

The Usage of CAUSE in Three Branches of Science

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Abstract

Semantic prosody is a concept that has been subject to considerable criticism and debate. One big concern is to what extent semantic prosody is domain or register-related. Previous studies reach the agreement that CAUSE has an overwhelmingly negative meaning in general English. Its semantic prosody remains controversial in academic writing, however, because of the size and register of the corpus used in different studies. In order to minimize the role that corpus choice has to play in determining the research findings, this paper uses sub-corpora from the British National Corpus to investigate the usage of CAUSE in different types of scientific writing. The results show that the occurrence of CAUSE is the highest in social science, less frequent in applied science, and the lowest in natural and pure science. Its semantic prosody is overwhelmingly negative in social science and applied science, and mainly neutral in natural and pure science. It seems that the verb CAUSE lacks its normal negative semantic prosody in contexts that do not refer to human beings. The implications of the findings for language learning are also discussed.

Keywords: CAUSE, collocation, semantic prosody, scientific writing

1. Introduction

The word *collocation* was brought into its modern form by Firth when he said “I propose to bring forward as a technical term, meaning by *collocation*, and apply the test of collocability” (Firth, 1957, p. 194). Collocations of a given word are “statements of the habitual or customary places of that word” (Firth, 1968, p. 181). Firth’s notion of collocation is essentially quantitative, however. Most linguists today agree that the only way to reliably identify the collocates of a given word or phrase is to study patterns of co-occurrence in a corpus (Sinclair, 1991; Hoey, 1991; Stubbs, 1995; Partington, 1998; McEnery & Wilson, 2001; Hunston, 2002; Sinclair et al., 2004).

A closely related concept is *semantic prosody* which is initially defined as a “consistent aura of meaning with which a form is imbued by its collocates” (Louw, 1993, pp. 156-159). Louw illustrates semantic prosody with the examples of *utterly*, *bent on* and *symptomatic of*, which are followed by expressions referring to undesirable things (such as *destroying*, *ruining*, *clinical*, *depression*, *multitude of sins*, etc.). Although the term “semantic prosody” was first used by Louw (1993), it was attributed to Sinclair (1991) who shows that the phrasal verb *set in* occurs primarily with subjects which refers to unpleasant states of affairs, such as *rot*, *decay*, *malaise*, *despair*, *ill-will* and *decadence*.

Semantic prosody is a concept rooted in the neo-Firthian concordance-based analysis of collocation. For example, Stubbs (1996, p. 176) states that semantic prosody is a particular collocational phenomenon and classifies it into three categories: negative prosody, positive prosody and neutral prosody. The node word bears a strong negative prosody if its collocates are mainly of strong negative semantic characteristics. The node word bears a strong positive prosody if its collocates are mainly of strong positive semantic characteristics. If both positive and negative collocates exist in the context, the node word can be said to bear a neutral or mixed prosody. Some words have a predominantly negative prosody. For example, *incidence* typically collocates with words referring to diseases or defects, such as *infections*, *HIV*, *injury*, *colon cancer*, *defects*, *disruption*, *cracking*, and so on (Wei, 2002a). A few words have a positive prosody, for example, *provide* mainly collocates with words related to services or help, such as *facilities*, *information*, *services*, *aid*, *assistance*, *help*, *support*, *care*, *food*, *money*, *nourishment*, *protection*, *security*, and so on (Stubbs, 1995). Many words are neutral or mixed in this respect. The main collocates of *probability of* can be divided into three categories: neutral collocates, such as *percent*,

change, occurrence and prototype structure; positive collocates, such as *success, survival, acquisition, and winning*; negative collocates, such as *failure, accidents, error, loss, malfunction, and deficiency* (Wei, 2002b). Both individual words and phrases can have semantic prosodies (Schmitt & Carter, 2004, p. 7).

Semantic prosody is also a concept that has been subject to considerable criticism and debate (Partington, 2004; Whitsitt, 2005; Hunston, 2007; Stewart, 2009). One big concern is to what extent semantic prosody is register-related. This paper will investigate the collocational behaviour and semantic prosody of the verb CAUSE in three branches of scientific writing in order to shed new insights into the important yet controversial notion in modern linguistics. The results of the study, therefore, may have implications for EAP (English for Academic Purposes).

