

# A Corpus-Based Behavioral Profile Study of the Near-Synonyms: Serious, Severe, Grave, Grievous

Qi Chen\*

Fujian Normal University, Fuzhou 350007, Fujian Province, China

\*Corresponding author: Qi Chen, 1009474478@qq.com

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**Abstract:** Using Corpus of Contemporary American English as the source data, this paper carries out a corpus-based behavioral profile study to investigate four near-synonymous adjectives (serious, severe, grave, and grievous), focusing on their register and the types of nouns they each modify. Although sharing core meaning, these adjectives exhibit variations in formality levels and usage patterns. The identification of fine-grained usage differences complements the current inadequacies in describing these adjectives. Furthermore, the study reaffirms the effectiveness of the corpus-based behavioral profile approach in examining synonym differences.

**Keywords:** Corpus; Behavioral profile; Near-synonym; Corpus of Contemporary American English (COCA)

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## 1. Introduction

Synonymy or near-synonymy, a common and intricate semantic phenomenon, often implies conveying the same message and usage. However, in practical use, synonyms tend to exhibit subtle differences in various contexts or from different perspectives. That is, synonyms are not entirely identical in meaning and hence not completely interchangeable<sup>[1]</sup>. Lyons distinguished clearly between what Taylor has called “perfect synonyms” and “near-synonyms”<sup>[2,3]</sup>. “Perfect synonyms” or “absolute synonyms” in Lyons’ definition should be (1) identical in all meanings; (2) synonymous in all contexts; (3) “semantically equivalent” on all dimensions of meaning, descriptive and non-descriptive<sup>[2]</sup>. However, this level of synonymy is rare, with most so-called synonyms being near-synonyms that share similarities but are not identical.

Synonyms are typically identified through substitution and dictionary definitions<sup>[4]</sup>. However, neither of these methods provides clear distinctions in semantic characteristics and collocations of synonyms, as they rely on individual experience and intuition<sup>[4]</sup>. With the increasing effectiveness of corpus-based studies, more attention is being paid to exploring near-synonyms<sup>[5-7]</sup>. This study aims to investigate the usage differences among four near-synonyms: “serious,” “severe,” “grave,” and “grievous” through a corpus-based behavioral profile analysis. The rationale behind choosing these four words lies in the complexity of their internal semantic structure. These synonymous adjectives share some core meanings, such as “bad,” “worrying,” and

“dangerous”<sup>[8-12]</sup>. However, Merriam-Webster Dictionary defines “serious” as “having important or dangerous possible consequences,” without the implication of “bad”<sup>[11]</sup>. These adjectives are generally interchangeable when modifying specific nouns like “damage” and “problem.” However, there are situations where they are not interchangeable, particularly when paired with specific nouns. Furthermore, existing dictionaries provide varying definitions, which create challenges for learners. For instance, Merriam-Webster is the only dictionary that does not treat “severe” as a synonym for “serious” and treats “grave” as a synonym for “grievous”<sup>[11]</sup>. Lastly, vocabulary, crucial for language learning, poses challenges due to the vast number of synonyms, as confirmed by Lu’s research on Chinese learners of English<sup>[13]</sup>.

In summary, considering the intricate usage patterns, ambiguous definitions in current references, and the difficulties posed by synonymy in English learning, this paper employs a corpus-based behavioral profile approach and extracts data from the Corpus of Contemporary American English (COCA), aiming to (1) unveil semantic and usage distinctions among the four adjectives by analyzing their registers and various distributional patterns; (2) complement existing dictionary descriptions; (3) test the effectiveness of corpus-based behavioral profile research on differentiating synonymous adjectives.

## **2. Methods**

### **2.1. Corpus**

Corpus of Contemporary American English (COCA), encompassing more than one billion words, was selected as the reference corpus. Spanning from 1990 to 2019, COCA sees an annual addition of 25 million words, and it is evenly distributed across eight registers including informal genres like television and movie subtitles, Web (general), Web (Blog), spoken, fiction, and formal genres such as academic texts. Magazines and newspapers are two genres within this continuum. COCA, featuring a robust search engine, offers user-friendly functions like phrases and string searches, along with the ability to explore individual words and their collocates.

