Revisiting the Givenness Hierarchy
A Corpus-Based Evaluation

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Background and Motivation

Human communication is organized around **entities (discourse referents)**, their characteristics and their relations

For a speaker, effective communication usually requires
- to **keep track of entities** (supposed to be) known, identifiable or accessible to the hearer,
- to use communicative devices that allow their **unambiguous identification** by the hearer, and
- to use communicative devices that **indicate their relevance** with respect to the speaker's communicative goals

The **Givenness Hierarchy** (GH, Gundel et al. 1993) is one of several theoretical frameworks to account for this, which the following characteristics
- fine-grained predictions regarding the choice of referring expressions, esp. for demonstratives
- practical relevance (e.g., for language acquisition and human-robot interaction)*
- applied to a broad array of typologically diverse languages*
- comes with concise, cross-linguistically tested annotation guidelines ("coding protocol", 2006)

* see references in paper

BUT
- almost no annotated data available
- some GH claims are controversial
  - personal pronoun > demonstrative pronoun ? (against Sgall et al. 1986)
  - demonstrative NP > definite NP ? (against Ariel 1990)
- previous studies were small-scale and usually did not involve statistic significance tests
  - results have not always been significant, especially for demonstratives

We suggest to

- **replicate** the original findings of Gundel et al. (1990, 1993)
- **over corpora with entity coreference corpora**, not direct annotation for GH
  - the coding protocol defines a decision tree for annotation, *to a large extent* based on (the form) of previous or subsequent mention
  - sufficient in size to expect significant results for less frequent types of referring expressions
  - available (now) for the original set of languages studied by Gundel et al. (1990, 1993)
    - Arabic, English, Chinese, Japanese, Korean, Russian and Spanish

Givenness Hierarchy (Gundel et al. 1993)

- hierarchy of „cognitive statuses" ranked from highly given (in **focus**) to new, but identifiable in type (**type**)

1. **in focus**: referent is the current focus of attention and highly prominent in the local context (∼ *he, she*).
2. **activated**: referent is present in the local context (∼ *this/that, this man*).
3. **familiar**: referent is known to both speaker and hearer from prior discourse (∼ *that man*).
4. **unique**: the referent is uniquely identifiable to hearer and speaker (∼ *the man*).
5. **referential**: the speaker refers to a specific but possibly unknown entity (∼ *this guy*).
6. **type** (type identifiable): hearer can identify the category of a referent (∼ *a man*).

- *implicative hierarchy*
  - higher status ⊆ lower statuses
    - e.g. referent r of „*that man*" is **familiar**
      - r is also **unique**, **referential** and **type**
      - but not **in focus**, or **activated**

in focus	> activated	> familiar	> uniquely identifiable	> referential	> type identifiable
{*it*}	{*this*, *that*, *this* N}	{*that* N}	{*the* N}	{indefinite *this* N}	{*a* N}

- cognitive statuses are lexicalized
  - referring expressions indicate the (expected) cognitive statuses as part of their lexical meaning
    - e.g. personal pronoun => **in focus**
- speakers deviate from lexicalized cognitive statuses to express implicit information
  - speakers can use a „lower" expression to trigger **quantity implicatures**, e.g., when using a definite NP in place of a personal pronun
- *cross-linguistic annotation studies* support the predicted correlations
  - for 7 major languages in Gundel (1990/93), for other languages later on

e.g., English (Gundel 1993)

seems to match the predicted correlations

	IN FOCUS	ACTIVATED	FAMILIAR	UNIQUE	REFERENTIAL	TYPE	total
it	214	1					215
HE		1					1
this		15					15
that	1	17					18
this N	1	11					12
that N		10	7				17
the N	30	95	47	108			280
indef. this N					1		1
a N					41	55	96
total	246	150	54	108	42	55	655

re-assessment: most GH-specific claims are not statistically significant (for the original statistics)