2. Previous Studies on CAUSE

The word CAUSE is famous in the studies of semantic prosody. The initial investigation can be traced back to Stubbs. When examining the usage of CAUSE in 1-million-word corpus Brown, Stubbs (1995) documented the lexical set of its collocates by constructing a concordance of all occurrences of this word. Nearly 80% of occurrences are negative (such as *cause of death, cause breakage, cause anxiety, cause errors*, etc.); 18% are neutral (such as *caused the removal of the pulpit to the side, caused the fantail to start revolving*, etc.); 2% are positive (such as *caused such widespread interest, caused a pleasurable mental state, caused him to smile, a cause to display such amiability*, etc). Stubbs (ibid) then investigated the usage of *cause* in a 120-million-word Cobuild corpus, which confirms the negative prosody that CAUSE has.

Wei (2002b) studied CAUSE in a 4 million words Academic English corpus (JDEST) by examining its collocates. The research produced 52 significant collocates of CAUSE, all of which refer to problems, accidents, errors, diseases, or other negative factors in specialized fields (such as *failure, bleeding, damage, death, unemployment, injury, trouble, problems, disruption, harm, worry, deterioration*, etc.).

Xiao and McEnery (2006) investigated CAUSE in FLOB and Frown, each of which contains approximately one million words. Their study produced 287 instances of CAUSE used as a verb. Of these, 223 occurrences have a negative prosody, 56 are neutral and only 8 cases are positive. The neutral use of CAUSE typically occurs in academic prose which provides 28 out of 56 neutral occurrences (e.g., these echoes are caused by reflection of the speaker's voice back from the distant receiving end...). Besides, the apparently neutral or even positive occurrences of CAUSE are often offset by their longer co-texts (e.g., that idea caused a brief, groundless burst of hope which brought her a little closer to real waking).

Hunston (2007) compared the usage of CAUSE in general corpus (the Bank of English) and that in academic corpus (the journal New Scientist corpus). In general corpus, the caused entities are either illnesses or symptoms (suffered by people), or emotions such as *anger, confusion, frenzy* (experienced by people), or processes or abstractions involving people and their goals (*fragmentation, rift, problem*). However, in academic corpus, the caused entities comprise inanimate entities or processes involving inanimate objects (*signal, alpha Lyman line, changes, convection*). No particular attitude can be discerned towards the entity brought into being, even when an extended context is shown (e.g., these proteins cause a smell to become less strong if we continue to sniff at it). Hunston (2007) thus argues that semantic prosody is correlated with register.

Previous studies have confirmed that CAUSE has a negative prosody in general English. However, different research produced different results concerning the semantic prosody of CAUSE in academic English, which may be related to the size and register of the corpus used in different studies. In order to minimize the role that corpus choice had to play in determining the research findings, we decided to use British National Corpus (BNC) as data which is big enough and contains different registers of academic English.

3. Method

3.1 Corpus Data

BNC is a 100 million word collection of samples of written and spoken language from a wide range of sources, which is designed to represent a wide cross-section of British English from the later part of the 20th century, both spoken and written (Aston & Burnard, 1998). The written part of the BNC (90%) includes extracts from regional and national newspapers, specialist periodicals and journals for all ages and interests, academic books and popular fiction, published and unpublished letters and memoranda, school and university essays, among many other kinds of text. The spoken part (10%) consists of orthographic transcriptions of unscripted informal conversations and spoken language collected in different contexts, ranging from formal business or government meetings to radio shows and phone-ins. The present study investigates the usage of CAUSE as a verb in three domains for written corpus texts respectively: social science, applied science, natural & pure science.

3.2 Corpus Tool

The corpus tool used in this study is the Sketch Engine (SkE) online interface, which falls into the category of fourth-generation concordancers (McEnery & Hardie, 2012). Corpora in SkE are often annotated with additional linguistic information, the most common being part of speech information (for example, whether something is a noun or a verb), which allows large-scale grammatical analyses to be carried out. As a leading corpus tool, SkE is widely used in lexicography, language teaching, translation and the like (Kilgarriff et al., 2004, 2014). The SkE online interface allows users to search for exact words or phrases, wildcards, lemmas, part of speech, or any combinations of these. One can also search for collocates within a ten-word window (e.g., all nouns, all adjectives, or all verbs near a search word).