### **2.2. Corpus query and analysis procedures**

Utilizing the versatile search capabilities of the COCA, this study employed a three-phase query and analysis procedure: firstly, an overall frequency query for each of the four words; secondly, the frequency query of each adjective in eight genres; lastly, a query and examination of the semantic types of the nouns that each adjective modifies. The detailed query procedures and the rationale are elaborated in the following section.

### **2.3. Statistical tests**

To examine potential significant differences in the distributional patterns of the four adjectives across various categories, we utilized Python and SPSS20 to compute cell frequency and the chi-square test, the results of which can identify which cell frequencies are significantly higher or lower than expected in the contingency table. A cell frequency significantly exceeding expectations was labeled as a “type” while a lower frequency was an “antitype.” A cell frequency that was higher or lower than expected but yielded an insignificant *P* value remained unmarked.

## **3. Results and discussion**

### **3.1. Overall and cross-register usage patterns**

To grasp the usage patterns of the four adjectives, we initially sought information on their overall frequency. Since “grave” can function as a noun meaning “the place to bury the dead,” falling outside our research scope,

we employed the “show pos [parts of speech]” function of the COCA search engine. The results (**Table 1**) revealed the frequency order (from the lowest to highest): grievous, grave, severe, and serious, indicating a substantial variation among the four adjectives.

**Table 1.** Frequency of the four adjectives

Serious	Severe	Grave	Grievous
122,289	33,110	19,052	1,076

The total frequency alone lacks insights into semantic distinctions and specific distribution patterns for each adjective beyond their usage frequency. To address this, we first consulted five dictionaries (*Cambridge Advanced Learner’s Dictionary online*; *Longman Dictionary of Contemporary English online*; *Oxford Learner’s Dictionaries online*; *Collins English Dictionary online*; and *Merriam-Webster Dictionary*) for their core meaning and then examined their special register distribution<sup>[8-12]</sup>. Despite variations in the source meaning, all dictionaries indicate a shared sense of “bad or serious”<sup>[8-12]</sup>. For instance, as *Oxford Learner’s Dictionaries online* shows, “*grievous*” means very serious and often causing great pain or difficulty; “*grave*” means very serious and important; “*severe*” means extremely bad or serious; and “*serious*” means bad or dangerous<sup>[12]</sup>. These semantic nuances can be expected to contribute to diverse register distributions and usage patterns. Consequently, we conducted a further investigation of their distribution across eight genres. Initially, we searched COCA for the frequency of each adjective across genres and then calculated the chi-square and cell frequency of each adjective in various registers. The preliminary results are reported in **Table 2**. After sorting the data and using annotations (“T” for “type” and “A” for “antitype”), we compiled **Table 3** below.

**Table 2.** Chi-square test of the cross-register distributions of the adjectives

Adjective	Register	Freq	Exp	Chi-square	Obs-exp	P value
serious	SPOK	19963	17740.0048	261.9029	>	6.6030148649793555e-59
serious	BLOG	15700	14682.0800	68.0747	>	1.5741371986395877e-16
serious	WEB	14842	15933.3976	77.2674	<	1.493126709171243e-18
serious	TV/M	19015	16282.4567	422.7686	>	6.092924905672614e-94
serious	FIC	10426	11611.6142	127.3560	<	1.5527051926324934e-29
serious	MAG	15493	15968.9306	14.3385	<	0.0001527064329292992
serious	NEWS	14158	14030.6424	1.1328	>	0.2871759974832042
serious	ACAD	12697	16044.8736	779.4595	<	1.5776626360703815e-171
severe	SPOK	3580	4802.6565	356.0792	<	2.010688091320817e-79
severe	BLOG	3697	3974.8009	19.9741	<	7.849720767784518e-06
severe	WEB	5026	4313.5635	108.3866	>	2.2114309882898036e-25
severe	TV/M	1370	4408.0623	3192.6785	<	0
severe	FIC	1491	3143.5502	1177.0799	<	5.84139423130637e-258
severe	MAG	5410	4323.1831	242.2637	>	1.2622151323277812e-54
severe	NEWS	4090	3798.4407	21.4047	>	3.7186625578130975e-06
severe	ACAD	8444	4343.7427	2628.1276	>	0
grave	SPOK	1844	2763.2537	366.0271	<	1.3715911688176499e-81
grave	BLOG	1572	2286.9392	264.1706	<	2.1156688349750527e-59
grave	WEB	2640	2481.8494	9.6435	>	0.0019002154679716875
grave	TV/M	2872	2526.2202	41.4471	>	1.2110487473113063e-10
grave	FIC	4628	1808.6712	2468.0388	>	0

