Discourse-semantics of risk in the *New York Times*, 1963–2014: a corpus linguistic approach

Jens Zinn
jzinn@unimelb.edu.au

Daniel McDonald
mcdonaldd@unimelb.edu.au

University of Melbourne, Australia

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Summary

In this report, we detail an investigation of risk words in the New York Times between 1963 and mid-2014. The investigation involves the creation of an annotated corpus of over 150,000 risk tokens and their co-text. Purpose-built functions for manipulating this dataset and visualising results were created and used to investigate the corpus according to a systemic-functional conceptualisation of the transitivity system.

Following the corpus interrogation, we use functional linguistics and sociological risk theory in tandem to analyse the findings. First, SFL is used to link lexicogrammatical phenomena to discourse-semantic meaning of the texts. Longitudinal changes in risk language are then mapped to key events, as well as broader social movements.

This report is accompanied by an interactive *IPython Notebook* interface to our corpus and developed computational tools. Key findings from this report are stored there, as well as additional information (e.g. concordance lines, keywords, collocation), that could not be included in this report due to spatial considerations. It is available for both interactive and static viewing at `https://github.com/interrogator/risk`.

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Chapter 1

Introduction

1. Risk and the social sciences

2. New approaches to risk research

3. Corpora

Text corpora—that is, large bodies of digitised, well-structured text—are not unknown to risk researchers.

Since their work, however, enormous strides have been taken in the field of corpus-assisted discourse studies, as well as in computational fields such as natural language processing, which provide means of annotating language with grammatical information, and querying the annotated texts in complex ways.

It is also more and more feasible to build particular corpora for particular investigations, rather than relying on general corpora, comprised of diverse kinds of texts.

4. Functional linguistics

Central to any well-considered study of language use is a theory of language, which may either implicitly or explicitly inform the kinds of analyses being done. A number of frameworks exist for connecting lexis and grammar to functional meanings. Notable within risk research has been frame semantics, which has been used to categorise different risk frames and their constituents (Fillmore & Atkins, 1992). One such framework is *systemic functional linguistics* (see Halliday & Matthiessen, 2004), which conceptualises language as a *sign system* that is employed by users in order to achieve *social functions*. This theory explicitly underlies our investigation.

We use SFL for three main reasons. First, it is the most detailed functional grammar (Eggins & Slade, 2004): when compared with frame semantics, it provides a more rigorous description of how risk can behave *lexicogrammatically*—that is, in relation to both other words and grammatical features—within a clause. This makes it possible to search parsed texts in nuanced ways. Second, it is a functional-semantic theory, rather than a cognitive-semantic one. While the remarkable achievement of frame semantics is its mapping out of cognitive frames, we are largely unable to operationalise these with our dataset, as we have little information regarding the specific interactants (writers and readers) of the original texts. Moreover, cognitive understandings of text are complicated in situations where the text's

author is producing the text within an institutional context, for a readership. Without downplaying the potential importance of cognitivist accounts of risk, we have instead opted here to focus on risk words as *instantiations of parts of the linguistic system for the purposes of meaning-making*, rather than as a *representation of the cognitive schemata that underlie our behaviour*.

The third benefit of SFL is that it provides not only a grammar, but a a conceptualisation of the relationship between text and context. A foundational tenet of SFL, and a point of departure from other linguistic theories, is the notion that we can create a description of context based *solely* on the lexicogrammatical content of the text. This is particularly suitable for us, given that our texts arrived to us abstracted from their original contexts. This context was then further obscured through the parsing process. As such, SFL provides an ability to account for discourse-semantics using corpora that other theories cannot.

5. Outcomes of the study

Our project makes significant contributions to both sociological theory and digital humanities methodology.

5.1. Risk theory

Most obviously, our study presents an empirical study of risk.

5.2. Methodology

Given the novelty of Big Data and Big Data methods, investigations such as ours involve the development of theoretical frameworks for linking instantiated language to discourse-semantics. In our case, this involved a thorough investigation of the lexicogrammar of risk language in news journalism. In this report, we map out strategies for engaging with the systemic functional notion of experiential meaning primarily through complex querying of constituency parses, combined with wordlists that assist with the task of dividing clauses into *process types* (chiefly *relational*, *mental* and *verbal*). In terms of the systemic functional conceptualisation of the Mood system as a resource for making interpersonal meanings, as well as the notion of *arguability*, we demonstrate novel strategies of exploiting dependency parsing provided by the Stanford CoreNLP toolkit. Though existing automated parsing generally cannot provide the level of depth necessary for full systemic annotation of language, the partial account that can be provided still proves sufficient for connecting lexicogrammar to discourse-semantics in a rigorous and systemaic fashion.

As these new methods involve automated analysis via computer programming, our project also contributes to methodology via a repository of code for manipulating large and complex linguistic datasets. This repository, though designed for our particular investigation, is readily reusable by other researchers interested in how language is used as a meaning-making resource. Our methdological work is available open source at `https://github.com/interrogator/risk`. Documentation and code used to build and annotate the NYT corpus is also freely available there.

5.3. Communicating results

Emerging digital tools make it possible to display results of academic research in novel, sophisticated ways. This is crucial in Big Data studies, which may involve so much data that only a tiny fraction

can be qualitatively analysed by individual (or even teams of) researchers. For risk research, the ability to package and share tools for exploring the NYT dataset allows researchers to engage in data-driven studies, which can empirically test the claims of key authors in the field.

For our investigation, we produced an IPython Notebook, through which researchers can easily either cross-check or build upon the kinds of queries we use in our project. This goes well beyond the capacity of traditional written reports, and radically expands the potential for reproducible and transparent humanities research. In this way, our research does not stop with the publication with results: the creation of a stable database and toolkit for analysing this database is a result in and of itself. Our study is thus best considered both an investigation of risk language in the NYT and an addition to the burgeoning research area of Digital Humanities, both in terms of method for investigating data and methods for presenting results.

Chapter 2

A sociological conceptualisation of risk

1. History of risk research

Since the 1980s and 1990s the notion of risk has become increasingly influential in societal discourses and scholarly debate (Skolbekken, 1995).

2. Contemporary theories and methods

From early work on risk and culture (Douglas, 1986, 2013) to the *risk society* thesis (Beck, 1992, 2009; Giddens, 2002), from governmentality theorists working in the tradition of Foucault (Dean, 2010; O'Malley, 2012; Rose, 1999) to modern systems theory (Luhmann, 1989, 1993) all have built their work around the notion of risk and implicitly or explicitly refer to linguistic changes.

3. Lack of data-driven approaches

However, none of these approaches provides a detailed account of linguistic changes in recent history. Although Beck assumes an increase in risk debates after World War Two, he does not support his claims with detailed empirical analysis. Luhmann and Giddens provide anecdotal historical evidence of the shift towards risk, but deliver no detailed account of the linguistic dynamics after World War Two. In contrast, linguists have provided lexicographic descriptions of risk utilising corpus linguistic methods (Hamilton, Adolphs, & Nerlich, 2007) and have sketched out a cognitive-semantic frame for risk within frame semantics theory (e.g. Fillmore & Atkins, 1992). Lacking thus far, however, has been a functional linguistic account of longitudinal changes in the way risk is instantiated in written texts.

4. Lack of longitudinal studies

- Of the few data-driven studies, none has been longitudinal.

5. Risk in the age of Big Data

- The web has made possible the analysis of quantities of data that until recently have been unimaginable. This adds new epistemologies of risk, and the ability to test claims made about risk within sociology.
- Through a chain of operationalisation, we can reduce key claims made by Beck and Giddens into linguistic realisation, and then into search patterns. Though it is important to remember that our investigation is of only one text type (print journalism), given the vast size of our dataset, it is sensible to assume that any changes in the behaviour of risk language could be located within our corpus.
- Methods for building and interrogating Big Datasets are only emerging. In an even greater stage of infancy are methods for interpreting the results of Big Data interrogations, especially within the traditions of the humanities and social sciences.

Chapter 3

Case study: the New York Times, 1963–2014

Our investigation centred on digitised texts from *New York Times* editions in 1963 and between 1987–2014. These texts (defined here as individual, complete chunks of content) are predominantly news articles, but depending on archiving practices, also included in our corpus is text-based advertising, box scores, lists, classifieds, letters to the editor, and so on. More specifically, we were interested in any containing at least one 'risk word'—any lexical item whose root is risk (*risking*, *risky*, *riskers*, etc.) or any adjective or adverb containing this root (e.g. *at-risk*, *risk-laden*, *no-risk*).[1]

We relied on two sources for our data. The *New York Times Annotated Corpus* (Sandhaus, 2008) was used as the source for all articles published between 1987–2006. ProQuest was used to search for and download articles containing a risk word from 2007–2014, alongside some metadata, in HTML format. We also created a subcorpus of articles from NYT 1963 editions through optimal character recognition (OCR) of PDF documents archived by ProQuest as containing a risk word in either metadata (i.e. title, lede) or content. Due to the time-intensive nature of manual correction of OCR, a random sample of one-third (1218 texts) was selected, with paragraphs of texts containing a risk word being manually corrected by hand.

Article text and any available metadata were extracted from this unstructured source content using *Python*'s *Beautiful Soup* library and added to uniquely named text files in annual subfolders. The kinds of metadata available varied according to the data source: The *New York Times Annotated Corpus* provides a number of potentially valuable metadata fields, such as author, newspaper section, and subject (manually added by trained archivists). We then value-added to this partially annotated corpus in three main ways. First, keywords and clusters for each article were calculated using *Spindle* (see Puerto, 2012) and added as metadata fields. Second, *MALLET* (see McCallum, 2002), a topic modelling tool, used LDA to algorithmically assign 'topics' to each article. The topics and their strengths were added as a metadata field. Finally, we used the *Stanford CoreNLP suite* (see Manning et al., 2014) to parse each risk token and its co-text for grammatical structure and dependencies.[2]

A key strength of the methodology is that subcorpora based on article or metadata attributes can can be easily created and compared. Our interest was in creating a small set of topic-specific corpora in order to look for changes in risk word behaviour within specific fields of discourse. As a case study, we decided to focus on three broadly defined topics: *economy*, *health* and *politics*. Librarian-added metadata concerning article topic/category (MC metadata field) was used to locate all articles tagged

Tag	Content
MA	Author(s)
MC	Librarian-added category tags
MD	Date of publication
MI	Unique identifier
MK	MALLET topic
MM	Manually annotated topic
MP	Section of newspaper
MS	Risk concordance line
MT	Article title
MU	URL for article
MZ	Annotator comment(s)

Table 3.1: Metadata tags and content

```
<MY>92 0.14 71 0.12</M>
<MV>13 0.26 96 0.21</M>
<MG>11 0.29 3 0.20</M>
<MO>28 0.33 21 0.24</M>
<MS>One family has lost a child and others may be at risk from a deadly brain
    inflammation, officials warned yesterday</M>
<MJ>center: 45.444118, officials: 28.536198</M>
<MT>New Jersey Daily Briefing;Meningitis Warning Issued</M>
<MC>MENINGITIS</M>
<MU>http://query.nytimes.com/gst/fullpage.html?res=9B06EFDA1239F933A05751C1A963958260</M
    >
<MF>0819209.xml</M>
<MA>KELLER, SUSAN JO</M>
<MD>1995-12-30</M>
One family has lost a child and others may be at risk from a deadly brain inflammation,
    officials warned yesterday. Bacterial meningitis recently killed a baby who attended
     the Center day-care program, officials say. They are urging parents and staff at
    the Center to contact their doctors or a hospital emergency room.
```

Figure 3.1: Example file: NYT-1995-12-30-10.txt

case-insensitive regular expressions `\beconom.*`, `\bhealth.*` or `\bpolitic.*`.[3]

We used some of the metadata fields to identify and remove listings (of best-selling books, plays, TV guides, etc.). Reasons for this were threefold. First, the jargon, abbreviations and non-clausal nature of listing language was not handled well by the parser. Second, list content was often repeated verbatim in multiple files, potentially skewing counts. Third, our two data sources archived listings in different ways. Listings were located by querying metadata fields in a number of ways. Files with titles such as *Spare Times*, *Best Sellers*, articles with keywords such as 'theater', 'listing', or days of the week. If a file contained only a listing, the file was removed. If a risk word appeared only within the list portion of an article, the file was deleted. If a file contained both a body and listing, only the listing was removed.

After all data processing, we had a 150 million word corpus of nearly 150,000 articles containing a risk word published in the NYT or `NYT.com` in 1963, and between 1987 and mid 2014. The corpus had 29 annual subcorpora. The three subcorpora of economics, health and politics articles contained a subset of these articles. A breakdown of the size and composition of each annual subcorpus is provided in Table 3.2. Where necessary, frequency counts in the 1963 subcorpus were multiplied by four, to account for the smaller sample size. Frequency counts for 2014 were multiplied by 1.37 to fill in the uncaptured period between August 18–December 31.

Annual subcorpora	**Subcorpus**	**Words**	**Articles**	**Risk words**
	1963	83,188*	1218	1,584
	1987	4,885,883	4,878	7,690
	1988	4,834,791	4,703	7,430
	1989	5,059,517	4,997	7,810
	1990	5,416,187	5,250	8,244
	1991	4,748,975	4,774	7,493
	1992	4,923,509	4,818	7,329
	1993	4,686,181	4,615	7,330
	1994	4,857,729	4,762	7,384
	1995	5,130,206	5,150	7,834
	1996	4,969,911	4,773	7,257
	1997	5,121,088	4,759	7,318
	1998	6,085,810	5,437	8,351
	1999	6,053,731	5,392	8,248
	2000	6,472,727	5,717	8,434
	2001	6,603,456	5,902	8,722
	2002	6,865,631	6,423	10,288
	2003	6,795,591	6,481	10,066
	2004	6,776,200	6,215	9,989
	2005	6,722,240	6,191	10,031
	2006	6,722,592	6,278	9,965
	2007	4,757,290**	5,110	8,976
	2008	5,300,254	5,384	9,645
	2009	4,926,381	5,189	9,236
	2010	5,443,658	5,527	9,560
	2011	5,617,002	5,773	10,055
	2012	5,366,342	5,302	9,095
	2013	5,271,006	5,176	9,083
	2014	3,331,580	3,310	5,635
	Total	**153,828,656**	**149,504**	**240,082**
Topic subcorpora	**Subcorpus**	**Words**	**Articles**	**Risk words**
	Economics	10,489,137	8,286	32,448
	Health	8,524,023	6,944	36,547
	Politics	9,465,115	7,428	20,904
	Total	**28,478,275**	**22,658**	**89,899**

Table 3.2: Subcorpora, their wordcount, file count and number of risk words

* Only a small window of co-text—usually two sentences either side of the risk word—was preserved in this subcorpus, hence the smaller size of this sample.
* The drop in word-count here coincides with the switch from NYT Annotated Corpus to ProQuest as the datasource.