3.3 Analytic Procedures

Concordance enables researchers to compare frequencies of CAUSE in three branches of science. The first step is thus to conduct the concordance of CAUSE in three domains of BNC: social science, applied science, and natural & pure science. The next step is to calculate collocates of CAUSE in different branches. The span (the number of words left and right of the search word) is (-5, 5), the minimum frequency of each collocate being set 5 and minimum frequency in given range (in our case -5, 5) 3. Of seven measures to calculate the strength of collocation (T-score, MI, MI3, log likelihood, min. sensitivity, and LogDice), I choose the default one *logDice* which is considered more reliable than the frequently used MI (Mutual Information) measure. The final step is to examine the context of the fifty top collocates to make sure whether it is negative or positive so that the percentage of each type of semantic prosody can be calculated.

4. Results and Analysis

4.1 The Frequency of CAUSE in Three Branches of Science

Table 1 indicates that the occurrence of CAUSE changes over different domains of science, its frequency in social science being much higher than that in pure science.

Table 1. Frequency of CAUSE in three branches of science

	social science	applied science	natural & pure science
Total	3,632	2,759	1,491
Per million	32.38	24.59	13.29

4.2 The Collocates and Semantic Prosody of CAUSE in Social Science

Table 2 lists the top 50 collocates of the verb CAUSE in social science automatically generated by the SkE. Further examination suggests that 38 out of 50 (76%) significant collocates of CAUSE are negative: *damage, harm, injury, distress, negligence, nuisance, difficulty, grievous, reckless, confusion, disruption, inconvenience, loss, death, handicap, offence, suffering, serious, delay, accident, defect, injustice, obstruction, alarm, severe, problem, hardship, odour, anxiety, illness, unnecessary, friction, harassment, manslaughter, disease, disturbance, disorder* and *infection*.

Table 2. The top 50 collocates of CAUSE in social science

Rank	Collocates	Freq	logDice	Rank	Collocates	Freq	logDice
1	damage	280	9.292	26	injustice	18	7.077
2	harm	126	9.231	27	obstruction	17	7.051
3	injury	188	9.159	28	alarm	26	7.025
4	distress	61	8.57	29	severe	32	6.999
5	bodily	44	8.306	30	intentionally	15	6.991
6	negligence	35	7.869	31	problem	230	6.988
7	nuisance	33	7.857	32	hardship	17	6.962
8	difficulty	116	7.836	33	odour	17	6.934

9	grievous	27	7.818	34	plaintiff	28	6.933
10	intent	38	7.796	35	anxiety	25	6.929
11	reckless	27	7.728	36	illness	27	6.91
12	confusion	39	7.607	37	unnecessary	20	6.909
13	disruption	27	7.593	38	friction	15	6.891
14	inconvenience	24	7.572	39	concern	67	6.889
15	loss	107	7.534	40	harassment	15	6.861
16	death	134	7.404	41	permit	30	6.843
17	handicap	29	7.4	42	smoking	19	6.825
18	offence	49	7.382	43	indirectly	16	6.811
19	suffering	26	7.311	44	manslaughter	14	6.793
20	mental	44	7.269	45	physical	44	6.785
21	serious	74	7.269	46	disease	48	6.78
22	delay	45	7.268	47	disturbance	17	6.764
23	driving	29	7.254	48	disorder	20	6.747
24	accident	51	7.134	49	infection	23	6.743
25	defect	23	7.127	50	likely	87	6.742

These examples of unpleasant company collocate with CAUSE so frequently that the typical use of this word shows a negative affective meaning, as shown in (1) to (5).

(1) There was evidence that the book, if published, would almost certainly come to her attention, and would cause her gross psychological **damage**.

(2) It is not in the public interest that people should try to cause or should cause each other actual bodily **harm** for no good reason.

