

Across discipline corpus-based study of logical relation verb patterns in the research article

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1. Introduction

A common pattern in abstract or technical writing is to present a consequential conjunction recoded by a verb (Jones, 2010). The notion of PATTERN refers to all the words and structures that are regularly associated with a word and contribute to its meaning (Francis & Hunston, 2000). This paper attempts to investigate disciplinary variation of logical relation verb patterns and associated meanings of causal relation.

2. JC-JDEST

The corpus used is Journal Corpus of the second generation of JiaoDa English for Science and Technology (JC-JDEST).

Table 1 Overall statistics of JC-natural science subcorpus

Parameters	Numbers	Parameters	Numbers
Natural sciences	25	Standardized type/token	37.52
Text samples	2447	Word length	5.03
Average text size (words)	1343.17	Sentences	14,9417
Tokens	340, 0252	Sentence length	22.00
Types	6,2424		
Type/token ratio	1.90		

Table 2 Overall statistics of JC-social science subcorpus

Parameters	Numbers	Parameters	Numbers
Social sciences	15	Standardized type/token	41.23
Text samples	683	Word length	5.17
Average text size (words)	5565.22	Sentences	15,7648
Tokens	388,1220	Sentence length	24.11
Types	7,8922		
Type/token ratio	2.08		

3. Logical relation verb pattern

In line with 'favourite clause type' of English scientific or academic writing, we define logical relation verb pattern as one consisting of two nominal phrases or clauses plus one verbal phrase. In syntactic terms, the two nominal phrases or clauses, whether they are de-verbal nouns, de-adjectival nouns, abstract nouns, embedded finite clauses or embedded non-finite clauses, realize Subject, Object, or Transitive Complement (Fang, 2007), and semantically, they realize two types of activities, that is, argument-oriented activity and event-oriented activity (Gledhill, 1996). The verbal phrase falls into monotransitives or transitives (Fang, 2007) and semantically construe four types of causal relation (Crombie, 1985): 1) Reason–Result construed by two event-oriented activities of causation; 2) Means–Result construed by one or two argument-oriented activities; 3) Condition–Consequence construed by two event-oriented activities of contingency; 4) Grounds–Conclusion construed by two argument-oriented activities. For example,

- 1) The logical *advances* in computer hardware design during the last few years, *has enabled* the *calculation* of viscous flows at high Reynolds numbers to be made.
- 2) More detailed *studies* of larger samples of galaxies *ought to allow* more clear-cut *conclusions* in this important field.
- 3) *How copy cataloging is affected in the realm of classification depends* to some extent *on whether the library uses Dewey Decimal Classification*.

4. Results and Discussion

The results are shown from table 3 to table 7.

Table 3 disciplinary distribution of causal relation patterns of the 8 logical relation verbs

	Frequency and Percentage of causal relation patterns in natural science		Frequency and Percentage of causal relation patterns in social science		Significant disciplinary difference
ALLO W	278	278/1858=14.96%	133	133/1525=8.72%	0.000 (<0.05) sig
BASE	218	218/3337=6.53%	169	169/3712=4.55%	0.000 (<0.05) sig
DEPEN D	133	133/2130=6.24%	131	131/1348=9.72%	0.000 (<0.05) sig
ENABL E	120	120/422=28.44%	116	116/463=25.05%	0.256 (>0.05) insig
INVOL VE	159	159/1436=11.07%	155	155/1942=7.98%	0.002 (<0.05) sig
MEAN	290	290/2689=10.78%	340	340/5125=6.63%	0.000 (<0.05) sig

RESULT	368	368/5673=6.49%	137	137/3721=3.68%	0.000 sig	(<0.05)
SHOW	378	378/5651=6.69%	190	190/2850=6.67%	0.969 insig	(>0.05)
Total	1944	1944/23196=8.38%	1371	1371/20686=6.63%	0.000 sig	(<0.05)

Table 4 Most frequent causal relation patterns of the 8 logical relation verbs in subcorpora of natural science and social science