1. Tools and interface used for corpus interrogation

Special tools needed to be developed to work with the very large dataset of both raw NYT articles and parsed paragraphs containing a risk word. Given a well-established history of use within humanities and social sciences, as well as a particular strength in working with linguistic data, we developed a Python-based toolkit for querying our data and visualising query results. Our purpose-built toolkit provided the ability to quickly search each subcorpus of our data and generate useful visualisations of results. Though many parts of the toolkit were designed with more general Digital Humanities projects in mind, certain components of the toolkit were designed exclusively to aid in our particular investigation (projection of counts from 1963 and 2014; automatically stripping names and titles from U.S. politician names, etc.). The specific functions and their purpose are outlined in Table 3.3, with a simple example of a function shown in Figure 3.2. More detailed explanations and demonstrations are provided at `http://nbviewer.ipython.org/github/interrogator/risk/blob/master/risk.ipynb`; the repository of code itself is available via *GitHub* (`https://github.com/interrogator/risk`), where it can freely be downloaded, or duplicated and modified.

Function name	**Purpose**
`interrogator()`	interrogate parsed corpora
`dependencies()`	interrogate parsed corpora for dependency info (presented later)
`plotter()`	visualise `interrogator()` results
`table()`	return `plotter()` results as table
`quickview()`	view `interrogator()` results
`tally()`	get total frequencies for `interrogator()` results
`surgeon()`	edit `interrogator()` results
`merger()`	merge `interrogator()` results
`conc()`	complex concordancing of subcorpora
`keywords()`	get keywords and ngrams from `conc()` output
`collocates()`	get collocates from `conc()` output
`quicktree()`	visually represent a parse tree
`searchtree()`	search a parse tree with a Tregex query

Table 3.3: Python functions developed for our investigation

Finally, we developed an IPython Notebook based interface for using these functions to investigate the NYT corpus (also available cia our GitHub URL above). This served not only as our main platform for interrogating the dataset, but also as a means of dynamically disseminating results without being limited by considerations of space. In being open-source, and in explicitly showing the exact queries used to generate findings, the Notebook ensures both reproducibility and transparency of the entirety of our investigation. At the same time, it provides a framework for sophisticated corpus-assisted discourse analysis using cutting-edge digital research tools. Researchers are encouraged to run the Notebook in conjunction with this report, so that they can generate and manipulate our key findings as they see fit.

```
def collocates(data, nbest = 30, window = 5):
    """Feed this a csv file generated with conc() and get collocations"""
    import nltk
    from nltk import collocations
    from nltk.collocations import BigramCollocationFinder
    import re
    f = open(data)
    raw = f.read()
    bad, good = re.compile(r'Entire sentences \(n=[0-9]+\):').split(raw)
    good = unicode(good.lower(), 'utf-8', errors = 'ignore')
    sent_tokenizer=nltk.data.load('tokenizers/punkt/english.pickle')
    sents = sent_tokenizer.tokenize(good)
    tokenized_sents = [nltk.word_tokenize(i) for i in sents]
    allwords = []
    # for each sentence,
    for sent in tokenized_sents:
    # for each word,
        for word in sent:
        # make a list of all words
            allwords.append(word)
    bigram_measures = nltk.collocations.BigramAssocMeasures()
    finder = BigramCollocationFinder.from_words(allwords, window_size=window)
    ignored_words = nltk.corpus.stopwords.words('english')
    # anything containing letter or number
    regex = r'[A-Za-z0-9]'
    # the n't token
    nonot = r'n\'t'
    # lots of conditions!
    finder.apply_word_filter(lambda w: len(w) < 2 or w.lower() in \
        ignored_words or not re.match(regex, w) or re.match(nonot, w))
    finder.apply_freq_filter(2)
    results = sorted(finder.nbest(bigram_measures.raw_freq, nbest))
    listversion = []
    for index, thecollocation in enumerate(results):
        aslist = [index, thecollocation[0], thecollocation[1]]
        listversion.append(aslist)
    return listversion
```

Figure 3.2: Python code to find collocates in concordance results

Chapter 4

Methodology

The challenge of making sense of enormous datasets is a formidable one, both at the practical level (the creation of scripts and search patterns, the transformation of search results into findings, etc), and at the more theoretical level of Big Data as both dataset and approach. *Big Data* approaches to social sciences and humanities research should be operationalised critically, with an acknowledgement that data size alone does not produce findings of higher truth or objectivity: automatic processing tools such as topic modellers and parsers do not provide perfect results, and their failures may often be buried within such large amounts of data.[4] Moreover, as boyd and Crawford (2012) note, even the imagination of phenomena as data itself constitutes an act of interpretation. There is also the potential for researchers to cherry-pick interesting or extreme examples from the set, rather than look for common patterns (Mautner, 2005). Finally, researchers must remain sensitive to the fact that the phenomenon under investigation (in this case, risk lexis) has been abstracted from its original multimodal context (as a component on a page in a daily paper).

To cope with these concerns in the context of natural language Big Data, we drew upon systemic functional linguistics (SFL) as a theory of language. SFL informed our study in two main respects: first, we relied on its conceptualisation of the stratal relationship between instantiated wordings in texts, their discourse-semantic functions, and the context they both respond to and construct; second, the systemic functional grammar (SFG) guided our attempt to locate specific sites of lexicogrammatical change in clauses containing one or more risk words.

1. A systemic-functional conceptualisation of language

SFL, as developed by Michael Halliday (see Halliday & Matthiessen, 2004) treats language as sign-system from which users select meanings for the purpose of achieving meaningful social functions. Inspired by the anthropological work of Malinowski, SFL divides the social functions of language into three realms of meaning: **interpersonal meanings**, which construct and negotiate role-relationships between speakers; **experiential meanings**, which communicate doings and happenings in the world; and **textual meanings**, which reflexively organise language into coherent, meaningful sequences.

One of the more radical dimensions of SFL is its inversion of the common discourse-analytic aim of analysing *texts in context*: in SFL, context is treated as being *contained within* instantiated texts—'context is in text' (Eggins, 2004). Based on the distribution of certain lexicogrammatical phenomena, we can accurately determine the overall genre/purpose of a text, even in highly decontextualised scenarios:

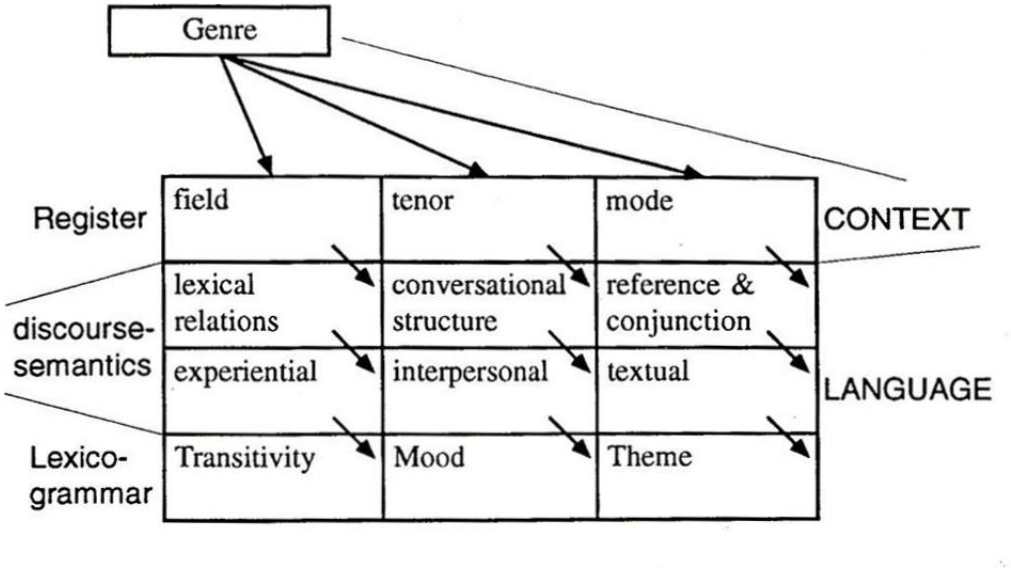


Figure 4.1: Strata and metafunctions of language (from Eggins, 2004)

'*Submissions must contain 3–5 references*' can be quickly identified as part of a set of instructions for an undergraduate assignment, based purely on its lexical (submissions, references) and grammatical (nominalisation, modalisation, etc.) properties. In the same way, Halliday conceptualises lexicogrammatical features of texts as probablistically determined by their context. That is to say, a given constellation of interpersonal, experiential and textual variables (e.g. the writing of a professor to undergraduates in a written course overview) will likely contain the kinds of lexicogrammatical features described in the example above (Halliday, 1991).

In SFL and its expansions (e.g. Martin, 1984; Christie & Martin, 2005), culturally recognised constellations of these three variables are treated as *genres*, within which other micro-genres may also be contained. In our case, the vast majority of texts under consideration are within the genre of newspaper article, with micro-genres such as sports-journalism, editorials, opinion articles and so on being differentiated by the appearance of different lexicogrammatical choices within both mood (i.e. use of interrogative mood, modalisation to connote subjectivity/objectivity) and transitivity systems (what is being spoken about).[5]

Three key factors informed our decision to adopt the SFL framework for our study. First, in contrast to most mainstream grammars, SFL conceptualises lexis and grammar as a different ends of the same system: lexis is the most delicate realisation of grammar (see Hasan, 1987). Such a conceptualisation, we believe, is vital to an investigation of the behaviour of a concept in a large text corpus, as much of this behaviour will indeed be grammatical. Accordingly, in this study, automated parsing of corpus texts is used to carry out (often simultaneous) searches of both grammar and lexis.

The second benefit of SFL to our research aims is that SFL is explicitly designed as a framework that to make it possible to say meaningful things about how real-world instances of language work to build meanings and perform social functions. It is thus an *appliable linguistics*, built to 'empower researchers to undertake projects of investigation and intervention in many contexts that are critical to the workings of communities and the quality of human life' (Matthiessen, 2013, p. 437).

Finally, SFL contains the best-articulated means of systematically connecting instantiated lexico-

grammatical units (i.e. wordings) to the more abstract stratum of discourse-semantics (i.e. meanings) (Eggins & Slade, 2004). On the strength of this link is the whole endeavour of corpus-discourse research predicated: absent a systematic connection of these two planes of abstraction, corpus-assisted discourse studies lose much of their explanatory power, and corpus-informed discourse research becomes a contradiction in terms.

2. Risk words and the systemic functional grammar

Perhaps the most laudable achievement of SFL is the ability of its grammar (admitted even by critics, e.g. Widdowson, 2008) to connect the three kinds of meanings to distinct components of lexicogrammar in consistent, stable ways. Interpersonal meanings are made through the **mood system**, including features such as *modality* and *modulation*. Textual meanings are made through the use of **systems of reference and conjunction** between and within clauses. Experiential meanings are made via the **transitivity system** (predicators, their subjects and object arguments, and adjuncts, in more mainstream grammars). This latter system is of most interest to us.[6] In SFL, transitivity analysis of a clause involves breaking it down into its *process*, *participants* and *circumstances*, realised by verbal groups, nominal groups and adverbials/prepositional phrases, respectively. Most central is the process, whose head (the rightmost verb in a verbal group), may be grouped into five types: **material processes** (doing and happening: *Risk declined*), **mental processes** (thinking: *She thought it risky*), **verbal processes** (saying: *We talked about the risks*), **existential processes** (*There are risks*) and **relational processes** (being and having: *It seemed risk-free*). Each type has different configurations of possible participants: mental processes have *Senser* and *Phenomenon* (the sensed); material processes generally have an *Actor*, in subject position, with optional participants such as *Goal*, *Range* and *Beneficiary*. Circumstances (e.g. '*this week*' in Figure 4.2) provide specifications such as the manner, extent or location of the process. Circumstances are more syntactically flexible, in that they are often able to be placed in a number of positions within the clause.

But	*the bang of the gavel*	*can hold*	*risk*	*for novices*
	Participant: Carrier	Process: Relational attributive	Participant: Attribute	Circumstance: Extent

Figure 4.2: Transitivity analysis of a clause

An important caveat remains. SFL considers each kind of meaning as having a *congruent* realisation in the lexicogrammar—participants are congruently nominal; qualities as congruently adjectival. Aside from simply using native speaker intuition tests, SFL theorists argue that congruent forms often can be identified by their *typicality* and their *unmarkedness*: congruent realisations are expected to be more frequent in the language as a whole, and to involve fewer derivational morphemes (*nation* as a thing is less inflected than the quality, *national*) (Lassen, 2003). That said, as Halliday and Matthiessen (2004, p. ?) explain, 'it is by no means easy to decide what are metaphorical and what are congruent forms'. *Risk* is in itself a good example of a concept that straddles the terrain between participant, process and quality.

Incongruent choices, however, are also common in many kinds of texts, carrying a 'very considerable semantic load' (Halliday & Matthiessen, 2004, p. ?). First, through *grammatical metaphor*, semantic processes may be realised grammatically as participants ('I accepted *the invitation*') for the purpose of

Clause complex
Clause
Group/phrase
Word
Morpheme

Table 4.1: Rank Scale in SFL

packing more information into clauses—a key feature of written journalistic text (Simon-Vandenbergen, Ravelli, & Taverniers, 2003). Furthermore, similar meanings may be made at different ranks/strata of language: 'a good risk' and 'a risk is good' communicate the same positive appraisal of the same participant, but at different levels (group/phrase level via adjectival modification in the first example; clause level via relational ascription in the second). Incongruence poses serious challenges for corpus linguistic studies of discourse, as it limits our ability to locate, for example, all the ways in which risk is evaluated, graded or judged. This issue is exacerbated if, in line with SFL theory, we consider all lexicogrammatical choices to be meaningful and purposive, including the author's decision to invoke an incongruent form (as in Eggins, 2004). In some cases, rank-shifted meanings may be found using increasingly complicated lexicogrammatical search queries (see Figure 4.5 for an example). Automatic location of some other cases remain at this point beyond our capabilities: in appraisal at the level of clause-complex ('*I see a risk—it's a big one*') extremely complex grammatical searches would be needed to first recover the identity of *it* and *one* as *a risk*, before we could automatically determine that the risk is being semantically modified by *big*. Accordingly, our analysis is limited to group/phrase and clausal levels, with meanings made via the clause complex excluded.