**Table 2 (Continued)**

Adjective	Register	Freq	Exp	Chi-square	Obs-exp	P value
grave	MAG	1884	2487.3842	166.0191	<	5.478845993095147e-38
grave	NEWS	1804	2185.4687	72.5693	<	1.6127057153929586e-17
grave	ACAD	1805	2499.2133	223.2904	<	1.7325619302689638e-50
grievous	SPOK	75	156.0849	55.5085	<	9.305518165721138e-14
grievous	BLOG	104	129.1798	5.0147	<	0.02513289339936839
grievous	WEB	361	140.1895	192.8079	>	7.752596161633554e-44
grievous	TV/M	113	143.2607	6.6822	<	0.009738221344487003
grievous	FIC	121	102.1644	2.8509	>	0.09132392027912463
grievous	MAG	133	140.5021	0.3092	<	0.5781964261710498
grievous	NEWS	86	123.4482	12.6854	<	0.0003685168696626654
grievous	ACAD	83	141.1703	29.1604	<	6.66277246998404e-08

**Table 3.** Distributions of the four adjectives across genres

	Spoken	Blog	Web	TV/Movie	Fiction	Magazines	Newspapers	Academic texts	Total
Serious	19963 T	15700 T	14842 A	19015 T	10426 A	15493	14158	12697 A	122294
Severe	3580 A	3697 A	5026 T	1370 A	1491 A	5410 T	4090 T	8444 T	33108
Grave	1844 A	1572 A	2640	2872 T	4628 T	1884 A	1804 A	1805 A	19049
Grievous	75 A	104	361 T	113	121	133	86	83 A	1076

Note: A cell frequency followed by the letter T means it is a “type” (discussed above) while a cell frequency followed by an A means it is an “antitype.” A cell frequency followed by no letter is neither.

Given that spoken language and academic writing represent the formality continuum’s two extremes, with spoken being the least formal and academic writing the most formal, it is reasonable to focus on how the four terms distribute in these registers. Based on the results in **Table 3**, “serious” appears to be the least formal classified as a type in the spoken register and an antitype in the academic writing register. On the contrary, “severe” is perceived as the most formal, categorized as an antitype in the spoken register and a type in the academic writing register. Meanwhile, “grave” and “grievous” both fall as antitypes in both registers, positioning them in the middle of the formality scale (**Figure 1**).

less formal ← *serious* < *grave/grievous* < *severe* → more formal

**Figure 1.** The formality scale of the four adjectives

### 3.2. Semantic differences: The types of nouns that each adjective typically modify

While the general frequency and register distribution patterns of the aforementioned adjectives offer valuable insights into their semantic and usage patterns, a more thorough understanding of their differences requires an examination of the semantic types of typical nouns they modify <sup>[14]</sup>. Liu confirmed that studying the semantic types of a lexical item’s collocates is effective for determining its semantic patterns, particularly for adjectives primarily used to modify nouns <sup>[1]</sup>. Thus, we explored the typical nouns modified by each adjective using two query types in COCA: (1) frequency, identifying the most frequently modified nouns, and (2) Mutual Information (MI) score (**Table 4**). An MI score, measuring collocations, with a score of 3 or higher signifies a high co-occurrence frequency of the two items. The combined use of frequency and MI score

avoids dilemmas arising from the independent use of either instrument, ensuring the representativeness of the retrieved most frequent nouns. Liu supports this research approach, validating its rationale<sup>[15]</sup>. To enhance the representativeness of the top 10 nouns measured by MI score, we set selection thresholds at 100 for “serious” and “severe,” 50 for “grave,” and 5 for “grievous” for the low overall general frequency of “grave” and “grievous,” which only satisfies the top 10 nouns when we set the threshold of 50 and 5 respectively.