	Most frequent causal relation patterns in natural science		Most frequent causal relation patterns in social science	
ALLOW	n V n	36.69%	n V n	48.87%
	n V n <i>to-inf</i>	27.33%	n V n <i>to-inf</i>	24.81%
	<i>this V n to-inf</i>	12.59%	<i>this V n</i>	9.02%
	<i>this V n</i>	10.79%		
BASE	n V n	81.19%	n V n	76.92%
	n V -ing	11.01%	<i>this V n</i>	5.33%
	<i>this V n</i>	4.13%	n V -ing	5.33%
			-ing V n	5.33%
		<i>this V -ing</i>	2.37%	
DEPEND	n V n	59.40%	n V n	57.25%
	n V <i>wh-cl</i>	9.77%	n V <i>wh-cl</i>	9.16%
	<i>wh-cl V wh-cl</i>	5.26%	<i>wh-cl V wh-cl</i>	8.40%
	<i>wh-cl V n</i>	5.26%	<i>wh-cl V n</i>	3.82%
	<i>this V wh-cl</i>	2.26%	<i>this V wh-cl</i>	3.82%
ENABLE	n V n <i>to-inf</i>	40.00%	n V n <i>to-inf</i>	43.97%
	<i>this V n to-inf</i>	20.83%	n V n	16.38%
	n V n	15.00%	<i>this V n to-inf</i>	14.66%
INVOLVE	n V n	47.17%	n V n	46.45%
	n V -ing	25.79%	n V -ing	18.06%
	<i>this V n</i>	12.58%	<i>this V n</i>	10.32%
	<i>this V -ing</i>	8.18%	<i>this V -ing</i>	6.45%
MEAN	<i>this V that-cl</i>	62.76%	<i>this V that-cl</i>	47.65%
	n V <i>that-cl</i>	16.90%	n V <i>that-cl</i>	23.82%
RESULT	n V n	65.22%	n V n	57.66%
	<i>this V n</i>	16.85%	n V -ing	15.33%
			<i>this V n</i>	10.22%
SHOW	n V <i>that-cl</i>	73.54%	n V <i>that-cl</i>	82.11%
	n V n	18.78%	n V n	11.58%
	<i>this V that-cl</i>	4.23%	<i>this V that-cl</i>	3.68%

Table 5 Accumulative frequencies of the 8 verbs' most frequent patterns of argument-oriented activities

	Most frequent patterns construing argument-oriented activities in natural science		Most frequent patterns construing argument-oriented activities in social science		Significant difference between the two disciplines
ALLOW	n V n	117	n V n	53	
	n V n <i>to-inf</i>		n V n <i>to-inf</i>		
	<i>this</i> V n		<i>this</i> V n		
	<i>this</i> V n <i>to-inf</i>	35	<i>this</i> V n <i>to-inf</i>	9	
BASE	n V n	155	n V n	101	
	n V -ing		n V -ing		
	<i>this</i> V n		<i>this</i> V n		
DEPEND	n V n	49	n V n	39	
	n V <i>wh-cl</i>		n V <i>wh-cl</i>		
	<i>wh-cl</i> V <i>wh-cl</i>		<i>wh-cl</i> V <i>wh-cl</i>		
	<i>wh-cl</i> V n		<i>wh-cl</i> V n		
	<i>this</i> V <i>wh-cl</i>		<i>this</i> V <i>wh-cl</i>		
ENABLE	n V n <i>to-inf</i>	64	n V n <i>to-inf</i>	60	
	<i>this</i> V n <i>to-inf</i>		n V n		
	n V n		<i>this</i> V n <i>to-inf</i>		
INVOLVE	n V n	74	n V n	44	
	n V -ing		n V -ing		
	<i>this</i> V n		<i>this</i> V n		
	<i>this</i> V -ing		<i>this</i> V -ing		
MEAN	n V <i>that-cl</i>	6	n V <i>that-cl</i>	5	
	<i>this</i> V <i>that-cl</i>	225	<i>this</i> V <i>that-cl</i>	238	
RESULT	n V n	92	n V n	41	
	<i>this</i> V n		n V -ing		
	n V -ing		<i>this</i> V n		
SHOW	n V <i>that-cl</i>	336	n V <i>that-cl</i>	178	
	n V n		n V n		
	<i>this</i> V <i>that-cl</i>		<i>this</i> V <i>that-cl</i>		
Total Percentage		1237/1944=63.63%		840/1371=61.27%	0.166 (>0.05) insig

Table 6 Top 10 argument-oriented nouns in the 8 verbs' most frequent patterns (lemmatized)