2.1. Risk and the experiential metafunction

We situate our analysis of risk words predominantly within the experiential realm of meaning. At the most abstracted level of this dimension of language, we are interested in changes in the field of discourse in which risk as a concept is instantiated: *has risk shifted, as per key claims of sociological theory, from international relations toward population health?* Then, within these fields, we are interested in the constellations of happenings in which risk may play a role: *when risk is a process, what participants are involved? When risk is a participant, what is it a participant in, and with whom? And when risk is part of a modifier, what kind of participants and processes does it modify, and how?* Through categorisation of the kinds of fields in which risk appears, as well as the kind of participants who are positioned as riskers, risked things and potential harms, we can then empirically test the claims of influential sociological examination of risk discourse (See Table **??**).

Either this needs to be expanded, or the mood description contracted...

2.2. Risk and the interpersonal function: arguability

Though our analysis is for the most part concerned with experiential meanings (via the Transitivity system), some aspects of interpersonal meanings (via the Mood system) are also relevant. Accordingly, a brief sketch of the mood system is required.

In SFL, the Mood system is used to give and request information (semiotic commodities) or goods and services (material commodities). Congruently, interrogatives request information, and imperatives

request goods and services. Declaratives provide information. Being by far the most common mood type in news discourse, our analysis is focussed on the structure of the declarative. A declarative clause contains a Mood Block, which contains a Subject and Finite (see Figure 4.3). Locating the constituents of the Mood Block is simple: if a tag question is added to this declarative (*the bang ... can hold risks ..., can't it?*), the tag picks up the Subject and the Finite (with polarity reversed).

Modality, also a component of the interpersonal metafunction, concerns modification of propositions with speaker judgements.[7] Prototypically, Modality is expressed through modal auxiliaries in the Finite position (*I can/should/might go*). Through Modality, speakers 'construe the region of uncertainty between yes and no' (Halliday & Matthiessen, 2004, p. 147). In Figure 4.3, for example, *hold* is modalised through *can* in order to express the author's judgement as to the possibility of the banging of the gavel holding risks.

But	*the bang of the gavel*	*can*	*hold*	*risk*	*for novices*
	Subject	Finite	Predicator	Complement	Adjunct
	MOOD		RESIDUE		

Figure 4.3: Mood analysis of a clause

At a greater level of abstraction, these Mood and Modality choices are responsible for the construction of role relationships between interactants: where interactants are of equal status (i.e. friends chatting at a cafe), similar overall frequencies in mood choices for each interactant may be observed. In a situation with interactants of less equal status, mood choice frequencies may vary more widely for the different participants: in a typical interaction between a professor and an undergraduate, only the professor is likely to use imperatives to issue commands. Importantly, as with experiential meanings, incongruence may occur, though the motivation for incongruence is an interpersonal one, such as politeness or face saving (*Shut the door!/Could you shut the door?*). For us, however, this kind of incongruence does not pose the same level of challenge as experiential incongruence, as print news journalism as a genre rarely commands or requests information from the reader, and as the faces of both writer and reader are rarely under threat.

We are interested in Mood mostly because Mood is the system through which *arguability* of propositions is mediated. In SFL, arguability is used to denote the relative ease of challenging or refuting a proposition, and thus, the level of implicitness of a meaning made about the world.

Chiefly, arguability rests in the two components in the Mood Block—the Finite and the Subject. To make a proposition arguable, it must be grounded in time and space, or to a speaker judgement of its validity. These are the two potential functions of the Finite. Locating a proposition within time and space is done through adding primary tense (*lives were risked*). Meanings are linked to speaker judgements through modality (*lives might be risked*) (Halliday & Matthiessen, 2004, p. 116). In either case, the Finite grounds the proposition with reference to the current exchange being undertaken by the interactants. Primary tense situates a proposition according to what is present at the time the utterance is made—it indicates 'the time relative to now' (Halliday & Matthiessen, 2004, p. 116). Modality either expresses an assessment of the validity (probability, certainty, obligation, etc.) of a proposition (*it might/will/-must happen*) or, in an interrogative, invites the addressee to make this assessment (*might/will/must it happen?*).

The Subject is the second component of arguability. Semantically, SFL treats the Subject as 'something by reference to which the proposition can be affirmed or denied' (Halliday & Matthiessen, 2004,

Role	Arguability	Example
Subject	Very high	*For Mobic, the **risks** of heart attack and stroke rose 37 percent, Dr. Graham's study showed.*
Finite/ Predicator	High	*But candid talk about job prospects and debt obligations **risked** the wrath of management, she said.*
Complement	Medium	*This approach holds some **risk** for a union boss.*
Adjunct	Low	*The wire is stretched very tautly, and we are at some significant **risk** it will snap from overload.*

Table 4.2: Arguability of risk words in differing mood constituents

Role	Arguability	Example
Head	Higher	'*So far, pregnancy **risk** does seem to come with this class of drugs*,' Ms. Glynn said.
Non-head	Lower	*They purchased billions of dollars in **risky** subprime mortgages.*

Table 4.3: Arguability of risk words as either head or non-head

p. 117). In the contexts of proposals and commands, it is the one who is supposed to perform the action (*Shut the door, will you?/I'll speak to her, shall I?*). In the case of declarative information provision, the Subject is the thing upon propositional validity rests. In *the bang of the gavel can hold risk for novices*, for example, a refutation still requires a coherent Subject and Finite, while the Residue is only required if it is the challenged component:

1. No, *it should* hold risks (refuting Modal Finite/speaker judgement)
2. No, but *a handshake can* (refuting Subject)
3. No, but *it can* hold excitement (refuting Complement)
4. No, but *it can* for experts (refuting Complement)

Thus, the Mood Block is the most arguable part of a proposition—'it carries the burden of the clause as an interactive event' (Halliday & Matthiessen, 2004, p. 118). The steps an interlocutor needs to take to deny the validity of a meaning are fewest when the disagreement concerns the composition of the Mood Block. Meanings made within Complements and Adjuncts, or within groups or phrases, are more implicit: they support, rather than enact, meanings made within the Mood Block (Matthiessen, 2002).

In the context of risk words, this conceptualisation of arguability can be used to empirically examine key sociological claims. Increasing prevalence of risk words generally would mean that risk words have an inbound trajectory in the NYT generally. Increasing risk words within the Mood Block and Predicator positions would indicate that risk is discussed and argued about. A shift from Mood Block to Residue (especially Complement and Adjunct positions) would indicate greater implicitness and inarguability of risk. At the same time, risk words as heads of groups/phrases would indicate greater discussion of risk, while risk words as modifiers would indicate implicitness.

The ways in which we operationalise the notion of arguability while interrogating the parsed data are outlined in Section 10.

3. SFL and corpus linguistics

Methodologically, our study may be characterised as an attempt to combine the systemic functional conceptualisation of language with practices from diachronic corpus linguistic (CL) research. As Hunston (2013) notes, SFL and CL share a number of underlying similarities, such as an emphasis on natural

language a focus on register/genre as shaping the lexicogrammatical choices made in texts. More fundamentally, both CL and SFL posit that we can learn about these texts through quantification of their various lexical, grammatical and semantic properties.

We use SFL and CL in tandem to locate patterns in texts without manual interpretation or categorisation. Sociological insights into key events and movements are then mapped at later stages to observed lexicogrammatical and discourse-semantic change in the behaviour of risk words (challenges in balancing the systemic-functional notion of context-in-text with the use of sociological methods are discussed below). Such an approach is characteristic of the emerging field of *corpus-assisted discourse studies* (CADS). The oft-noted 'methodological synergy' of CL and discourse analysis allows researchers a greater degree of empirical and quantitative support for claims, as well as a larger body of examples that can easily be accessed and qualitatively analysed (Baker et al., 2008). In terms of risk, corpus-based methods allow an empirical testing of sociological literature that has tended to invent examples of clauses containing risk words, despite there being little evidence that these phrases are commonly instantiated in general language use (Hamilton et al., 2007). Research has also tended to conflate risk words with the concept of risk itself, even though the word may not be critical to the experiential meaning of a clause (the *risk management team went for coffee*) and even though the latter is often present without the linguistic instantiation of the former.

Work within CADS varies chiefly in the extent to which the corpus itself is the focus of the investigation. In *corpus-driven* work, researchers are attempting to demonstrate that the corpus itself contains particular patterns of discourse. Theories are developed inductively according to patterns located in the data. *Corpus-informed* studies, on the other hand, may use the corpus as a body of examples that can be drawn upon in discussion of broader trends in society (Baker et al., 2008). Theories to be tested are developed before the corpus interrogation

Our study is in the latter domain.[8] As a diachronic investigation, we can further situate our method within *Modern Diachronic CADS*. As Partington explains,

> [MD-CADS] employs relatively large corpora of a parallel structure and content from different moments of contemporary time ... in order to track changes in modern language usage but also social, cultural and political changes as reflected in language (2010, p. 83).

As newspapers are well-structured and archived in digital collections, they have formed a common data-source for CADS. Johnson and Suhr (2003) investigated shifts in the discursive construction of *political correctness* in German newspapers. Duguid (2010) performed thematic categorisation of the keywords from two collections of digitised newspapers from 1995 and 2005. Freake and Mary (2012) focussed on the ideological positioning of French and English in Canadian newspapers.

Ours is not the first corpus-based study of risk. Most well-known is Fillmore and Atkins (1992), who studied the behaviour of risk as both noun and verb in a 25 million word corpus of American English. Ultimately, the authors' aims were lexicographic, rather than discourse-analytic, limiting the usefulness of the study's methods for our purposes. A second key point of difference is the small size and lack of structure of their corpus (though their research was a certainly remarkable and groundbreaking effort at the time of publication). Finally, their study was neither longitudinal, nor designed to connect patterns to social/societal change.

More recently, Hamilton et al. (2007) used a frame semantics approach to understand the behaviour of risk in two corpora: the 56 million word *Collins WordbanksOnline Corpus* (N risk tokens) and the five million word *CANCODE* (235 risk tokens). We depart from their methods in five respects. First, they use general corpora, while we used a specialised corpus. Second, our study is diachronic, while theirs is largely

monochronic. Third, we differ dramatically in the number of risk words analysed (n/n). Fourth, they relied on collocation (without lemmatisation[9]), while we performed specific queries of the lexicogrammar, using lemmatisation where needed. Sixth, they used frame semantics, while we use SFL (though informed by Filmore and Atkins' (1992) articulation of the components of the risk frame, as in Figure 4.4). Though these theories have a number of underlying similarities (both are semantically oriented grammars, for example), the two diverge in their treatment of the role of cognition and psychology. While frame semantics argues that lexicogrammatical instantiations are mapped by listeners to preexisting cognitive frames or schemata, SFL is largely silent on the subject of cognition, preferring to map lexicogrammar to external variables of field, tenor and mode.

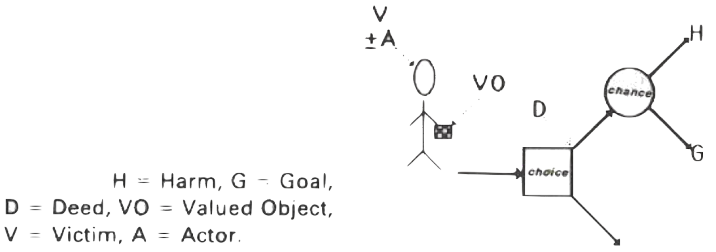


Figure 4.4: Risk frame (from Fillmore & Atkins, 1992)

Notably, our methodology also departs from typical methods of (MD-)CADS in a few key respects. First, CADS is often lexically-oriented, with techniques such as **keywording** used as a means of disinterring the 'aboutness of a text' (Baker, 2004) and **clustering** and **collocation** used to look for the co-occurrence of lexical items absent any consideration of grammar. Hunston (2013) contends that despite a number of areas of overlap, SFL and CL are at odds in the sense that SFL is grammatically oriented while CL is lexically oriented. Though the majority of CADS does indeed focus on lexis, this preoccupation stems more from the relative simplicity of searching for tokens in corpora, compared to grammatical features, than it does from any theoretical motivation.[10] Accordingly, our use of grammatically parsed data and equal consideration of lexical and grammatical features, though in line with SFL, is against the grain of much contemporary CADS literature.

The second key difference from mainstream CADS is that we did not rely on typical practices such as keywording, clustering, collocation and the use of stopword lists. Our reasons for avoiding these practices are varied. Keywording we found to be problematic due to its reliance on a reference corpus of general language. The usefulness of this reference corpus is predicated on the idea of corpus balance—that is, the notion that a corpus of texts, if comprised of a wide variety of genres, and if the relative proportion of these texts is akin to their prevalence in culture, may be taken to be representative of language generally (Chen, Huang, Chang, & Hsu, 1996). As corpus balance is well-acknowledged by CADS practitioners to be only a theoretical ideal (Gries, 2009), we took a different approach. Rather than keywording, we simply counted the base forms of the most common heads of participants, processes and circumstances in each subcorpus. This also liberated us from the arbitrary nature of stopword lists (lists of very common words that are automatically excluded from search results), as most stopwords are determiners, prepositions, conjunctions and so on, which rarely occupy key experiential roles.

Clustering and collocation, though mainstays of CADS, are also absent in our analysis, as they consider only the co-occurrence of lexical items within a specified (and arbitrary) number of words, and accordingly do not take grammatical relationships into account. As an example, *Men are from Mars,*

`__ >># (/(NP|VP|PP)/ > (VP <<# process.relational $ (@NP <<# /(?i)\brisk.?/)))`	In relational processes in which a risk word is the Token/Carrier, what is the head of the Value/Attribute?

Figure 4.5: *Tregex*-based search query and gloss

and women are from Venus would contribute to an understanding of *Mars* and *women* as collocates, regardless of the fact that the experiential meaning of the clause has the opposite meaning. We instead created nuanced search queries capable of drawing on lemma lists and lists of process types (as in Figure 4.5). This luxury was afforded by grammatical (phrase structure and dependency) annotation of the corpus, as well as the development of scripts for quickly searching lexicogrammar.

4. Discourse-semantic areas of interest

Our interest is ultimately in discourse-semantic experiential and interpersonal meanings of risk words. The first point of interest is simply the relative frequency of risk words in the NYT generally, and by word class. These areas of interest are at the clausal level. Within experiential meaning, we are interested the relative frequency of risk as a Participant and as a Process, as well as the behaviour of risk when occupying these roles. At the same time, we are interested in meanings made below clause level, within groups and phrases. When risk is a participant or process, we are interested in the ways it is modified. Furthermore, risk itself can be a modifier of participants and processes. Accordingly, we are also interested in both understanding the ways in which this modification happen and finding the participants and processes that risk commonly modifies. Finally, within the interpersonal realm of meaning, we are interested in the arguability of risk words—that is, the extent to which their meaning is symbolically available to negotiation by the writer/reader.