(3) The House of Lords accepted that the definitions of the two offences are the same, merely adding that the prosecutor should charge manslaughter when the maximum penalty for the offence of causing death by **reckless** driving (five years) might be insufficient.

(4) But admirable as this bon mot may be, the widespread use of the necessary techniques is causing some **anxiety**.

(5) A second virus, HIV 2, was discovered in 1986 and is mainly found in West Africa. HIV 2 may not have as great a potential to cause **illness** as HIV 1.

12 out of 50 (24%) significant collocates of CAUSE in social science are neutral: *bodily, intent, mental, driving, intentionally, plaintiff, concern, permit, smoking, indirectly, physical* and *likely*. Four of the above neutral collocates (*bodily, mental, driving* and *physical*) tend to (from 89% to 100%) appear with words of unpleasant meanings. For instance, *bodily harm (injury), mental handicap (disorder, disabilities, damage, defect, disease, suffering, problems, frailty), reckless (dangerous, negligent) driving, physical (deterioration, harm, injury, damage, handicap, disabilities, discomfort, pain, etc.)*. These negative collocations render the occurrences of CAUSE negative meanings, as shown in (6) and (7). In these two examples, *bodily* and *mental* appears quite neutral. Nevertheless, the neutrality is immediately traded off by *harm* and *handicap*.

(6) By allowing an intent to cause grievous **bodily harm** to suffice for a murder conviction, the law is violating a general principle, turning the most serious of its offences into a constructive crime.

(7) **Mental handicap** can be *caused* by a wide range of medical, social and environmental factors, of which some are to an extent preventable.

Besides, six other neutral collocates (*intent, intentionally, plaintiff, smoking, indirectly, and likely*) are always (from 66% to 100%) used in construction of negative meanings. For instance, *intent to cause harm (injury, loss), intentionally (or recklessly) cause death (injury, violent, battery, suffering, damage, detriment, loss), cause damage (injury, problems, loss, injustice, damnum) to (for) the plaintiff, smoking cause death (cancer, fatal*

diseases, bronchitis, illness), accident (legal liability, injury, disease, risk)... (directly or) indirectly caused by, likely to cause loss (damage, danger, confusion, problems, stress, suffering). The seemingly neutral occurrences of CAUSE are often offset by these negative constructions, as shown in (8) and (9).

(8) In Savage (1990) 91 Cr App R 317, the same court (but a different division) on the same day said that **intentionally** or recklessly **causing a battery** was sufficient, as long as actual bodily harm occurred.

(9) **Smoking causes** six times as many premature **deaths** as road accidents, all other accidents, suicides, murder, manslaughter, fires, illicit drug use and AIDS put together.

However, when CAUSE collocates with *concern* and *permit*, the meanings of the occurrences can be negative (examples 10 and 12) as well as neutral (examples 11 and 13). In (10), *concern* appears neutral, but the neutrality is immediately traded off by the extended context *losses of women on graduate management training programmes are high*. Similarly, the neutrality of *permits* in (12) is offset by *nuisance to continue*. In (11) and (13), the extended contexts show that the meanings of *concern* and *permit* are neutral.

(10) **Losses of women on graduate management training programmes are high**, -Unilever lost 75 per cent within 5 years-causing special **concern**.

(11) ALTHOUGH relationships with parents determine in large measure our longer-term preferences, attitudes and values, during adolescence it is often **relationships with friends** that cause most **concern** and which pre-occupy the thoughts of young people as they grow up.

(12) It is said, therefore, that it directly causes or **permits** the **nuisance to continue**, as happened in Halsey's case.

(13) It is an obtaining of services where the other is induced to confer a benefit by doing some act, or causing or **permitting some act to be done**, on the understanding that the benefit has been or will be paid for.

From the above analysis, we can see CAUSE is overwhelmingly (96%) negative in social science.

4.3 The Collocates and Semantic Prosody of CAUSE in Applied Science

As shown in Table 3, 29 out of 50 (58%) significant collocates of CAUSE in applied science are negative: *damage, pollution, virus, diarrhea, cancer, severe, disease, symptom, disturbance, bacterium, havoc, disruption, harm, inflammation, infection, lesion, stress, hepatitis, problem, overflow, confusion, tumour, hypergastrinaemium, toxic, erosion, vomit, error, delay and injury*.

