the mass sense)
- The system's output was compared against the hand-tagged sample to assess the overall accuracy of the system as well as its accuracy for each target word

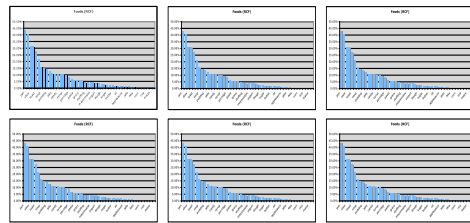
Results

- The system's ability to detect coercion of word senses we were interested in was highly dependent on the degree of polysemy/ homonymy of target words. Therefore, we removed XX words where the system's agreement with human judgments was below 80%

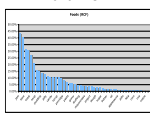
- Based on hand annotation we estimate the accuracy for each target word to be as shown in the graph below

RCF Distribution by Semantic Frame

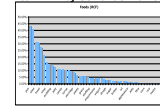
• Solid Liquid Foods Beverages Abstract Overall



Accuracy by Target Word



Mean RCF by Semantic Frame



Discussion

- There appears to be a continuous distribution of relative frequencies, from highly conventionalized/coerced tokens (~40-60% RCF) to nouns that are rarely if ever used coercively
- A similar distribution was found within each semantic frame we analyzed

Conclusions

- No single semantic category stands out as being more frequently coerced than any other or than the mean RCF of all target words
- Therefore coercion frequency does not seem to depend on some general feature of particular substances
- One possible explanation is a "coastal effect" whereby conventionalized coercions facilitate novel coercions via either semantic similarity (e.g., BEVERAGES) or syntactic priming (e.g., a MASS NOUN = coercion).

ERP Study (pilot)

Questions

- Does nominal coercion elicit the N400 effect associated with semantic integration difficulty?
- Or does it elicit the P600 effect associated with syntactic anomaly or structural reanalysis?
- Does the brain respond differently to conventionalized and novel instances?
- Can a MASS-to-COUNT nominal coercion construction (i.e., indefinite article + MASS NOUN = coercion) be primed?

Predictions

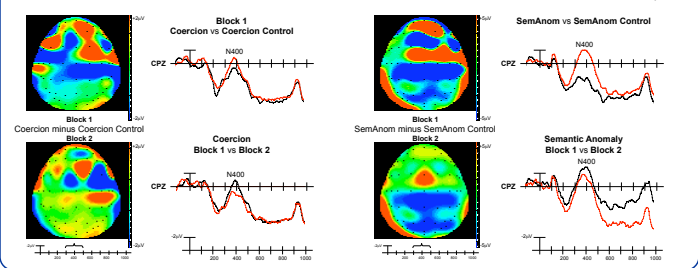
- In an ERP study Kuperberg (2008) showed that complement coercion led to a widely distributed N400 effect but without a late positive shift
- We therefore predicted a similar N400 effect for nominal coercion
- However we predicted that the N400 effect would diminish with increased exposure to the MASS-to-COUNT coercion construction

Methods

- 29 right-handed native English speakers
- Plausibility rating task
- Subjects read 240 sentences (40 per condition) presented word-by-word (300 ms, 200 ms ISI)
- ERPs were measured via 64 sintered Ag/AgCl electrodes, continuously sampled at 200 Hz, a bandpass filter of 0.01-40 Hz, an online vertex reference, and later re-referenced to averaged mastoids

Results

- No P600 effect was found in any of the coercion conditions
- An N400 effect for coercion was found in Block 1 but diminished in Block 2
- The N400 effect for coercion was surprisingly smaller than the classic N400 effect for Semantic Anomaly



Conditions

- Easy Coercion Andy asked the bartender for a beer.
- Easy Control Andy asked the bartender for some beer.
- Hard Coercion For exterior siding by an aluminum.
- Hard Control For exterior siding by some aluminum.
- Semantic Anomaly The hunter put down his bow and apple.
- Semantic Control The hunter put down his bow and arrow.

Discussion

- One possible explanation for the small N400 effect is that target words in the Coercion conditions are each in accord with the context of their sentences (i.e., they do not have low Cloze probabilities) and are therefore easily integrated into the semantic context
- Instead, it seems that the N400 effect (in Block 1) is the result of an unexpected semantic (rather than syntactic) mismatch in the determiner-noun combination
- The N400 effect for semantic anomalies becomes larger over time while the N400 effect for coercion is reduced
- Therefore, it appears that the MASS-to-COUNT coercion construction can be primed and thereby facilitates the processing of new coercion instances
- The semantic anomalies have no unifying feature or construction that can be used to generalized over, therefore no habituation of the N400 effect occurs

Conclusions

- An N400 effect rather than a P600 effect appears to indicate that the brain deals with nominal coercion as a semantic mismatch rather than a syntactic mismatch
- The habituation of the N400 to novel instances of nominal coercion over a short period of time (i.e., 30 min) provides evidence for language change on a micro scale
- Together we take these results to indicate that the need to maintain contextual coherence allows the brain to bracket a potential syntactic mismatch in order to appropriately interpret and integrate the noun-determiner combination into the semantics of the context

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