We can summarise our discourse-semantic interests with the following 10 questions. *In terms of longitudinal change in the NYT,*

1. *How frequently do risk words appear?*
2. *Which experiential roles do risk words occupy?*
3. *Is risk more commonly in the position of experiential subject or experiential object?*
4. *What processes are involved when risk is a participant?*
5. *How are participant risks modified?*
6. *What kinds of risk processes are there, and what are their relative frequencies?*
7. *When risk is a process, what participants are involved?*
8. *When risk is a modifier, what are the most common forms?*
9. *When risk is a modifier, what is being modified?*
10. *How arguable is risk?*

These questions are answered in this order in the Findings section. In the Discussion, these answers are synergised in order to perform a broader analysis of discouse-semantic change.

5. Lexicogrammatical realisations of discourse-semantic meanings

Discourse-semantic meanings are realised in texts by lexicogrammatical patterns. **Risk as participant** is congruently realised by a risk word at the head of a noun phrase that is an argument of a main verb. Other possible realisations of risk participants are adjectival risk words in participant positions (*The job is risky*) or risk words within prepositional phrases (*Votes were at risk*). SFL also treats prepositional phrases as partially realised relational processes, containing only object arguments. As this is perhaps a controversial analysis within linguistic theory generally, the treatment of risk within PPs is separated from risk as arguments of verbal groups. **Risk as a process** is congruently realised by a risk word as the main verb of a clause. When risk is instantiated here, we can extract the participants involved in the process. **Risk as a modifier** is realised by different word classes, depending on what is being modified. Risk can modify participants through pre-head or post-head modification. Analysed in this study[11] are adjectival pre-head modification (*a risky move*), nominal pre-head modification (*risk management*) and post-head modification via a prepositional phrase (*the electorate at risk*). **Arguability of risk words** can be determined by looking for the functional role of risk words within the Mood system: risk as Subject or Predicator is more arguable than risk as Complement and Adjunct.

The scope of our project necessitated some constraints on the kinds of patterns we analysed. Major constraints included our focussing on experiential meaning, perhaps at the expense of interpersonal meaning. Thus, the analysis contains little consideration of how risk may be operationalised in order to construct writer/reader or newspaper/readership relationships. Also largely unanalysed are the ways in which risk are appraised, judged, and graded in severity. This was mostly due to the lack of available automatic parsers for SFL's appraisal grammar (see Martin & White, 2005). Finally, queries returning less salient or ambiguous results are omitted from discussion here. Counting the kinds of determiners that occur before a nominal risk (this risk, a risk, the risk) uncovered no particularly interesting patterns, for example.

Chapter 5

Findings

Findings are organised according to the formulation of areas of interest as questions. These questions progress from general frequency counting (Q1), through experiential meanings (Qs 2–7), to risk as modifier (Qs 8 & 9) and finally to arguability (Q10). Discussion of the general significance of individual findings is also presented in this section, as the Discussion section synergises all findings to explain the discourse-semantics of risk.

An *IPython Notebook* interface for navigating the corpus (see McKinney, 2012), as well as the code used to interrogate it and the findings we produced, is available online: `https://github.com/interrogator/risk`. A non-interactive version is available at `http://nbviewer.ipython.org/github/interrogator/risk/blob/master/risk.ipynb`. This Notebook does not suffer from spatial limitations, and thus contains additional information, including the exact Tregex queries used in interrogations, as well as complete lists of the concordance lines discussed only briefly here. Tools and results from other kinds of corpus linguistic analysis, such as keywording and collocation, are also available there, but have not been described here.

1. How frequently do risk words appear?

The first point of interest was the overall frequency of risk words in the NYT (Figure 5.1) and the distribution of risk words by word class (nominal, verbal, adjectival/adverbial), absent any consideration of surrounding grammar (see Figure 5.2). In terms of the relative frequency of risk words, we note a general upward trend, with a number of peaks and troughs worthy of further investigation. In terms of word classes of risk, we found that not only are nominal forms by far the most common in the NYT, but that it is nominal risk words that vary the most in frequency, with the other categories remaining more or less stable. Interestingly, in the span for which we have no data (1964–1986), adjectival forms overtake verbal forms of risk in frequency.

We compared this against the relative frequencies of nominal, verbal and adjectival/adverbial lexical items in the corpus as a whole, in order to account for any trends toward nominalisation in our dataset more generally (Figure 5.2). This showed that even when compared to potential trends toward nominalisation generally, nominal risks are still on an inbound trajectory.

These initial findings guided the rest of the investigation: particular attention was paid to nominal risks, as these were the site of the most longitudinal change. That said, these categories provide merely

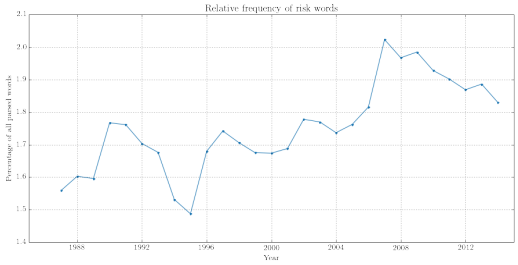


Figure 5.1: Relative frequency of risk words

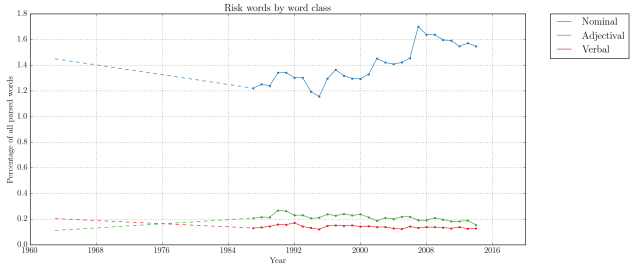


Figure 5.2: Relative frequency by word class

a categorisation of the formal features of risk words. Functionally, things are substantially more complicated: *running a risk*, for example, while featuring a nominal risk, is in reality a risk process; similarly, though risk is nominal in *risk management*, risk is nominal, it functions as a modifier, rather than a participant.

A similar question is the number of unique risk words appearing per year. Figure 5.3 demonstrates that there does appear to be a general increase in the relative number of risk words over time. That said, given that approximately half of unique tokens in each subcorpus appear only once, 1963 is excluded from analysis here, as poor quality OCR created a number of non-word results.

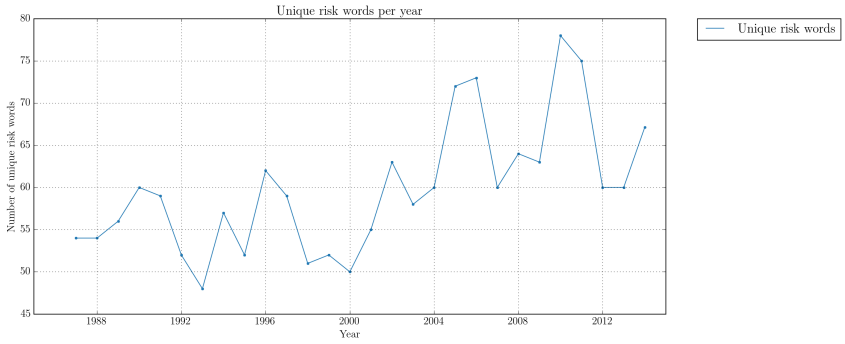


Figure 5.3: Unique risk words

2. Which experiential roles do risk words occupy?

Within the Transitivity system, a risk word may take the form of a participant (*The risk was there*), process (*I risked it*) or a modifier (*a risky encounter*). Using both constituency parsing/SFL categories and Stanford CoreNLP's dependency parsing, we counted the frequency of risk words within these three functional roles (Figure 5.4). In line with the results from word-class based searching, we find that risk as a process is declining in use. Risk as modifier, patterning with adjectival risk, today comprises a larger proportion of risk participants than in earlier samples.

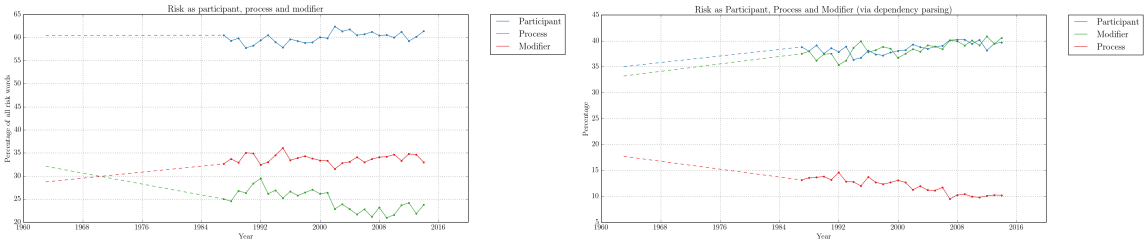


Figure 5.4: Functional roles of risk words (via constituency and dependency parses)

3. Is risk more commonly in the position of experiential subject or experiential object?

Risk as a participant may take the form of an experiential subject or an experiential object. Our first area of interest was the proportion of each, with respect to general trends in the NYT. As shown in Figure 5.5, risk is more commonly an object than a subject. It is also apparent that risk as experiential subject is on an static trajectory, while risk as experiential object is inbound. The significance of this is discussed in more depth in Section 10.

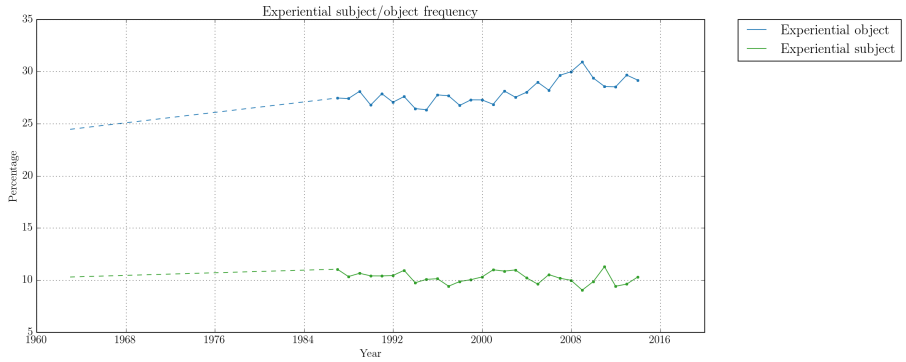


Figure 5.5: Risk as experiential subject and object as percentage of all risk roles

As subject	**As object**
*But the most prevalent **risk** for the average traveler to Peru is the high altitude of the Andes*	*The company has resolved accounting problems, he said, and stabilized profit margins, while new management has reduced the company's **risks***
*The **risk** would be that the stock would recover during the period that the investor was out of the stock*	*But an empty village is a big **risk**.*
*But the **risk**, though very small, that a man facing execution could win a new trial raises the question why this rule has proved so hard to follow*	*They said there was only a little **risk**, and now he 's not with us anymore*

Table 5.1: Examples of risk as experiential subject and object in 2001

4. What processes are involved when risk is a participant?

We then wanted to determine the most common processes in which risk as a participant is involved. Tables 5.2 and 5.3 show the top twenty processes for risk as experiential subject and object, taking passivisation into account.[12]

Processes when risk is experiential subject	**Total**
be	8954
increase	460
outweigh	278
rise	269
say	222
come	201
remain	192
go	190
have	179
make	148
seem	148
involve	145
grow	133
exist	127
take	121
become	120
lose	120
include	113
appear	111
pay	100

Table 5.2: Processes when risk is experiential subject

Processes when risk is experiential object	**Total**
reduce	5609
pose	4179
increase	4063
have	2879
carry	2115
face	1477
raise	1115
minimize	1009
assess	841
create	731
outweigh	704
avoid	683
present	619
assume	593
consider	588
see	563
understand	493
accept	492
weigh	473
eliminate	450

Table 5.3: Processes when risk is experiential object

5. How are participant risks modified?

Most commonly, risk as a participant is modified through adjectival pre-head modification or post-head modification with a subordinate clause or prepositional phrase. Ignoring the distinction between subject and object risk, and collapsing pre-head and post-head kinds of modification, Tables 5.4 and 5.5 show the most common pre- and post-head modifiers of risk as a participant.

Some of these modifiers are undergoing longitudinal trajectory change. As can be seen in Figure 5.6, *calculated risk* has an outbound trajectory, decreasing steadily. The large number of occurrences projected for 1963, however, is partially the result of the 1962 Broadway play by the same name. Of course, the choice of name for the production may also serve as evidence for the salience of the construction in the earlier samples. *Potential risk*, on the other hand, is on an inbound trajectory. Also interesting is the spike in the *high risk* construction between 2002–2004.

Concordancing reveals links to particular events. *High risk*, peaking in 2004, is asociated with the outbreak of the H5N1 avian flu outbreak. Interestingly, however, many concordance examples deal only with strains common in the USA:

1. *Mr. Johannessen said health care providers had a moral obligation to ensure – through direct questions and, if necessary, medical records – that people who asked for flu shots were at high risk.*

Pre-head modifier	Total
high	4753
great	3444
big	1672
political	1520
potential	1340
financial	1164
low	1056
more	1051
significant	1003
serious	935
real	869
little	761
own	713
substantial	547
less	541
such	514
calculated	469
considerable	463
possible	458
other	423

Table 5.4: Pre-head modification of participant risk

Post-head modifier	Total
cancer	2344
disease	1777
attack	1597
death	1025
injury	823
infection	811
loss	408
war	391
failure	383
inflation	368
problem	346
default	336
stroke	325
complication	288
damage	251
transmission	248
harm	244
aid	227
recession	217
accident	208

Table 5.5: Pre-head modification of participant risk

2. *Dr. Anthony S. Fauci, director of the National Institute of Allergy and Infectious Diseases, said that nearly 90 million Americans had a high risk of catching flu, with half of that number usually seeking vaccinations.*
3. *Nearly 90 million Americans are at high risk to contract a potentially fatal case of influenza.*
4. *Dr. Hinds said his county had about 90,000 people at high risk for flu.*

It is likely that the global influenza spread increased awareness and discussion of the risks associated with other influenza strains that may be more likely to afflict US populations.

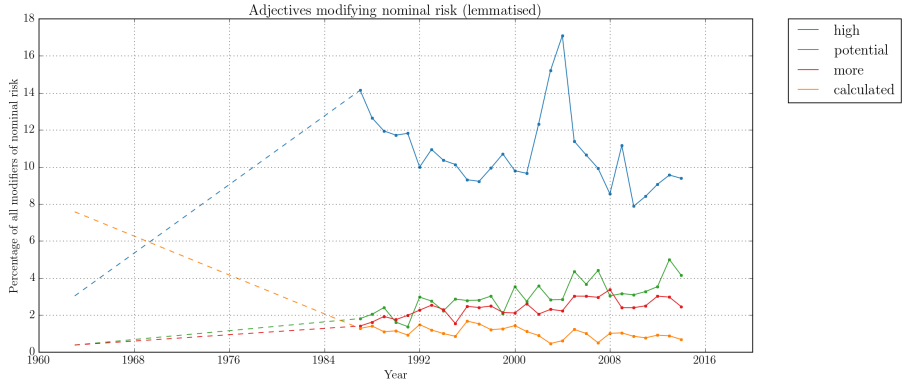


Figure 5.6: Selected modifiers of participant risk as percentage of all risk modifiers

6. What kinds of risk processes are there, and what are their relative frequencies?

Our second area of interest within the transitivity system is risk as a process. Within the corpus, we located five distinct risk processes. First, risk alone may be a process (*I won't risk it*). Second and third are *running risk* and *taking risk*—*process–range* configurations, where the verbal component is largely shorn of meaning, and with meaning conveyed primarily in the nominal in object position (Halliday & Matthiessen, 2004). Fourth is *putting somebody/something at risk*, which involves an obligatory nominal object argument and a prepositional-phrase complement. Finally, we have

Other phrases sit on the cusp as recognisable risk processes: *to carry risk*, for example, is frequent in the data, but we have not included it because we feel that the semantic burden of this process still lies in *carry* (unlike *pose* in *to pose risk*).