Table 3. The top 50 collocates of CAUSE in applied science

Rank	Collocates	Freq	logDice	Rank	Collocates	Freq	logDice
1	damage	188	8.806	26	hepatitis	11	6.715
2	pollution	60	8.154	27	problem	187	6.711
3	virus	30	7.696	28	overflow	11	6.71
4	diarrhea	20	7.55	29	confusion	18	6.697
5	cancer	41	7.498	30	stricture	10	6.676
6	severe	39	7.447	31	pancreatic	10	6.653
7	disease	69	7.394	32	intestinal	11	6.647
8	symptom	33	7.392	33	tumour	13	6.608
9	liver	22	7.334	34	condensation	9	6.574
10	radiation	22	7.313	35	environmental	32	6.556
11	chronic	21	7.273	36	hypergastrinaemium	8	6.527
12	acid	34	6.998	37	acute	14	6.509
13	disturbance	16	6.946	38	toxic	11	6.499
14	bacterium	15	6.904	39	erosion	11	6.483
15	pylorus	14	6.883	40	ozone	11	6.478
16	havoc	11	6.864	41	NSAIDs	8	6.476

17	bile	14	6.852	42	vomit	9	6.475
18	disruption	13	6.844	43	dose	14	6.469
19	harm	21	6.842	44	reduction	24	6.466
20	secretion	13	6.836	45	gastric	13	6.461
21	warming	12	6.811	46	error	23	6.441
22	inflammation	11	6.803	47	mucosal	9	6.415
23	infection	21	6.803	48	delay	22	6.374
24	lesion	12	6.789	49	injury	25	6.37
25	stress	37	6.761	50	widespread	15	6.36

When these unpleasant companies collocate with CAUSE, the occurrences show negative meanings, as shown in (14) to (18).

(14) The closures could *cause* severe **damage** to hundreds of miles of streams and rivers, the NRA claims.

(15) Researchers at the University of Warwick have found that Salmonella typhimurium, a bacterium that causes **diarrhoea**, survives for much longer than three weeks, but in a dormant state that makes it much more difficult to detect.

(16) This concentration of fish causes social **stress**, disease and oxygen depletion, which may in turn cause high mortality rates especially in hot weather.

(17) The National Rivers Authority is to close a loophole under which the 12,000 sewage works in England and Wales can cause highly **toxic** pollution of rivers without fear of prosecution.

(18) Often one simple fault, for example an incorrect protection on a storage account, can cause many **errors** to be reported.

21 out of 50 (42%) significant collocates of CAUSE in applied science are neutral: *liver, radiation, chronic, acid, pylorus, bile, secretion, warming, stricture, pancreatic, intestinal, condensation, enviromental, acute, ozone, NSAIDs, dose, reduction, gastirc, mucosal* and *widespread*.

10 of the above neutral collocates (*liver, chronic, pylorus, warming, pancreatic, enviromental, acute, ozone, mucosal* and *widespread*) always (from 70% to 100%) appear with words of unpleasant meanings. For instance, *liver damage (malfunction, disease, failure, injury), chronic pancreatitis (enteritis, blood loss, constipation, enterocutaneous fistulas, lymphocytic leukaemia, gastrointestinal symptoms, anxiety), H pylori infection, global warming, pancreatic hyperplasia (fistula, toxicity), enviromental damage (destruction, devastation, degradation, pollution), acute pancreatitis (abdominal pain, tubular dysfunction, papillary necrosis, gastroenteritis, complication, infections), damage to (depletion of) the ozone layer, mucosal damage (injury, losses, abnormalities, hyperplasia), widespread air pollution (smogs, environmental damage, unintentional deaths, inflation, anguish)*.

These negative collocations render the occurrences of CAUSE negative meanings, as shown in (19) and (20). In these two examples, *liver* and *warming* appears quite neutral. Nevertheless, the neutrality is immediately traded off by *injury* and *global*.

(19) Patients were stratified according to whether recurrent HBV *caused* severe, progressive **liver injury**, including cirrhosis, or mild liver disease (see Table 3).

