Table 8.1 The SHARel Typology

ID	Type
	Morphology-based changes
1	Inflectional changes
2	Modal verb changes
3	Derivational changes
	Lexicon-based changes
4	Spelling changes
5	Same polarity substitution (habitual)
6	Same polarity substitution (contextual)
7	Same polarity sub. (named entity)
8	Change of format
	Lexico-syntactic based changes
9	Opposite polarity sub. (habitual)
10	Opposite polarity sub. (contextual)
11	Synthetic/analytic substitution
12	Converse substitution
	Syntax-based changes
13	Diathesis alternation
14	Negation switching
15	Ellipsis
16	Anaphora
17	Coordination changes
18	Subordination and nesting changes
	Discourse-based changes
18	Punctuation changes
20	Direct/indirect style alternations
21	Sentence modality changes
22	Syntax/discourse structure changes
	Other changes
23	Addition/Deletion
24	Change of order
	Extremes
25	Identity
26	Unrelated
	Reason-based changes
27	Cause and Effect
28	Conditions and Properties
29	Functionality and Mutual Exclusivity
30	Named Entity Reasoning
31	Numerical Reasoning
32	Temporal and Spatial Reasoning
33	Transitivity
34	Other (General Inference)

discourse, other) consist of the 24 "linguistic" types. The two types in the "extremes" category ("identity" and "unrelated") are neither linguistic, nor reason-based. The last category consists of the 8 "reason-based" types.

The distinction between linguistic and reason-based types is introduced by Sammons et al. [2010] and Cabrio and Magnini [2014] for textual entailment. The linguistic phenomena require certain linguistic capabilities from the human speaker or the automated system. The reason-based phenomena require world knowledge and common-sense reasoning.

For the linguistic types, we compared the existing typologies and decided to use the Extended Paraphrase Typology (EPT) [Kovatchev et al., 2018a] as a starting point. The authors of EPT have already combined various linguistic types from the fields of Paraphrasing and Textual Entailment and have taken into account the work of Sammons et al. [2010], Vila et al. [2014], Cabrio and Magnini [2014]. As such, the majority of the linguistic types that they propose are in principle applicable to both Paraphrasing and Textual Entailment.

We examined the types from EPT and made several adjustments in order to make the linguistic types fully independent of the textual relation.

- EPT contains "entailment" and "non-paraphrase" types in the category "extremes". These types were created specifically for the task of Paraphrase Identification (PI). We removed these types from the list.

- We added "unrelated" type (#26) to the category "extremes" to capture information which is not related at all to the other sentence in the pair.

- We added "anaphora" type (#16) in the syntax category. This change was suggested by our annotators during the process of corpus annotation.

For the reason-based types we studied the typologies of Sammons et al. [2010], LoBue and Yates [2011] and Cabrio and Magnini [2014]. While these typologies have a lot of similarities and shared types, they are not fully compatible. We analyzed the type of common-sense reasoning and background knowledge that is required for each of the types in these three typologies. We combined similar types into more general types and reduced the original list of over 30 reason-based types to 8. For example, the "named entity reasoning" (#30) includes both reasoning about geographical entities and publicly known persons (those two were originally separated types). [2]

With respect to specificity, we propose a fine-grained token level annotation, which allows us to determine the particular elements in one sentence that are more (or less) specific than their counterpart in the other sentence. Ko et al. [2019]

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[2]The annotation guidelines and examples for all types can be seen at `https://github.com/venelink/sharel` and in Appendix C of the thesis.

demonstrated that specificity needs to be more linguistically and informational theoretically based to be more semantically plausible. This could partially be solved through a more fine-grained annotation of specificity, as it is performed in this study.

Table 8.2 Comparing typologies of textual meaning relations

Typology	Relation	All	Ling.	Reason.	Hierarchy
Sammons et al. [2010]	TE, CNT	22	13	9	No
LoBue and Yates [2011]	TE, CNT	20	0	20	No
Cabrio and Magnini [2014]	TE, CNT	36	24	12	Yes
Bhagat and Hovy [2013]	PP	25	22	3	No
Vila et al. [2014]	PP	23	19	1	Yes
Kovatchev et al. [2018a]	PP	27	23	1	Yes
SHARel	TE, CNT PP, SP, TS	34	24	8	Yes

Table 8.2 lists some properties of the existing typologies of meaning relations. All typologies before SHARel were created only for one (or two) meaning relations. SHARel contains general types that are not specific to any particular meaning relation and can be applied to pairs holding Textual Entailment, Contradiction, Paraphrasing, Textual Specificity, or Semantic Textual Similarity meaning relation. SHARel follows the good practices of typology research and organizes the types in a hierarchical structure of 8 categories and has a good balance between linguistic and reasoning types.

8.3.3 Research Questions

There are two main objectives that motivated this paper:
1) To demonstrate that multiple meaning relations can be decomposed using a single, shared typology;
2) To demonstrate some of the advantages of a shared typology of meaning relations.
Based on our objectives, we pose two research questions (RQs) that we want to address in this article.

RQ1: Is it possible to use a single typology for the decomposition of multiple (textual) meaning relations?

RQ2: What are the similarities and the differences between the (textual) meaning relations in terms of types?