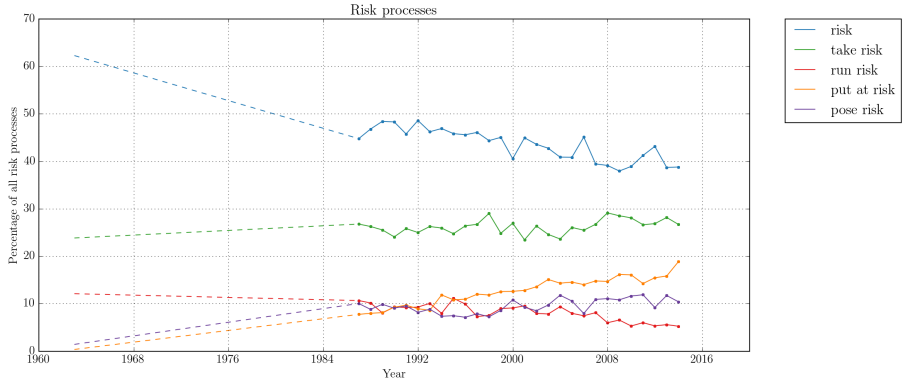


Figure 5.7: Risk processes as percentage of all parsed processes

Our first interest is the overall frequency of these five risk processes. Figure **??** charts the trajectory of the five identified risk processes. Most interesting here are that the 'standard' (predicatorial) risk process is steadily decreasing, in favour of the other processes, each of which seems to provide additional connodations of the agency of the risker as well as his/her/its understanding of the level of risk.

The second notable finding here is that *putting at risk* has overtaken *running risk* in frequency.

Concordancing revealed that in 2014, *putting at risk* is used in cases where the potential harm is either implicit or explicit:

1. *Ultimately, there is a price to pay: If you attack our soldiers, you're putting yourself at risk.*
2. *But addicted health care workers need not be physicians to put patients at risk.*
3. *While obviously no airline or company deliberately puts people at risk, 'sometimes new risks are identified and steps have to be taken,' Mr. Koch said.*

1. *The auction houses deny that they are trimming profits with givebacks or putting themselves at financial risk.*
2. *Rather, such tax status is generally put at risk when groups stray from their mission.*
3. *They had handled her body, putting them at serious risk of infection.*

That said, we also noted that there seems to be some evidence for lessening agency in recent *risk running* processes. Compare 1963 and 2014 results:

1. *However, if adults decide to run a risk, this is up to them, and anyway, Switzerland adequately handles American affairs in Havana.*
2. *In Washington at the weekend it was pretty welt agreed that the MIG incident was not deliberate provocation; the feeling was that, even with the Russian presence, Castro would not wilfully run the risk of American retaliation.*
3. *If he sticks to the more-or-less official Republican position against off-track betting, he runs the risk of losing thousands of New York City votes, which he needs.*

1. *Fans see this revolving door of injuries with so much regularity that they run the risk of becoming desensitized*
2. *'One runs the risk of falling for a voice.'*
3. *'I would run the risk of having two boys,' she said.*
4. *On the other hand, if Argentina does default, it runs the risk of more lawsuits, said Siobhan Morden, head of Latin America strategy at Jefferies.*
5. *And, like an overdressed beachgoer, a classic cocktail served straight up runs a high risk of wilting in the sunshine.*

Overall, the shift in both the semantics of risk running and the increasing preference for *putting at risk* can be seen as evidence for decreasing agency in risk, as well as an increasing implicitness of the potential harm. This finding is especially significant, given that the existing descriptions of risk (Fillmore & Atkins, 1992), as well as the current FrameNet database, include accounts of *running risk* as a frame, but not *putting at risk*.

7. When risk is a process, what participants are involved?

Clauses containing risk processes are a rich site for analysis, as the semantic roles of participants are determined by their placement with respect to the process. Experiential subjects of risk processes can be mapped to *riskers*. Experiential objects are either *risked things* or *potential harm* (*they risked their lives/death*). Table 5.6 lists the most common subject and object participants of risk processes. Also of interest are clauses embedded within risk processes (e.g. *she risks hurting herself/losing her life*). Table 5.7 lists the (lemmatised) top twenty subordinated processes in the corpus.

Riskers are most typically powerful institutions or individuals. Risked things and potential harms are generally serious and grave. A mismatch occurs here: *Bush* and *Obama* do not likely risk *wounds*, *arrest* or *death*. In terms of subordinated processes, notable is the appearance of processes that are fairly uncommon: *alienating*, *offending*, *undermining* and *angering* and are three key examples, ranking amongst expected processes like *being*, *having*, *getting*, *making* and *going*. Without considering longitudinal change, we can see from this that the embedded processes are often related to more powerful social actors: states, political parties and politicians risk alienating electorates; diplomats risk offending one another. Even embedded processes lacking explicit connotations of power are typically deployed in the contexts of government, industry or society. Below are concordance results for *risk alienating* in 2013, which appears 14 times.

Risker	Risked thing/ potential harm
person	life
company	injury
state	loss
woman	everything
man	death
investor	money
bush	wound
player	war
government	career
worker	arrest
republican	health
clinton	damage
bank	reputation
democrat	fine
anyone	capital
obama	future
child	confrontation
move	job
firm	backlash
administration	failure

Table 5.6: Riskers and risked things and/or potential harms

Embedded process	Total
lose	1260
be	1095
alienate	379
have	347
become	285
get	184
make	166
turn	119
go	113
offend	110
take	86
look	85
undermine	82
anger	79
fall	78
create	76
put	74
miss	73
give	73
damage	62

Table 5.7: Most common embedded processes in risk processes

stoked further concerns that unemployment risked	becoming	endemic and could eventually cause social upheaval
franchise, the stage scene could have risked	becoming	an embarrassment for the brand, but Mr. Timbers'
with locally, or else the Vatican offices risk	becoming	institutions of censorship
on which the experience depends – or risk	becoming	irrelevant to future generations, Mr. Staggs said
restart growth, warning that the euro area risked	becoming	mired in the same kind of economic stagnation that
If left unaddressed, such practices risk	becoming	more and more entrenched, Ann Harrison of
without serious savings in this area, we risk	becoming	an unbalanced force, one that is well compensated
Switzerland risks	becoming	one of the most restrictive places for management
What was the exception before now risks	becoming	the standard practice
the pope's new remarks that the church risked	becoming	a 'small chapel' overly fixated on sexual
hailed the step as significant, it risks	becoming	the latest of many tentative moves toward talks
Rather than race the clock to Bed-Stuy and risk	becoming	an early bike-share casualty, I stopped at a
increasingly turning to what, strangely, risked	becoming	the most marginalized group of all: the bosses
and currency crisis in the European Union risks	becoming	a crisis of liberal democracy itself

Figure 5.8: *To risk becoming* in 2013 subcorpus

8. When risk is a modifier, what are the most common forms?

There are many different kinds of risk as modifier (see Table 5.8 for a non-exhaustive list of examples). Our first interest was in gauging the prevalence of the different forms. From this query, we noted that pre-head nominal modifiers are increasing in frequency. A good example is *risk factor* (see Figure 5.10).

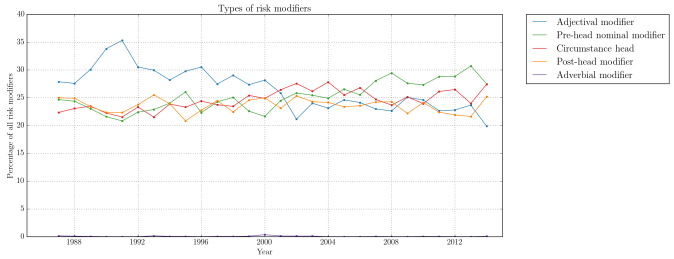


Figure 5.9: Types of risk modifier

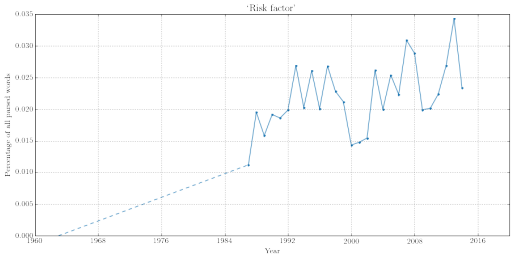


Figure 5.10: Relative frequency of *risk factor*

Modifier risks are unique for their variety and diversity: through compounding, comprehensible new risk words and phrases can easily be created. The entire corpus contained 327 unique adjectival risk words, including *non-risk*, *de-risk*, *once-risky*, *take-no-risks*, *risk-swapping*, *risk-abhorrent*, *price-for-risk*, *post-risky*, *pooled-risk*, *personal-risk*, *optimum-risk*, *one-risk-factor*, *one-pitch-can-end-his-career-risk* and *low-risk-to-society*. That said, most of these occur no more than a handful of times. By far the most common were *risky/riskier/riskiest* (15588 occurrences), *high-risk* (5533), *low-risk* (1086), *at-risk* (902), *risk-free* (883) and *risk-taking* (789). Of these, four exhibited trajectory shifts (see Figure 5.11). The basic adjectival forms (*risky*, *riskier*, *riskiest*) are dominant in the 1963 sample, then decrease, and re-emerge in 2000. *High-risk* though very rare (two instances) in 1963, has become more common, and stabilised in trajectory. *Low-risk* and *at-risk* are on a consistent inbound trajectory.

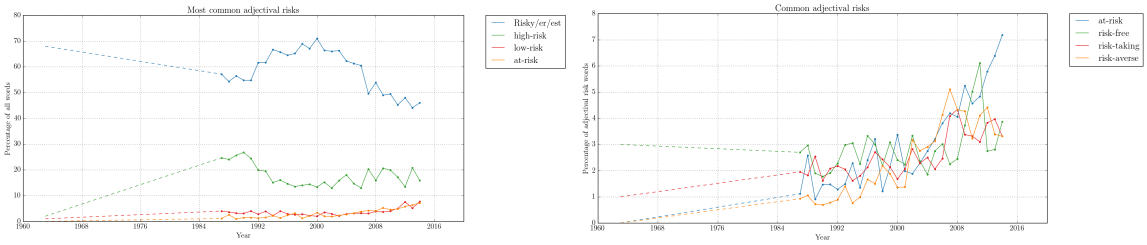


Figure 5.11: Common adjectival risk words as percentage of all adjectival risks

The prevalence of high-risk in the 1980s is largely due to the AIDS epidemic: concordancing reveals that certain populations (gays, African Americans, Haitians) are at high-risk of being inflected by HIV.

Modifier type	**Example**
Adjectival pre-head	*a risky move*
Post-head	*A person at risk*
pre-head nominal	*risk management*
Adverbial	*to riskily act*
Circumstance head	*to be at risk*

Table 5.8: Types of risk-as-modifier

At-risk is rare in earlier editions, but increases in prevalence steadily.

This shift in risk is modifier is an important one. Low, moderate and high risk comprises a gradient, or scale, while at-risk is a binary. As with the shift toward *potential risk*, this indicates both an increasing pervasiveness and a decreasing calcuability of risk.

9. When risk is a modifier, what is being modified?

Risk as a modifier can be placed either before or after the noun it modifies (*an at-risk person/a person at risk*). These two constructions are collapsed in Tables 5.9 and 5.10, which respectively list the participants most frequently modified by any risk modifier, and the participants most frequently modified by *at-risk/at risk*. Note that while risk-modified participants generally are financial and economic in nature (*investment, business, loan, asset*), the at-risk subset is comprised of vulnerable populations of people (*women*, *children*, *students*).

Risk-modified participant	**Total**
investment	696
business	515
behavior	508
group	466
loan	421
asset	388
strategy	377
bond	346
area	307
venture	301
security	287
patient	265
pool	239
bet	214
move	204
activity	201
proposition	199
child	170
woman	161
student	158

Table 5.9: Most common risk-modified participants in the corpus

At-risk participant	**Total**
person	439
child	368
woman	209
student	179
nation	135
patient	110
youngster	93
group	91
population	64
family	58
kid	50
youth	48
money	48
worker	45
life	41
job	41
man	40
area	35
teenager	32
other	32

Table 5.10: Most common at-risk participants in the corpus

In need of further research is whether or not the list of entities that can sensibly be modified by *at-risk* is beginning to grow: since the U.S. subprime mortgage crisis (beginning in 2007), references to *at-risk homeowners* appear to be on the rise. Results from 2011, for example, show that *nations* and even *economic sectors* are being modified with *at-risk*:

1. *Mr. Obama asked for $400 million for the World Bank's clean technology fund, $95 million for the bank's program to prevent deforestation and $90 million for its program to help at-risk nations cope with the effects of a warming planet by, for instance, developing drought-resistant crops.*
2. *The most at-risk sectors included auto components and automobile companies, which generate nearly 30 percent of their sales in Europe, as well as food and tobacco firms.*

Note that it is difficult to reconcile the semantic meaning of *at-risk* constructions with the semantic frame of risk provided by Fillmore and Atkins (1992). Though elements of both the VICTIM and *valued object* appear to be at work, neither provides an adequate label for *at-risk people, children, homeowners or nations*. Rather than being an oversight during the articulation of the risk frame (recall Figure 4.4), in light of the increased use of these kinds of constructions since the mid 1990s, we hypothesise that *at-risk* constructions (as well as *to put at risk*) are demonstrative of a broader shift in risk discourse toward general clusters of negative outcomes, rather than specific and measurable potential harms. Connection between this shift and sociological theory is made in the following chapter.

10. How arguable is risk?

As noted earlier, our central concern with the Mood system is the degree of arguability associated with the concept of risk. Risk in Subject, Finite and Predicator positions is the most arguable. Risk words within Complements and Adjuncts are less arguable.