(20) It warns that ever more land will be needed for crop production, while the land surface is shrinking as a result of rising sea levels *caused* by **global warming**.

Besides, although 3 other collocates are neutral (*radiation, stricture, and condensation*), these words always (from 91% to 100%) appear in longer co-texts of negative meanings. The extended contexts render the occurrences of CAUSE negative meanings, as shown in (21) and (22).

(21) This study aimed to evaluate various aspects of gastrointestinal function in **patients with diarrhoea** caused by **chronic radiation enteritis** and the effects of treatment with the peripheral opiate agonist precursor loperamide-N-oxide.

(22) Insulation in lofts which has blocked the natural ventilation of the roof at the eaves can cause **condensation** and **wreak damage** as great as the heaviest gales, but with **no insurance to cover it**.

However, when CAUSE collocates with *acid, bile, secretion, intestinal, dose, reduction* and *gastirc*, the meanings of the occurrences can be negative (23 and 25), as well as neutral (24 and 26). In (23), *acid* and *intestinal* appears neutral, but the neutrality is immediately traded off by the extended context *emissions of pollutants which cause acid rain*. In (24), a process involving inanimate objects is depicted, which is neutral in affective meaning.

(23) The government will ensure power stations meet EC requirements for reduced emissions of pollutants which **cause acid** rain.

(24) Here it is interesting to note that intrajejunal beer stimulated **acid** release without causing gastrin release.

(25) The results of Brunsson's study and the present one indicate that intramural reflex(es) are involved in the fluid secretion caused by **intestinal** inflammation.

(26) There was only a slight but statistically not significant decrease in HCO₃-absorption caused by vasoactive **intestinal** polypeptide.

From the above analysis, we can see that CAUSE is overwhelmingly (86%) negative in applied science.

4.4 The Collocates and Semantic Prosody of CAUSE in Natural & Pure Science

When examining collocates in Table 4, it is found that only 21 out of 50 (42%) significant collocates of CAUSE in natural and pure science are negative: *infection, deformation, paralysis, damage, extinction, mortality, severe, virus, disease, subsidence, swelling, senescence, enteritis, distress, abnormality, distortion, displacement, erosion, pathogenic, syphilis* and *diarrhoea*.

Table 4. The top 50 collocates of CAUSE in natural and pure science

Rank	Collocates	Freq	logDice	Rank	Collocates	Freq	logDice
1	mutation	17	7.849	26	bacterium	8	6.53
2	infection	29	7.601	27	mammalian	5	6.522
3	deformation	10	7.567	28	aggregation	5	6.519
4	paralysis	8	7.27	29	tissue	12	6.497
5	damage	58	7.249	30	gene	15	6.446
6	compaction	7	7.168	31	anti-peptide	4	6.434
7	extinction	9	7.132	32	stimulation	6	6.416
8	mortality	14	6.929	33	mycobacterium	4	6.411
9	DNA	17	6.836	34	curvature	5	6.402
10	severe	21	6.828	35	glaciations	4	6.396
11	heating	12	6.824	36	displacement	5	6.393
12	virus	12	6.823	37	erosion	7	6.375
13	disease	41	6.786	38	bacillus	4	6.353
14	subsidence	6	6.786	39	pathogenic	4	6.342
15	swelling	6	6.781	40	localized	4	6.333
16	organism	11	6.779	41	accumulation	6	6.319
17	senescence	5	6.731	42	rearrangement	4	6.285
18	larva	7	6.723	43	neurone	4	6.28
19	enteritis	5	6.719	44	lithosphere	4	6.267
20	distress	10	6.716	45	orbit	6	6.264
21	abnormality	7	6.694	46	precipitation	4	6.25
22	uplift	6	6.685	47	oscillation	4	6.244
23	distortion	7	6.57	48	syphilis	4	6.224
24	gravitational	6	6.563	49	diarrhoea	5	6.199
25	limb	9	6.559	50	proliferation	5	6.198

Examples with typical negative prosody are shown in (27) to (31):

(27) More serious mental and physical deterioration may follow-Injecting can cause **infection** leading to sores, abscesses, jaundice and blood poisoning.