**Table 4.** Nouns modified most frequently by each of the four adjectives measured by frequency and MI score

Serious		Severe		Grave		Grievous	
By frequency	By MI	By frequency	By MI	By frequency	By MI	By frequency	By MI
Problem 3424	Contender 7.09	Weather 922	Sepsis 10.05	Danger 448	Breaches 10.77	Harm 72	Harm 9.57
Threat 1303	Illnesses 7.04	Problem 752	Thunderstorms 9.29	Concern 269	Injustice 9.25	Error 59	Sins 9.39
Issues 1276	Repercussions 6.78	Pain 726	Storms 8.37	Mistake 206	Danger 9.04	Sin 51	Error 9.28
Injury 1273	Injury 6.60	Disabilities 634	Drought 8.30	Threat 193	Doubts 8.70	Injury 35	Wounds 9.07
Trouble 1130	Complications 6.58	Damage 543	Shortages 8.26	Consequences 131	Mistake 7.61	Mistake 22	Injury 8.34
Questions 1120	Doubts 6.54	Depression 521	Allergies 8.17	Risk 119	Concern 7.57	Wounds 19	Mistake 7.16
Consequences 1035	Flaws 6.45	Cases 415	Disabilities 8.13	Doubts 99	Sin 7.35	Loss 16	Fault 6.93
Illness 967	Consideration 6.40	Storms 352	Asthma 8.08	Error 96	Consequences 7.28	Fault 15	Blow 5.94
Business 965	Offenses 6.26	Injuries 345	Headaches 7.98	Injustice 90	Threat 7.25	Damage 10	Loss 5.86
Damage 797	Jeopardy 6.11	Disease 325	Penalties 7.52	Sin 85	Error 7.21	Blow 7	Damage 5.79

Based on the results from both the frequency and the MI queries, we compiled a list of the top ten nouns modified by each adjective in each measure (**Table 4**). Overlaps exist between the outcomes of the two measures: 100% overlap for “grievous,” 90% for “grave,” and 25% for both “severe” and “serious.” Additionally, there is overlap among the nouns modified by all four adjectives, resulting in a total of only 46 different words in the entire list. An issue worth discussing is the exclusion of “wolf” from the “grievous” list. This decision was based on the limited instances of the collocation “grievous wolf” (totaling only 8 entries) and their appearance solely in the context of the web or movies in 2012. Furthermore, in all cases, “grievous” takes on the meaning of “atrocious,” a definition not found in five dictionaries. Therefore, we considered this collocation of “grievous wolf” to be of limited research significance. Another consideration is the inclusion of the noun “contender,” which appears exclusively in collocation with “serious.” While this raises questions about its inclusion, three reasons support it. Firstly, even though it exclusively collocates with “serious,” in this context, “serious” functions as an adjective, and their MI score is the highest compared to other collocation pairs of “serious.” Secondly, a distinct semantic and usage connection between “serious” and “contender” is revealed, with “serious” conveying the meaning of “the competitor that must be treated as important.” Thirdly, consulting the five dictionaries mentioned above confirms that, in this context, “serious” cannot be substituted by any other adjectives, as it carries a unique meaning. In summary, “contender” is a robust collocate with

“serious,” uncovering semantic and usage patterns aligned with our objective and, therefore, merits inclusion.

To delineate differences among the near-synonymous adjectives in terms of the nouns they modify, we categorized the nouns into six major semantic categories: (1) abstract (e.g. question and trouble), (2) concrete (e.g. contender), (3) dual (e.g. complication and business), (4) medical (e.g. injury and asthma), (5) weather (e.g. thunderstorms and drought), and (6) law (e.g. offense and injustice). The classification results are provided in **Table 5** with explanations for specific classifications below the table. Then we identified the types of noun collocates of each adjective, and the results (**Table 6**) vary substantially across adjectives.