Based on the kinds of parsing provided by Stanford CoreNLP, it was possible to measure arguability in two ways. First, we can map dependency relationships to the systemic-functional notion of arguability. A dependency grammar locates the predicator of a clause and assigns it a position of zero. A '1' is then assigned to its most immediate dependent (other components in the verbal group, if present, or the head of the Subject, if not). This process continues until no lexical items are unattached, or 'ungoverned'. In effect, the higher the number attached to a word, the further it is semantically from being an important component in the meaning, and thus, in systemic functional terms, the less arguable the word.

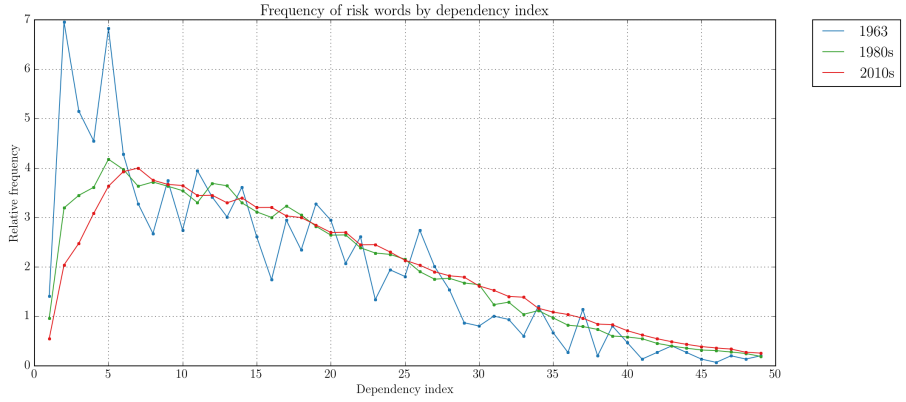


Figure 5.12: Risk words by dependency position in clause

Highlighting three sampling periods as in Figure 5.12 shows that in early samples, risk occupies core roles within the dependency hierarchy, and thus sits closer to the core part of the meaning being exchanged within the clause. In later samples, risk more commonly occurs later in the dependency structure, in less focial positions. As explained earlier, though this experimental method is not a perfectly reliable indicators of arguability, it does indicate an increasing preference to position risk as non-core, ancillary information, rather than as the main thing which is under discussion.

The second thing we can use dependency output for is identifying the functional roles of risk words. This is more accurate than using the dependency ranking, but creates a long list of functional roles. Of key interest, however, are risk words at the head of each major component of the Mood system—Subject,

Finite/Predicator, Complement and Adjunct (CoreNLP parses unfortunately do not distinguish between Finite and Predicator in a reliable way, so the categories are collapsed here). From Figure 5.13, we can see that risk is shifting from Subject and Finite/Predicator to Complement and Adjunct roles. This is an important result: risk words in more arguable roles are steadily decreasing, while risk in less arguable roles are becoming more common. Like earlier findings, this suggests an increasing implicitness of risk in NYT discourse, with less talk actually *about* risk, but more talk where the relationship between risk and the subjects of the talk is assumed to be more or less common knowledge.

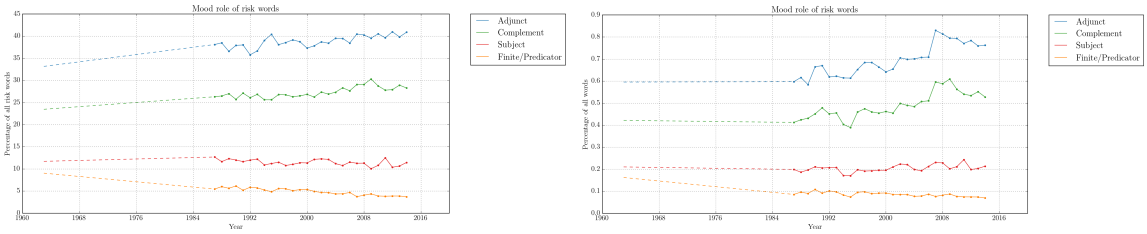
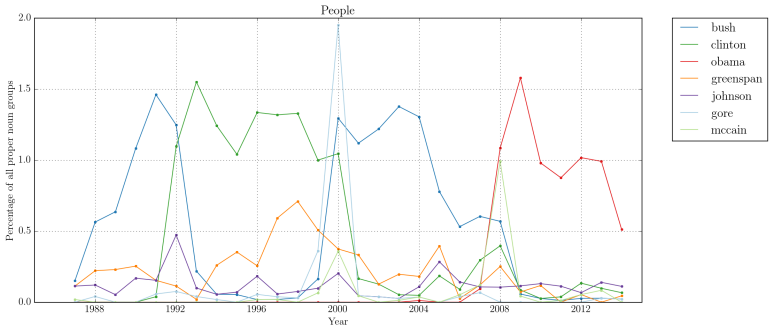


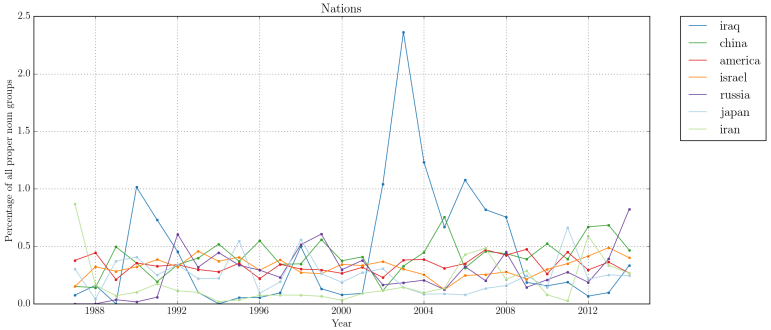
Figure 5.13: Frequency of risk words for each Mood component as percentage of all risk words/all parsed data

11. Risk words and proper nouns

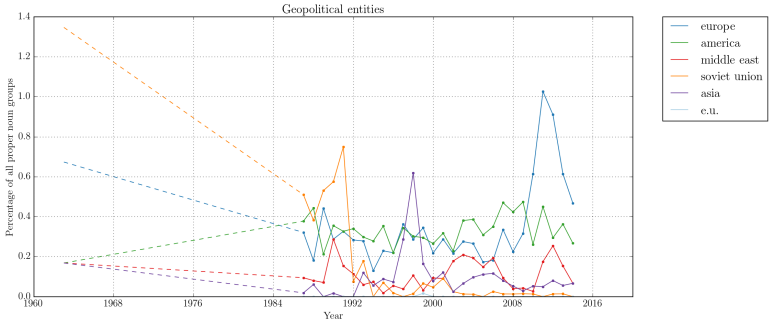
We searched for proper noun groups in parse trees containing a risk word. This is a departure from many of our earlier queries, as here we are looking only at which entities co-occur with risk language, rather than determining how risk words and non-risk words relate to other another lexicogrammatically. The result of this query was 68891 different proper noun groups. We took the 200 most common results, and merged any that denoted the same entity: *F.D.A./Food and Drug Administration*, or *Federal Reserve and Fed*. We then grouped results into thematic categories: *People*, *Nations*, *Geopolitical entities*, *Companies*, *Organisations* and *Medical themes*. The results were then plotted (See Figure 5.14).



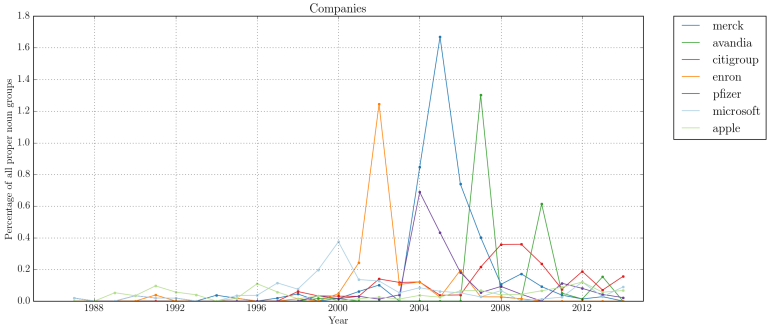
(a) People



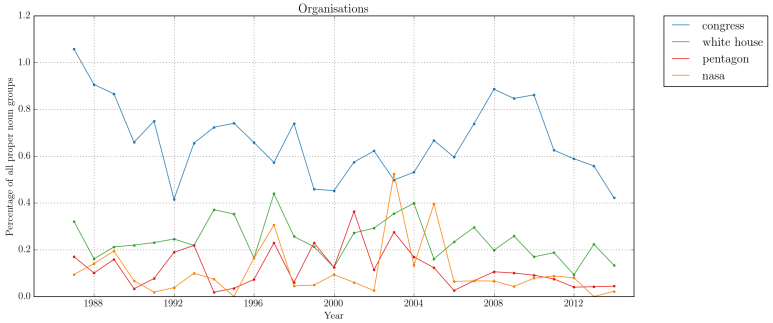
(b) Nations



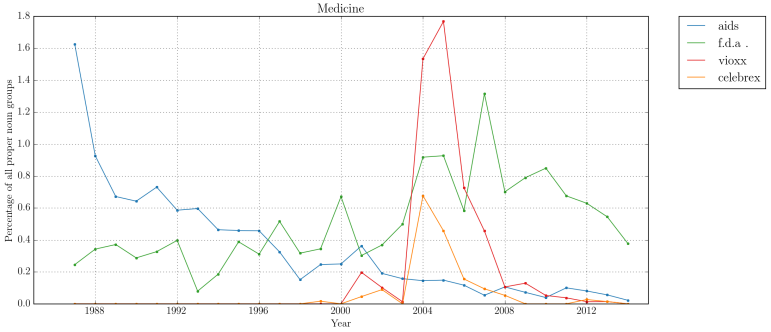
(c) Geopolitical entities



(d) Companies



(e) Organisations



(f) Medical terms

Figure 5.14: Proper noun groups co-occurring with risk

A number of historical events were easily recognisable within the peaks and troughs of these charts. Key events represented through these interrogations include:

1. US presidents and presidential candidates[13] (Figure 5.14a)
2. The First Persian Gulf War (Figure 5.14b)
3. The Iraq Wars (Figure 5.14b)
4. September 11 and the War in Afghanistan (Figure 5.14b)
5. The beginning of the 2014 Crimean crisis (Figure 5.14b)
6. The Asian financial crisis (Figure 5.14c)
7. The breakup of the Soviet Union (Figure 5.14c)
8. The Eurozone crisis (Figure 5.14c)
9. The Space Shuttle Colombia Disaster (Figure 5.14d)
10. The collapse of Enron (Figure 5.14e)
11. The U.S. subprime mortgage crisis (Figure 5.14e)
12. The U.S. outbreak of HIV and the AIDS crisis (Figure 5.14f)
13. The recall of Vioxx (Figure 5.14f)

This area of our investigation is by far the most promising as a means of connecting risk language to particular people and events. Spatial considerations have precluded a full treatment of the charting of risk language to specific events, despite the fact that enough data exists for detailed analyses of any number of potential foci. Future research that centres on detailed exploration of health domains (including the Vioxx recall) is planned.

It should also be noted that the kinds of tasks needed for analysis of proper nouns in particular (selecting particular tokens or thematic clusters of tokens, merging results, zooming in to particular spans of time, etc.) are key components of the corpus analysis toolkit and IPython Notebook interface (`https://github.com/interrogator/risk`). Exploration using the purpose-built interface reveals that many topics are present in the data, but are hidden by the frequency of the very prominent examples charted here. Searching for *Yugoslavia*, *Bosnia*, *Kosovo*, *Serbia*, *Milŏsević*, NATO, (etc.), reveal expected peaks at different stages of the 1990s, despite falling outside of the range of the visualisations presented here. Given that the dataset and toolkit are open-sourced, we encourage researchers to conduct further, more specific analysis of risk language and either particular people, places and events, or risk language and topics such as health, politics, economics or sport.

Chapter 6

Discourse-semantics of *risk* in the NYT

Accordingly to SFL, the sum total of lexicogrammar, abstracted, realises the discourse-semantics of texts. Accounting for discourse-semantic meaning involves sensitivity to realised lexicogrammatical forms, but also to the ways in which incongruence and grammatical metaphor can create similar meanings through differing grammatical constructions: as noted earlier, *potential harms* may be realised as a participant in a process of risk (*Bush risked losing the election*), or as a modifier of a risk participant (*the cancer risk/the risk of cancer*).[14] Given the diversity of roles in which risk words can appear, the delineation of risk by roles within mood and transitivity systems in the previous section was thus a methodological necessity, but one with heavy ramifications for analysis. At the level of discourse-semantics, it becomes necessary to discuss risk word behaviour more fluidly, with reference to both experiential and interpersonal meanings, and with distinctions between risk as participant, process and modifier largely collapsed. This is perhaps especially so in in our case, as risk is an example of a lexical item that may be congruently realised as either participant and process, straddling the semantic space between entity and event.

The first part of this discussion provides a description of risk in the NYT absent longitudinal considerations—something akin to the descriptions provided by Hamilton et al. (2007) and Fillmore and Atkins (1992), but from a systemic-functional, rather than frame-semantic purview. The second part is concerned with accounting for shifting discourse-semantics of risk, via the lexicogrammatical findings presented in the previous section. In the final section, longitudinal shifts are discussed in the context of specific events, broader social change, and sociological theory.

1. A monochronic description of risk

Before turning our attention to the behaviour of risk words over time, it is useful to provide a short description of the way risk words are generally used in the NYT.

Foremost, striking is the ability of risk to function within all open word classes (noun, adjective, verb, adverb), as well as the sheer diversity of risk words. 507 unique lexical items containing risk were found[15], including many (albeit vary rare) words lacking existing lexicographical description: examples such as *risk-shy*, *risk-addicted*, *risk-elimination*, *species-at-risk* and *risk-happy* demonstrate the overall salience of risk and the nuance with which it is instantiated in news discourse. Further testament to this salience are the nuanced distinctions in riskers' awareness of potential harm in *risking*, *putting at risk, taking* and *running* risks.

In many respects, our findings agree with those of other monochronic descriptions of risk language.

First, we can see the usefulness of the frame-semantic categorisation of the kinds of participants/social actors that occur within the risk frame (i.e. Fillmore & Atkins, 1992): we often found it useful to divide corpus interrogation results into categories of *risker*, *potential harm*, *risked thing*, and the like. Promising is the fact that in many cases, we can use the grammatical structure of the clause to automatically return lists of each kind of participant. In cases where the grammar alone cannot tell us the participant role (*I risked my death*, *I risked my life*), manual sorting is not difficult, as there is little ambiguity. If we insert the *losing* participle (*I risk losing my life*, but **I risk losing my death*), we can quickly determine if a result is a *potential harm* or a *risked thing*. This is especially so when risk is the *process*, rather than a participant or modifier. With this in mind, focussing more exclusively on risk as process in very large parsed datasets may prove elucidating.