	IN FOCUS	ACTIVATED	FAMILIAR	UNIQUE	REFERENTIAL	TYPE
it	0,895++	-0,373++	-0,21++	-0,311++	-0,183+	-0,212++
HE	-0,03 n/a	0,072 n/a	-0,012 n/a	-0,017 n/a	-0,01 n/a	-0,012 n/a
this	-0,119 n.s	0,281 n/a	-0,046 n/a	-0,068 n/a	-0,04 n/a	-0,046 n/a
that	-0,111+	0,286 n/a	-0,05 n/a	-0,075 n/a	-0,044 n/a	-0,051 n/a
this N	-0,082(+)	0,224 n/a	-0,041 n/a	-0,061 n/a	-0,036 n/a	-0,041 n/a
that N	-0,127(+)	0,14 n/a	0,195 n/a	-0,073 n/a	-0,043 n/a	-0,049 n/a
the N	-0,479++	0,227++	0,268++	0,514++	-0,226++	-0,262++
indef. this N	-0,03 n/a	-0,021 n/a	-0,012 n/a	-0,017 n/a	0,149 n/a	-0,012 n/a
a N	-0,479++	0,227++	0,268++	0,514++	-0,226++	-0,262++

1.0 > r > 0.5 +/++
0.5 > r > 0.1 +/++
0.1 > r > 0 +/++
n.s / (+) / n.a
0 > r > -0.1 +/++
-0.1 > r > -0.5 +/++
-0.5 > r > -1.0 +/++

n/a χ^2 not applicable
n.s. not significant
(+) marginal, p<=.05
\+ significant, p<=.01
++ highly significant, p<=.001

Bootstrapping Givenness from Entity Coreference

Coding protocol (2006):
- for every referring expression, **check the statuses from highest to lowest**, annotate the highest possible status
  - for every status, a number of test formulate criteria sufficient for annotation

annotate **in focus** if
- r is subject of the preceding utterance
- r mentioned earlier in same utterance
- r mentioned in both of the two previous utterances
- r is the event of the preceding utterance
- r is an inferred discourse topic

corpus with entity coreference
<= coref + sentence splits + UD *nsubj*
<= coref + sentence splits
<= coref + sentence splits
(only with event coref)
(not available)
60% (3/5 tests covered)

annotate **activated** (if not **in focus** and)
- r is mentioned in the two previous utterances
- r evoked by gesture or gaze
- r is an associated proposition or speech act

corpus with entity coreference
<= coref + sentence splits
(not applicable: written text)
(not available)
50% (1/2 applicable tests)

annotate **familiar** (if not **activated** or **in focus** and):
- r previously mentioned
- r known from shared background

corpus with entity coreference
<= coref
(not available)
50% (1/2 tests covered)

annotate **unique** (if not **familiar**, etc.):
- expression contains sufficient lexical material to create a unique referent
- r linked via lexical association to activated referent

corpus with entity coreference
<= approx: ≥ 3 content words
<= possessive pronoun
up to 100% (2/2 tests, approximated)

annotate **referential** (if not **unique**, etc.):
- r mentioned later in discourse
- r linguistically marked for discourse prominence

corpus with entity coreference
<= coref
(this is circular)
all non-circular tests

annotate **type** (if not **referential**, etc.):
- expression encodes interpretable conceptual content

corpus with entity coreference
<= coref (anything subject to coreference annotation)
100% (all tests)

if coreference annotation *fails* to capture a criterion, the bootstrapped status may be lower than the actual status (but never higher)

because the hierarchy is implicative, this is imprecise, but **not incorrect**

Empirical Evaluation

10 corpora, 7 languages, 4 coref formats, UD syntax (as provided / spaCy)
up to 11 types of referring expressions* per language

*exactly those defined by Gundel et al. (1990/1993)

	OntoNotes	LitBank	GUM	AnCora	NTC	KoCoNovel	ECMT	RuCor
version	5.0	CU 1.3	CU 1.3	CU 1.3	1.5	—	CU 1.3	CU 1.3
language	ar / en / zh	en	en	es	ja	ko	ko	ru
modality	written	written	written/spoken	written	written	written	written	written
genre	news, web, lit	literature	diverse	news	news	literature	news	diverse
tokens (K)	325 / 1,750 / 235	190	170	429	1,000	165	439	145

Evaluation for English

	IN FOCUS	ACTIVATED	FAMILIAR	UNIQUE	REFERENTIAL	TYPE	total
pron	3066	949	258	7	323	117	4720
dem.prox	105	162	38		72	39	416
dem.dist	117	174	42	1	35	34	403
dem.prox N	155	216	156	130	109	216	982
dem.dist N	101	76	19	54	34	90	374
the N	1046	910	1082	1169	1021	2921	8149
a N	691	130	123	731	416	1628	3719
total	5281	2617	1718	2092	2010	5045	18763