**Table 5.** Type classification of the top 50 nouns modified by the five adjectives

Abstract	Concrete	Dual	Medical	Weather	Law
Question	Contender	Complication*	Injury	Weather	Offense
Trouble		Threat*	Illness	Thunderstorm	Injustice
Consequence		Business*	Disease	Storm	Sin
Consideration		Issue*	Disability	Drought	Breach
Damage		Problem*	Pain		Penalty
Repercussion			Depression		
Jeopardy			Allergy		
Doubt			Asthma		
Flaw			Sepsis		
Shortage			Harm		
Danger			Wound		
Concern			headache		
Risk					
Mistake					
Error					
Fault					
Blow					
Loss					

\*The explanations for the reason(s) for classifying the nouns with an asterisk the way they are: The word complication when modified by the adjectives can be used in the concrete sense of “medical problem” (i.e. serious complication = “serious medical problem”) and the abstract sense “difficulty.” The word threat when modified by the adjectives can be used in the concrete sense (i.e. I knew he was a serious threat for a medal) and in the abstract sense (i.e. Islamic fascism is a serious threat). The word business when modified by the adjectives can be used in the concrete sense as in the example “Guns are serious business” and in the abstract sense (i.e. Love is a serious business). The word problem when modified by the adjectives can be used in the concrete sense (i.e. Creepy guys can be a serious problem) and in the abstract sense (i.e. Inflation ... is a serious problem). The word issue when modified by the adjectives can be used in the concrete sense (i.e. Birds/bats are not a serious issue) and in the abstract sense (i.e. Efficiency is a serious issue).

**Table 6.** Types of nouns modified by each adjective

Serious (18 different nouns)	Severe (18 different nouns)	Grave (11 different nouns)	Grievous (11 different nouns)
7 abstract	1 abstract	7 abstract	6 abstract
1 concrete	3 dual	1 dual	3 medical
7 dual	9 medical	3 law	2 law
2 medical	4 weather		
1 law	1 law		

Regarding the breadth of distribution, abstract and law nouns exhibit the widest distribution, appearing with all four adjectives. Notably, only “serious” collocates with concrete nouns, and “severe” exclusively associates with weather nouns. Although the concrete noun list contains only “contender,” it provides valuable information indicating that the other three adjectives, excluding “serious,” do not collocate with concrete nouns.

In the case of weather nouns, a distinctive distributional feature of “serious” is evident, habitually linking with abstract and dual nouns, recorded 7 times out of 18 nouns. For “severe,” the most frequent collocate is medical nouns, recorded 9 times out of 18 nouns. “Grave” and “grievous” each total 7 and 6 occurrences, respectively, in collocation with abstract nouns across 11 different nouns. Nevertheless, this analysis serves as an initial exploration, and for a more in-depth and convincing discussion, statistical tools are required. We queried COCA for the frequencies of the four adjectives with each of the 46 nouns, tabulated the total frequencies of the adjectives with the 46 nouns, and their frequencies with each of the six types of nouns. The results are reported in **Table 7**. It is noteworthy that the order of total frequencies of the adjectives’ uses with the 46 nouns mirrors the overall total frequencies of the adjectives reported in **Table 1**: *serious* > *severe* > *grave* > *grievous*. According to Liu, the significant matching between these two orders indicates representativeness<sup>[4]</sup>. Therefore, the overlap suggests indirectly that the 46 nouns we conclude can represent the overall nouns modified by the adjectives, avoiding over-representation or under-representation.

To assess whether and how the distributions of the four adjectives among the six types of nouns differ significantly, we utilized Python and SPSS20 for the chi-square test and computed the corresponding cell frequencies (**Table 7**). Subsequently using the annotations used in the register distribution pattern, we marked “T” or “A” for each cell depending on the *P* value, expected value, and actual value. The outcomes are presented in **Table 8**. In the abstract, concrete, and dual categories, “serious” stands as the only type, with the other adjectives serving as antitypes or neither. The explanation for “serious” being the sole type in the concrete category lies in the earlier mentioned fact that the only concrete noun “contender” is a unique collocation of “serious.” In the medical category, “severe” and “grievous” are the types, while the other two are the antitypes; in the weather category, the exclusive type is “severe”; and in the law category, “grave” and “grievous” are the types, with “serious” as the antitype and “severe” as neither. These results demonstrate that abstract, concrete, and dual nouns are primarily modified by “serious”; the medical ones mainly collocate with “severe” and “grievous”; weather-related nouns habitually collocate with “severe,” and “grave” and “grievous” are frequently considered as the modifiers of the law nouns. The findings of these distribution patterns provide meaningful information not comprehensively and systematically presented in the five dictionaries examined. Therefore, our findings address some deficiencies in dictionaries and contribute to distinguishing fine-grained differences among the four near-synonymous adjectives for English learners.