Our findings also agree with a key claim made by Hamilton et al. (2007): health and illness risks were surprisingly prominent within our data. As will be discussed below, however, this does not appear to be a purely static phenomenon: our longitudinal analysis points toward health risks as being far more common in contemporary language than in the language of our 1963 dataset.

A second point on which we agree is with their contention that risk words behave differently in different social situations (i.e *registers*) and different genres, and that comparison of genres is worthy of further study (though here we rely on not on our dataset but on a long history of research in support of this contention within SFL):

> We find in these discourse environments that the focus of the semantic prosody and the semantic preference changes according to the context in which they occur. While this may be something that some (but not all) sociologists of risk may have intuitively sensed in the past, there are empirical data from corpus linguistics to suggest now that the semantic prosodies can and do change slightly from one context to another (2007, p. 177).

Their dataset included transcribed spoken conversations. This register is remarkably different to that of NYT articles, and examples of risk in these contexts demonstrate this quite clearly (e.g. *Don't don't risk it eh*; *Cos there isn't a risk of going of there*). The key characteristics of these examples (informal lexis, unrecoverable deictic references, low lexical density, etc.) contrast starkly with our examples.

Due to the composition of our dataset, we can have little to add to descriptions of risk in casual spoken language, aside from recognising that spoken risk talk is likely to point toward very different, and interesting, results. Though we believe our results may be generalisable to the behaviour of risk in relatively formal written contexts, extended investigation of risk in spoken corpora remains needed.

A key finding that received little attention in this earlier linguistic research of risk language is the notion of participants' *agency in risk*. Consider the following two sets of examples. The first, from 2012, shows examples of the embedded process as negative outcome.

1. *Some Democrats are saying the White House set itself up for the charges by making a vow that was bound to be difficult to keep and that would* ***risk alienating*** *its business supporters.*
2. *Some speculated that this partnership* ***risked alienating*** *other big retailers, like 7-Eleven, by giving Starbucks influence over how Square 's payment system was developed.*
3. *And campaigning on behalf of members of Congress could* ***risk alienating*** *swing voters, many of whom seem to prefer bipartisan government and dislike one-party rule.*

The second contains grammatical subjects modified by *at-risk* (from 2008):

1. *He secured nearly $100,000 for a program at the Sephardic Community Center in Brooklyn that seeks to help 'at-risk immigrant youth successfully acculturate' into American society*

2. *Through the years, he said, more than 1,000 at-risk young people have arrived at his doors.*
3. *The document signed off on a $1.5 million grant to World Vision, a group that hires only Christians, for salaries of staff members running a program that helps 'at-risk youth' avoid gangs.*

Readily apparent when risk is process is that the kinds of people who risk are typically institutions or humans in positions of power and influence. Actors of risk processes are often states, politicians, or political parties. The *potential harm* being risked is often an abstract concern: *alienating* or *offending electorates* or *allies*. In these cases, risk is a process engaged in purposively by Actors who stand to gain something equally abstract. In contrast, when risk functions as a modifier of a participant, the participant is far less powerful: women and children are at-risk of sickness; workers are at risk of injury or death. Here, risk is a quality ascribed to the self. Risky behaviour is not often mentioned. For these people, the potential harm is often recoverable from context, but not outlined within the clause. This distribution was largely consistent throughout our dataset, and will be unpacked through sociological analysis in the following chapter.

2. Shifting discourse-semantics of risk in the NYT

Some lexicogrammatical and discourse-semantic phenomena have demonstrated consistent shifts over our sampling period. We turn our attention to them now.

First, though we noted above that risk as a process involves a different set of participants to risk as a modifier, there are still longitudinal changes within this area. When looking at the *risk of loss*, for example, we can see a general trend toward individual losers, rather than institutional losers. In 1963, the things at risk of loss were macro-level and abstract: athletic funding, market share, vital technology, sympathy in the west, and the like. Later, risked things are more individual assets—life and injury being the two most common. We link this conceptually to neoliberalism

2.1. Domains of risk disourse

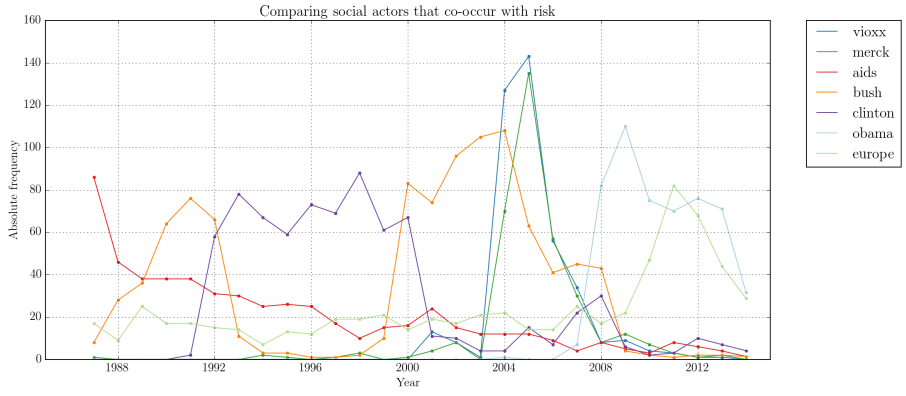


Figure 6.1: Comparing social actors that co-occur with risk

In terms of the topics in which risk words are deployed, we saw that health risks are very prominent in the more contemporary data samples. Our comparison of *Risk of terror* attack* and *risk of heart attack* demonstrates this preference clearly. This change is indeed a longitudinal one: in 1963 editions, a number of constructions evidence that risk was commonly instantiated with regard to diplomacy, war,

international relations, and the like. In their most prominent years, AIDS, Vioxx and Merck comprise over 1.6 per cent of all proper nouns that co-occur with a risk word. This is higher than Clinton, Bush or Obama at their peaks, as well as Soviet Union in 1963/1987 or Europe during the Eurozone crisis in 2011 (See Figure 6.1). Moreover, in the years following the AIDS crisis, health risk have increasingly related not to infectious diseases (which require institutional responses), but to kinds of illnesses where the responsibility for prevention falls upon everyday citizens through lifestyle choices, rather than politicians, hospitals, or the FDA. Even in the case of Vioxx, where the risk was created by the premature FDA approval, risk language surrounding Vioxx remained geared toward the risks faced by everyday people. Though Merck and the FDA may be blamed, risk remains a more appropriate frame for discussing the potential for heart attack than it does for discussing the potential harm caused by improper clinical trials or financial interests causing the FDA to approve the medication prematurely[16]. In hundreds of co-occurrences of risk words, Vioxx and Merck, we uncovered a mere handful where the potential harm was to the manufacturer. Though we found one solid example in the 2006 subcorpus (*'The verdict highlights the **risks** that Merck faces as the number of lawsuits over Vioxx continues to grow.'*), this same article containined four other risk words, each of which positions the consumer as being subject to potential negative outcomes:

1. *Mr. Escobedo said that Vioxx was especially dangerous to Mr. Garza because of his other **risk** factors and that he should never have been prescribed the drug.*
2. *'Mr. Garza was the last person in the world that should have been taking Vioxx,' said Mr. Escobedo, who told the jury that Merck had known since 2000 that the drug posed heart **risks** but continued selling it for four years.*
3. *About 20 million Americans took Vioxx from 1999 to 2004, when Merck withdrew the drug after a clinical trial showed that it increased the **risk** of heart attacks and strokes compared with a placebo. Earlier clinical trials had also shown that Vioxx appeared to be much riskier to the heart than naproxen, an older painkiller.*
4. *But recently the tide has seemed to turn abruptly against the company, as its lawyers struggle to explain a raft of documents that show its scientists were concerned about Vioxx's heart **risks** several years before Merck stopped selling the drug in 2004.*

As Widdowson (2000) suggests, corpus linguistics often reveals things that are contrary to intuition, and this is certainly the case here. Our expectation of new risk meanings related to terrorism after 9/11 was for the most part not met. Rather than a limitation, this can be treated as an insight in itself: the events and topics that come to mind when we think of risk may not necessarily correspond to the reality of risk language generally. Such is the benefit of corpus linguistic investigation of risk, when compared with previous methodologies employed within the humanities and social sciences to better understand risk.

2.2. Implicitness and arguability

The most salient theme from the longitudinal mapping of risk is that of implicitness: increasingly common are grammatical constructions where potential harms and risked things are recoverable only from context. Below are three further examples of the *at-risk* construction:

1. *In 1999, we sold the company, and the next year, we moved to the United States with our two children—a third was born in 2003—so I could pursue my idea of helping low-income, **at-risk youth**.*
2. *Some of the proceeds from tickets sales for the event [...] will go to support local arts programs in Washington Heights and the Broadway League's Family First Nights, which the League describes as 'a nationwide program specifically designed to encourage **at-risk families** to attend theater on a regular basis.'*

3. *Mr. Tepfer noted that Mr. Douglas, who was in the neighborhood when the body was found and was interviewed by the police at the time, 'preyed on **at-risk women**, on prostitutes, and he engaged in sex and strangled them to death.'*

In these cases, what the participant is at-risk *of* is not a specific negative outcome, but an interrelated set of negative outcomes that are more likely to happen to less powerful people in society. Evoked within this cluster is *poverty*, *drug use*, *disease*, *homelessness*, *abuse*, *fatherlessness*, *dropout*, *gang activity*, and the like. In many cases, *at-risk* takes on a euphemistic quality, most obviously as a substitute for *lower-class*, *non-white* or *poor*. Also interesting here is the muddying of the semantic frame: it is both difficult to determine the exact potential harm, and to classify the participant as a *risker*, which seems to imply some agency or comprehension of the risk. More accurately, these participants are *put at risk*—a risk process that itself is on an upward trajectory within our dataset.[17]

This aligns with the decreasing arguability of risk. Risk in predicator or subject position is increasingly rare, as risk becomes less the nub of propositional meanings. Thus, less and less often is risk a fundamental component in meaning as exchange: in its role within complements and adjuncts, it now more typically plays a supporting role in the provision of information. A ramification of this is that risk becomes an inherent quality of participants in the field of discourse, rather than a process in which participants knowingly or by their own choice choose to engage. This shift is exemplified by the outbound trajectory of *calculated risk*, and its displacement by an uncalculated *potential risk*. Below are examples of *calculated risk* in 1963, contrasted with *potential risk* in 2008.

1. *It is, of course, a **calculated risk** that Mr. Kaye is taking.*
2. *Kennedy has taken a **calculated risk** here.*
3. *A spokesman for the group acknowledged that granting a 10 per cent discount before a study in depth had been made was a calculated risk.*

1. *One was to make health care providers and caregivers of infected children aware of the **potential risk** of pre-chewing.*
2. *At issue were the **potential risks** of having government-run funds in China and other foreign countries make big investments in American businesses.*
3. *Rat pups exposed to BPA, through injection or food, showed changes in mammary and prostate tissue, suggesting a **potential cancer risk**.*

In the former, the existence of the risk itself has been acknowledged, and the potential harm/reward have been weighed. In the latter, though the situation can be identified as having potentially negative outcomes, these are formless and immeasurable. *Potential risk* is in fact *a risk of risk*. This aligns with the idea that risk (sociological reference) has come to be simply *threat*.

2.3. Low-risk, moderate-risk, high-risk

1. *Hemophiliacs, at **high risk** of AIDS, have been hard hit by the disease.*
2. *Another 25 percent are **at moderate risk**.*
3. *But why on this isolated campus, where no AIDS cases have been reported among students at **low risk** of catching the disease, are students so concerned?*

During the first years of the U.S. spread of HIV, people could be classed according to low, moderate and high-risk groups. Here we have basic quantification of levels of risk. This stands in contrast to the *at-risk*

construction discussed above. Of these modifiers, only *low-risk* emerges as an increasingly frequent form. This is also interesting, as it points to a broadening of the semantic scope of risk to include situations where risk remains present: *low-resolution image* does not point toward the increased prominence of low resolution images, but more to the prominence of resolution as thing that meanings are made about. In the same way, the inward trajectory of *low-risk things* does not point toward a culture of less risk, but toward a culture where even things that do not have risk are characterised by their nature to it. We could not locate existing literature supporting a claim that the salience of a concept may be evidenced not only through *extreme case formulations the riskiest, high-risk, very risky*, but through minimisation. Nonetheless, our analysis points to the idea that the increased salience of risk as a concept is in part demonstrated through its instantiation in situations where its significance is claimed to be negligible or banal.

2.4. Risk as modifier

1. *At JPMorgan Chase, the* ***risk models*** *hid—and were used to hide—risks from the traders and top executives.*
2. *After a rogue trader cost MF Global $141 million, Promontory came in to bolster certain areas of the firm's* ***risk controls****.*
3. *He was a total* ***risk junkie****.*
4. *The programs are all based on the concept of risk management, rather than the unattainable goal of total* ***risk elimination****.*

Risk occurs within many different modifier positions (see Table 5.8). Of these, pre-head nominal types are rising, and adjectival pre-head types are falling. From these shifts, we can surmise some sociological insight related to arguability (as conceptualised by SFL). In the increasing frequency of pre-head nominal modifiers (*risk management, risk arbitage, risk factor, risk insurance*—more examples above), we can see increased social significance of risk as a concept through the evolution of specific jobs whose central concern is risk (see Section 8 for discussion of the emergence of *risk factor* in particular). Pre-head nominal modification reflects the codification of a concept: such constructions must be culturally recognised constellations of meaning. In comparison, adjectives attach to head nouns relatively freely in English. Cultural recognition of the adjective-noun combination (*a risky move*, *the riskiest option*) is not a prerequisite for meaning to be understood.

2.5. Arguability

Longitudinal change in the arguability of risk words is consistent. In earlier editions, risk words more commonly occupy more arguable roles, according to systemic functional grammar. In later editions, risk more commonly occurs in heavily dependent positions. Less often does a risk word form the central component being discussed; more often, it exists as a modifier of one of these components, or as a part of a supporting, subordinate clause.

We are limited in our ability to interpret this result. Little has been written about the relationship between dependency grammars and SFL. As dependencies are inherently functional-semantic, rather than generative-grammatical, dependency is perhaps the most useful [18] mainstream grammar for learning about the semantic behaviour of a given word. That said, though functional categories provided by Stanford CoreNLP's dependency parser overlap in many respects with categories in the Mood system of SFL, there are still mismatches, or shortcomings. Most critically, dependency grammar conflates

interpersonal, experiential and textual systems, while SFL demands three separate parses. As discussed earlier, the systemic-functional conceptualisation of subjecthood is threefold, whereas CoreNLP simply nominates the interpersonal subject.

Due to the availability of nuanced querying languages for phrase structure grammar annotation, our investigation leaned toward grammatical structure annotation over dependency grammar. This is despite a problematic relationship between functional and phrase structure grammars. Given that interesting preliminary findings were unearthed by querying dependency information, we conclude that further exploitation of dependency annotation for the purpose of risk language analysis appears to be a promising area for further analysis.