	Natural Science		Social Science
STUDY	102	STUDY	63
ANALYSIS	46	ANALYSIS	48
TEST	37	RESEARCH	22
METHOD	28	SURVEY	20

CALCULATION	24	MODEL	13
APPROACH	22	APPROACH	12
COMPARISON	19	ASSUMPTION	10
MEASUREMENT	19	SYSTEM	10
OBSERVATION	18	REPORT	6
ASSUMPTION	16	WORK	6

Table 7 Disciplinary distribution of the four types of causal relation among the 8 verb patterns

	Frequency and Percentage of the four types of causal relation construed in natural science			Frequency and Percentage of the four types of causal relation construed in social science			Significant disciplinary difference in most frequent types of causal relation
ALLOW	Means-Result	184	66.19%	Means-Result	92	69.17%	0.547 (>0.05) insig
	Condition-Consequence	72	25.90%	Condition-Consequence	26	19.55%	0.158 (>0.05) insig
	Reason-Result	22		Reason-Result	15		
BASE	Means-Result	141	64.68%	Means-Result	87	51.48%	0.009 (<0.05) sig
	Condition-Consequence	45	20.64%	Condition-Consequence	43	25.44%	0.193 (>0.05) insig
	Grounds-Conclusion	23		Grounds-Conclusion	23		
	Reason-Result	9		Reason-Result	16		
DEPEND	Condition-Consequence	66	49.62%	Condition-Consequence	66	50.38%	0.902 (>0.05) insig
	Means-Result	57	42.86%	Means-Result	43	32.82%	0.093 (>0.05) insig
	Grounds-Conclusion	10		Grounds-Conclusion	20		
				Reason-Result	2		
ENABLE	Means-Result	73	60.83%	Means-Result	59	50.86%	0.123 (>0.05) insig
	Condition-Consequence	42	35.00%	Condition-Consequence	39	33.62%	0.823 (>0.05) insig
	Reason-Result	4		Reason-Result	18		
	Grounds-	1					

	Conclusion						
INVOL VE	Means-Result	89	55.97 %	Means-Result	66	42.58 %	0.018 (<0.05) sig
	Condition-Consequence	70	44.03 %	Condition-Consequence	87	56.13 %	0.032 (<0.05) sig
				Grounds-Conclusion	1		
				Reason-Result	1		
MEAN	Grounds-Conclusion	196	67.59 %	Grounds-Conclusion	185	54.41 %	0.001 (<0.05) sig
	Means-Result	73	25.17 %	Means-Result	115	33.82 %	0.021 (<0.05) sig
	Condition-Consequence	20		Condition-Consequence	38		
	Reason-Result	1		Reason-Result	2		
RESULT	Reason-Result	260	70.65 %	Reason-Result	91	65.69 %	0.283 (>0.05) insig
	Means-Result	104	28.26 %	Means-Result	45	32.85 %	0.315 (>0.05) insig
	Grounds-Conclusion	4		Grounds-Conclusion	1		
SHOW	Means-Result	272	71.96 %	Means-Result	117	61.58 %	0.012 (<0.05) sig
	Grounds-Conclusion	92	24.34 %	Grounds-Conclusion	65	34.21 %	0.013 (<0.05) sig
	Condition-Consequence	14		Condition-Consequence	8		
Total	Means-Result	993	51.08 %	Means-Result	624	45.51 %	0.002 (<0.05) sig
	Condition-Consequence	329	16.92 %	Condition-Consequence	307	22.39 %	0.000 (<0.05) sig
	Grounds-Conclusion	326	16.77 %	Grounds-Conclusion	295	21.52 %	0.001 (<0.05) sig
	Reason-Result	296	15.22 %	Reason-Result	145	10.58 %	0.000 (<0.05) sig

Here it is shown that 1) most frequent logical relation verb pattern is n V n; 2) unattended *this* (Wulff, Römer & Swales, 2012) span through all of the 8 verb patterns; 3) with frequent nominal categories like *n*, *this*, *wh-cl* and *that-cl*, which tend to construe argument-oriented activities, the use of logical relation verb patterns is more saliently motivated by inferencing and reasoning in the textual world; 4) they are more typically used to foreground the inherent complexity of

inferential causal relations in natural science.

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