(28) Most of these are thought to have rifted away from the margins of Gondwana and moved northward before colliding with the southern margin of the Eurasian land mass and causing extensive **deformation** and thrusting.

(29) The argument was not that mutation itself caused **senescence**, but rather that, given some mutation load, the adaptive evolution of modifiers would shift the effects of that load to later life.

(30) In addition, diagnostic delay causes considerable **distress** to families and may result in subsequent bitterness if the child's symptoms are not taken seriously by family or health professionals or if a second affected boy is born.

(31) Furthermore, the mycobacteria detected in Crohn's disease were not identical, suggesting that a single **pathogenic** mycobacterium does not cause the disease.

29 out of the 50 (58%) significant collocates of CAUSE in natural and pure science are neutral: *mutation, compaction, DNA, heating, organism, larva, uplift, gravitational, limb, bacterium, mammalian, aggregation, tissue, gene, anti-peptide, stimulation, mycobacterium, curvature, glaciations, bacillum, localized, accumulation, rearrangement, neurone, lithosphere, orbit, precipitation, oscillation and proliferation.*

Although some collocates are neutral (such as *larva* and *mammalian*), these words only appear in longer co-texts of negative meanings, as shown in (32). When CAUSE collocates with the remaining 27 words, the occurrences can be negative (as in 33, 35 and 37) as well as neutral (as in 34, 36 and 38).

(32) A number of genes have been identified as inducible in **mammalian** cells by agents that cause **DNA damage** and **growth arrest**.

(33) Once a **mutation** that causes an abnormality is observed, it becomes possible to try and identify and isolate the gene.

(34) In fact, genetical analysis of plant "ecotypes" (i.e., populations adapted to a particular habitat, for example growing close to the sea) shows that sometimes rather few gene **mutations** can cause most of the morphological change.

(35) After about four to six weeks, when the temperature has dropped to about 41°C, the heap should be turned, when a further surge of bacterial activity and a second **heating** will take place, causing further breakdown of the vegetable matter.

(36) Fluctuations in temperature experienced by rocks at the Earth's surface due to day-time **heating** and night-time cooling certainly cause them to expand and contract.

(37) Identifying the specific new mutation in a particular **gene** that causes a given inherited disease in a patient.

(38) Natural selection favoured those ancestral caddis **genes** that caused their possessors to build effective houses.

From the above analysis, we can see that CAUSE is mainly neutral in natural and pure science, which can be reaffirmed by the 25 random samples of CAUSE occurrences in natural and pure science.

5. Conclusion

This paper has explored the usage of the verb CAUSE in scientific writing in British National Corpus with SkE. The results show that the occurrences of CAUSE is the highest in social science, less frequent in applied science, and the lowest in natural and pure science. The semantic prosody of this word is overwhelmingly negative in social science (96%) and applied science (86%), the caused entities being either illnesses or symptoms (such as *disease, infection, diarrhea, etc.*), or negative emotions (such as *distress, anxiety, confusion, etc.*), or unpleasant conditions (such as *difficulty, injustice, error, etc.*). However, CAUSE is mainly neutral in natural and pure science (54%), the caused entities being inanimate objects (such as *DNA, bacterium, tissue, etc.*), or processes (such as *mutation, compaction, oscillation, etc.*). It seems that CAUSE lacks its normal negative semantic prosody in contexts that do not refer to human beings, which has echoed the insight of Hunston (2007) in that the presence of a semantic prosody may be dependent on the presence of some other grammatical or semantic feature alongside the node.

This study has a number of pedagogical implications. First, since inappropriate word choice arising from an ignorance of collocation and semantic prosody is very frequent in L2 English learners, the importance of

collocation and semantic prosody should be emphasized in language teaching and learning (cf., also Hoey, 2000). Second, learners should be aware of the fact that collocational behaviour and semantic prosody of the same word can vary across text categories. This observation is relevant to the teaching and learning of EAP in that different disciplines may have more specific usage regarding a certain word like CAUSE. Third, given the huge amount of English vocabulary, it would be unlikely for teachers to teach the collocational behaviour and semantic prosody of all the words to students. It might be more promising to teach students how to use corpora and corpus tools to conduct their own research.

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