IN FOCUS	ACTIVATED	FAMILIAR	UNIQUE	REFERENTIAL	TYPE
0,475+++	0,103+++	-0,074+++	-0,203+++	-0,073+++	-0,319+++
-0,01 n.s	0,109+++	0 n.s	-0,053+	0,032+++	-0,059+++
0,003 n.s	0,125+++	0,007 n.s	-0,051+++	-0,01 n.s	-0,062+++
-0,065+++	0,055+++	0,055+++	0,016(+)	0,003 n.s	-0,026++
-0,004 n.s	0,026++	-0,02+	0,015(+)	-0,007 n.s	-0,009 n.s
-0,298+++	-0,07+++	0,125+++	0,089+++	0,051+++	0,177+++
-0,106+++	-0,15+++	-0,101+++	0,134+++	0,008 n.s	0,189+++

sample results (GUM corpus, Zeldes 2017)

	IN FOCUS	ACTIVATED	FAMILIAR	UNIQUE	REFERENTIAL	TYPE
pron	4:0	2:1	0:4	0:3	0:4	0:2
dem.prox	0:1	2:0		0:2	1:1	0:1
dem.dist	0:1	2:0	0:1	0:2	0:1	1:1
dem.prox N	0:4	3:0	3:0	0:1	1:1	0:1
dem.dist N	0:2	2:0	0:1	1:0		
the N	0:4	1:2	4:0	3:0	4:0	2:0
a N	0:4	0:3	0:3	3:0	2:0	2:0

4:0
3:0
2:0, 3:1
1:0, 2:1
1:1
0:1, 1:2
0:2, 1:3
0:3
0:4

in focus	pron	√
activated	*this*	√
	that	√
	this N	√
familiar	*that* N	✗
unique	*the* N	√
referential	indef. *this* N	n/a not observable
type	*a* N	√

aggregate results, 4 corpora: we count **significant (p ≤ 0.01)** **positive** and **negative** correlations

GH predictions largely confirmed, possible exception *that* N (dem.dist N)

Aggregate Results, 6 non-English Corpora

	IN FOCUS	ACTIVATED	FAMILIAR	UNIQUE	REFERENTIAL	TYPE
Ø	es,ja, zh,ar	ja,zh es,ar	ar	es,ja, zh,ar	es,ja, zh,ar	es,ja
pron	ru,es,ja, zh,ar	ru,ja,zh es,ar	ru,es,zh, ar (ja)	ru,es, zh,ar	ru,es, zh,ar	
dem.prox	ko1 ja	es,ja,zh	ko2,zh es,ko1	es,zh	es,ko1, zh	ko
dem.med	ko ja	es,ko,ja	ko1	es, ko2 (ja)	es,ko	ko
dem.dist	ko2 zh	zh				es
dem.prox N	ko2	es, ja,zh	ru,es, ko1,ja,zh	zh ko1 (ja)	es zh	ru,es, ko1,zh
dem.med N		ko1,ja	ko1	(ja) es,ko1	es	es,ko1 ko1
dem.dist N		zh	zh	zh		ru
the N		es,ar	es ar	es	es ar	es ar	es
N		ru,ko, ja,zh	ru,ko, ja,zh	ru,ko2, zh (ja)	ru, ja,zh ko1	ru,ko, ja,zh	ko, ja
a N		es,zh, ar	es,zh, ar	es,zh,ar	zh,ar	es,zh,ar	

√ GH core assumptions largely confirmed
✗ no consistent pattern for dem.dist, dem.med.N, dem.dist
✗ **unique**, **referential** and **type** don't seem to be good discriminators

Conclusions

GH assumptions largely confirmed
incl. GH-specific predictions for dem.prox, dem.med, dem.prox N

bootstrapping method confirmed
we can now study languages and phenomena not originally addressed by Gundel et al.
we can bootstrap training data for GH tagging

impulses for GH research
- Does GH really account for the differentiation *among* demonstratives?
- Should we abandon **unique**?
  Doesn't differentiate well / cannot be reliably identified (**referential** and **type** can)

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