**Table 7.** Chi-square test of distributions of the types of nouns modified by the four adjectives

Adjective	Noun type	Freq	Exp	Chi-square	Obs-exp	<i>P</i> value
serious	abstract	10184	9440.9162	56.1214	>	6.813306775518292e-14
serious	concrete	301	202.589	37.6851	>	8.313646661963557e-10
serious	dual	12266	9877.0546	515.0404	>	5.076775733860851e-114
serious	medical	4659	6379.8705	535.9162	<	1.4583562237090115e-118
serious	weather	116	1422.1612	2214.9120	<	0
serious	law	753	956.4805	47.9338	<	4.4086267128659726e-12
grave	abstract	1830	2358.9771	133.0921	<	1.9902064923282206e-140
grave	concrete	0	50.6204	97.2803	<	4.013467455556331e-09
grave	dual	400	2467.9539	2979.3354	<	5.599329354775147e-96
grave	medical	141	1405.0650	2063.7337	<	1.5581883632209685e-127
grave	weather	2	135.1805	694.8434	<	2.4225808155501191e-57

**Table 7 (Continued)**

Adjective	Noun type	Freq	Exp	Chi-square	Obs-exp	P value
grave	law	315	238.9753	20.3211	>	2.8550535708995553e-55
grievous	abstract	171	147.8951	3.0645	>	0.08002006479144412
grievous	concrete	0	3.1736	2.9774	<	0.08443256575016929
grievous	dual	15	154.7274	226.7788	<	3.005102271719159e-51
grievous	medical	160	99.9428	26.8348	>	2.216146091635868e-07
grievous	weather	0	22.2786	40.6470	<	1.82363651612526e-10
grievous	law	97	14.9825	117.2298	>	2.5565810437056665e-27
severe	abstract	1842	2079.2116	28.4585	<	9.572767255137441e-08
severe	concrete	0	44.6170	85.2788	<	2.5912243669267896e-20
severe	dual	1994	2175.2642	15.5880	<	7.87541779652135e-05
severe	medical	4519	1594.1216	2796.9556	>	0
severe	weather	1995	313.2084	2447.8383	>	0
severe	law	256	210.6338	8.4364	<	0.003677759405393181

**Table 8.** Distributions of the types of nouns modified by the four adjectives

	Abstract	Concrete	Dual	Medical	Weather	Law	Total
Grave	1830 A	0 A	400 A	141 A	2 A	315 T	2688
Severe	1842 A	0 A	1994 A	4519 T	1995 T	256	10606
Serious	10184 T	301 T	12266 T	4659 A	116 A	753 A	28279
Grievous	171	0	15 A	160 T	0 A	97 T	443

Note: A cell frequency followed by the letter T means it is a “type” (discussed above) while a cell frequency followed by an A means it is an “antitype.” A cell frequency followed by no letter is neither.

## 4. Conclusion

Through corpus-based behavioral profile analysis of distributional patterns of the four synonyms, this paper has identified usage differences and internal structures, not comprehensively described in the existing reference materials, and has also uncovered findings that are previously unclear. Firstly, we observed that among these four adjectives, “*severe*” exhibits the highest formality, followed by “grave/grievous,” while “serious” is the least formal. However, due to research instrument limitations, a more precise distinction between “grave” and “grievous” could be a potential avenue for future improvements. Secondly, examining the types of nouns these adjectives typically modify led to the conclusions: (1) Abstract and dual nouns are often modified by “*serious*”; (2) Concrete nouns are seldom modified by these four adjectives when conveying the meaning of “bad, dangerous, and worrying”; (3) Medical nouns are modified by “*severe*” and “*grievous*”; (4) Weather nouns are primarily modified by “*severe*”; (5) Law nouns are often pair with “*grave*” and “*grievous*”. These findings align with the total frequency order of these adjectives: *serious* > *severe* > *grave* > *grievous*. However, as our study lacks prosody examination and detailed context analysis, further research building upon our study is warranted.



## Disclosure statement

The author declares no conflict of interest.

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