3. Sociological perspectives

The task that remains is to connect observed shifts to their temporal context. In terms of the annual subcorpora, this was by no means a clear-cut task.

When focussing on the subcorpora of economic, health and political risks, linguistic reactions to real-world events were much easier to locate. We concluded that further investigation of risk would do well to focus on risk as instantiated within texts sharing a semantic field.

Our investigation of topic subcorpora was limited by scope. That said, the open-source tools we have developed for interrogating corpora for discourse analysis could easily be put to use in an investigation of a topic subcorpus.

We found little evidence that health crises resulted in increased frequency of risk in articles centred on economics or politics. This seems to suggest that while real-world events influence the instantiation of the risk semantic, this instantiation remains more or less limited to the field(s) of discourse to which the real-world event is most related.

A final point of interest is that adjectival risk words in some respects behaved contrary to our expectations. Simple adjectival risks as modifiers of participants (*the risky manoeuvre*, *riskier choices*) appear to be decreasing in frequency. Furthermore, though there is a very large variety of adjectival risks, and though there is a general trend toward a greater number of risk adjectives, this increase is a slight and gradual one.

Perhaps in this finding there is some evidence for the Risk Society thesis, in that the ways in which risk can characterise a situation were more or fully articulated during high modernity. Though these characterisations continued to be applied today, saturation point may have been reached.

What can be concluded from the finding that real world events do not appear to have long-lasting effects on the behaviour of risk words?

Ultimately, perhaps we should not be surprised by this finding. Language is a system that must be resilient against such influences: if single events caused meaningful changes in the lexicogrammatical behaviour of a single word, communication between those aware of and unaware of events would be made more difficult. Accordingly, our suggestion would be that temporary change in the behaviour of a word (as can be seen in spikes in the number of risk words surrounding certain events) are interesting in and of themselves. Moreover, these changes can potentially be measured in pseudo-real-time by mining RSS feeds, using the Twitter API, and so on. Lexicographers could take note of which kinds of events bring about instantiation of a certain word or concept, and create definitions accordingly. Discourse analysts and sociologists could hypothesise the co-occurrence of certain kinds of language with certain kinds of events, and use real-time data to confirm or refute these hypotheses. Cooperative efforts

between functional linguistics and sociology, however, are dependent upon a reconciliation of divergent conceptualisations of the relationship between text and context. This issue is elaborated below.

4. Reconciling sociological and systemic-functional conceptions of text and context

This part is still mostly just ideas. I think we need to discuss it so that we can agree on it, as it's quite lofty stuff.

Functional linguistic theories such as SFL not only provide a grammar, but also a conceptualisation of the relationship between text and context. In the case of SFL more specifically, the argument is that context is contained within text. Compelling evidence of this is that understanding of the more abstract genre/context from which a text is taken can be gained through exposure to lexicogrammar only.

At issue for sociologists is that this argument rests on a particular operationalisation of the idea of context. The definition according to SFL (though indeed inspired by scholars with significant in sociology, e.g. Malinowski) remains deeply concerned with language. In reality, it is a projection of grammatical phenomena (mood, transitivity, theme) onto the situations and cultures in which texts are produced. Though this has proven a useful heuristic within (critical) discourse analysis, it is in many ways alien to sociological theory, where texts tend to be considered with respect to political, historical and social events and movements, rather than with respect to communicative systems.

The systemic-functional description of the context of culture contains no references to the effects of current events on language production. While SFL has demonstrated its usefulness without such considerations, this usefulness has been for linguistics. Corpus linguistic applications of SFL have seldom traced the influence of real-world events.

It is not hard to imagine scenarios where important meanings can be made through absence of references to certain things. In seldom considering both cognitive elements of language production and the influence of specific events, SFL has remained largely unable to conceptualise the notion of meaning made through omission. ...

Naturally, a current event can influence the likelihood of certain parts of lexicogrammar (the most banal example is in proper nouns, where the appearance of a politician is certain to influence the likelihood of his or her mention in texts). SFL is predictive in the sense that it can predict that different genres will be more or less likely to involve certain speaker choices. So far, it has not been able to ...

Like SFL, sociology aims in part to provide a link between text and context. Context, however, is generally not treated as simply a Malinowskian constellation of field, tenor and mode, but also a backdrop of current and past events that inform and shape discourse at the time of its production.

With these issues in mind, we propose that SFL and general sociological theory are useful partners. SFL provides a means of relating lexicogrammar of texts to discourse-semantic meanings. It can then

Key sociological ideas such as reflexive modernity or neoliberalism can be expected to exert influence over texts produced during these movements. Though earlier SFL treats ideology as the most abstract stratum affecting the production of texts, this conceptualisation has been abandoned by a number of current SF linguists.

Earlier SFL indeed devoted significant energy to exploring the ways in which ideologies such as capitalism are manifested in the content strata of language.

What often goes unsaid in SF theory is that an additional usefulness of SFL is in its ability to draw a line between the kinds of context (field, tenor and mode) that are embedded within the lexicogrammar of a text and the kinds of context that leave no immediately identifiable trace.

At this point, sociological theory can fill in the missing parts of the picture.

At a level of greater abstraction, functional linguistics and sociological theory can be combined to flesh out the text/context relationship. Functional linguistics is concerned with language as a tool to make things happen in the world; sociology can add to the understanding of how culture informs our motivations for making these things happen, for presenting ideas in certain ways, etc.

Chapter 7

Limitations of the study

Broadly, our project synthesised *corpus assisted discourse studies* as a **methodology**, *systemic functional linguistics* as a **theory of language**, and *sociological accounts of risk* as **a set of related assumptions about risk**. Our overarching aim is to combine the theories and methods of these areas to provide an empirical account of the ways in the discourse-semantics of risk have undergone longitudinal change.

1. Limitations of scope

In order to fulfill these aims, we necessarily limited our investigation's scope. The first main issue of scope was our choice of print news data from a single publication. The advantages of this kind of text are many: the NYT is a widely read, well-known, and influential publication. The homogeneity of its language and its consistent structure in many ways facilitate longitudinal and quantitative analysis. The drawback of this kind of data, however, is that we can say little about how risk language works within other kinds of communication. Accordingly, we have made no effort to measure the importance or weight of print journalism against other text types in which risk language occurs, such as film and television, various online media or casual spoken/written conversation.

There were also import constraints imposed both by our chosen theory of language. Though SFL has proven useful as a framework for analysing how language is drawn upon as a resource for making particular kinds of meanings, it is also a theory which has little to say about language and cognition. This was suitable for our particular investigation, as we cannot possibly determine either the authors' intent behind, nor the readers' interpretations of, the thousands of articles being analysed. Accordingly, we did not attempt to draw links between risk language in the NYT and the ways in which risk is cognitively understood by writers or readers. We suggest that the various strengths of different functional accounts of language can work in tandem, however, and thus welcome future insights from cognitive approaches to risk.

A third and final constraint is our selection of linguistic phenomena for detailed analysis. Primarily, we focus on the experiential and interpersonal dimensions of risk language. The third key component of language is its textual dimension: how language is reflexively organised into meaningful, coherent units. Though our decisions here were guided by the fact that risk as a word does not tend to play important roles in building cohesion and coherence in narratives, we readily admit that more detailed analysis of the role of risk within this dimension may yield important insights that we have not uncovered. Tracking whether risk words shift longitudinally within the textual dimension (between given and new information

within a clause, for example) may also be able to show us the extent to which people are aquainted with the notion of risk itself.

2. Shortcomings in natural language processing tools

A major issue in our study relates to the performance and epistemological consequences of digital tools used during the investigation. In short, available digital tools may not perform as desired. Parsers remain far from perfect, and innumerable mistakes in parsing are present in our dataset. What was missing in our results as a result of parsing problems or query design likely went unnoticed amongst the streams of text. By the conclusion of the interrogation, millions of clauses had been manipulated, and millions of features extracted and counted. Accordinglyt, oversights and mistakes are unfortunately bound to remain.

A related issue is that the parser used here—Stanford CoreNLP—relies on phrase structure and dependency grammars, rather than systemic functional grammar (for which fewer computational resources are presently available). We were thus left with the task of translating systemic-functional concepts into phrase structure grammar and dependency grammar. This process was often time-consuming and counter-intuitive, as well as theoretically difficult to reconcile.

The second major issue unearthed during the investigation concerned the size of the dataset, which, aside from being simply computationally intensive, was also so large that it constrained the kinds of analytical methods available to us. With 29 annual subcorpora, as well as three topic subcorpora, we struggled to simultaneously maintain a focus on minute changes in lexicogrammar and to connect change generally to events of interest to sociologists. Indeed, though instantiations of risk words may react to current events, further subdivision of the corpus into weekly/monthly subcorpora proved too unwieldy. A similar investigation could be carried out on one subcorpus alone, divided into weeks or months, in order to better assess the influence of individual events. The richness of the data also prevented direct comparison of more risk fields, with only a basic treatment of health risks given here.

3. The limits of lexicogrammatical querying

A major issue we faced during our investigation, and did not deal with directly, is the potential for similar discourse-semantic meanings to be made via a number of different kinds of lexicogrammatical arrangements. Consider the following invented examples:

1. *They risked their money*
2. *Risked money was lost*
3. *They risked their savings*
4. *The risk of money loss was there*
5. *She took her money from her purse and risked it.*
6. *The money, which they risked, was lost.*
7. *They had money. They risked it.*

Each of these examples communicates the same kind of semantic meaning—that money was risked—but through different grammatical strategies, ranging from the group level (Ex. 1) to the clause-complex (Ex. 7). Our analyses typically dealt with the most common, or *congruent*, kinds of realisations, but at the

expense of meanings made incongruently, or above the level of the clause. With great difficulty, we could construct a query that matches every one of these results, or merge the results of a number of searches. As the queries grow in complexity, however, undesirable results may creep in: a query matching *money* in the above cases would also likely match *death* in *They risked death*, despite the fact that one is the risked object and one is the potential harm. Determining the proper functional role in the cases above is very simple for human coders, but the number of results in need of categorisation is often far from trivial. Limited by both the ability of current parsers and by constraints of scope, we found ourselves largely unable to devise methods for accounting for incongruence in risk language during automated querying. As a result, our analysis was restricted for the most part to meanings that were being made in the most probable, normative ways.

The second major issue is the exact converse scenatio: counted together in many our automatic queries are many examples with contradictory semantic meanings. Continuing our example of money loss, consider the following:

1. *They would have risked their money*
2. *They didn't risk their money*
3. *Risking money was a terrible idea, so they didn't do it.*
4. *Don't risk their money.*

In each of these cases, money was not necessarily lost. Lexicogrammatical querying, however, would simply count *money* as the *risked/lost thing*. Though we were careful not to conflate our abstracted results with occurrences of particular events (money loss), we did not attempt to determine whether certain things were more often either hypothetically or really risked.

Our approach is not unique in this sense: few corpus-based studies of discourse have attempted to distinguish between these kinds of meanings automatically. Though many grammars account for the notions of *possibility*, *counterfactuality* or *negation* presented above, how to use these meanings to include/exclude matches has for the most part yet to be determined.

It must also be noted, of course, that any study of text corpora necessarily involves removing text from the actuality in which it was produced. Though we can be attuned to the nature of written news journalism, we have not been able to account for meanings made multimodally (through adjacent images, advertisements, etc.). Though perhaps not a critical issue in studies of news corpora, it is nontheless important to acknowledge that in some sense we have been studying *text*, rather than *texts*. Synthesis of corpus findings with in-depth analyses of individual articles, or of the influence of the media production process, would no doubt improve our ability to generalise our results. Indeed, future research incorporating these perspectives is planned.

4. Conclusions

Notes

1. This was operationalised through the case-insensitive regular expression **\brisk.*?\b**, where **\b** acts as a word-boundary marker.

2. As a part of an ongoing Australian Digital Humanities initiative, since the beginning of our analysis, we have been allocated resources for creating and cloud-hosting a much larger corpus. All 1.8 million articles from the *New York Times Annotated Corpus* are currently being turned into an identically structured, though dramatically larger, cloud-hosted corpus. In planned future research, interrogation of this corpus will be used to determine whether trends in the behaviour of risk words were localised to the word itself, or to general stylistic/language change in the *New York Times*. More details on this project are to be presented in Zinn and McDonald, forthcoming.

3. We tried a number of strategies for collecting topic subcorpora, such as exploiting topic modeller and keyword metadata. Ultimately, however, we relied on the hand-classification. A limitation of the selected approach is that—an article collected in the health subcorpus was tagged with 'Livestock health', for example. Similarly, article categories may be lacking: Figure 3.1 is tagged only with MENINGITIS, and thus is not included in our health subcorpus. More obviously, 1963 articles had not been classified this way, and thus do not feature in the three topic subcorpora.

4. A key cause of incorrect parsing is non-standard language (perhaps regional, colloquial, etc.). Examples of this kind of language in news publications are interesting in their own right, but due to misannotation, are likely to go unfound during corpus interrogation, and thus unanalysed.In our case, this problem was exacerbated by the fact that time contraints precluded a manual scoring of parser accuracy.

5. The mode dimension, responsible for reflexively organising language into comprehensible sequences, remains largely static between print news micro-genres, though mode features are likely to be at risk when news is transmitted via different media

6. Though role relationships between journalists and their readership have undergone significant shifts (especially since the popularisation of online news), charting these changes falls largely outside the scope of this project.

7. The corpus contained too few modalised risk predicators for analysis of longitudinal change in modalisation.

8. Though we are focussed on corpus-assisted investigation at present, indeed the dataset under investigation is of size and scope as to be of interest to corpus-driven researchers, language and media specialists, etc., and indeed, such projects are forthcoming.

9. Lemmatisation is the process of counting the base forms of tokens, rather than the token itself. *Taken* would be classified under *take*, for example. While lemmatisation is not *always* the best option, as it can collapse different parts of speech, tense information, etc., it is certainly appropriate when determining the most common predicators, etc.

10. We need only to look at the number of lines of code needed to develop an accurate tokeniser and an accurate grammatical structure parser to understand the reasons why lexis appears as the de-facto centre of CL/CADS today

11. Modification through embedded clauses (*the children who were at risk*) has been left out for reasons of scope.

12. *Take* and *run* are removed from the object column here, as *take risk* and *run risk* are considered risk processes.

13. Though the filtering out of titles and given names collapses the distinction between Bushes and Clintons, we can still reasonably infer which was being spoken about at which, and doubt can be eliminated by concordancing

14. A key issue in CADS is the ability to systematically account for rank-shifted meanings (See McDonald, Forthcoming).

15. This naturally depends on your definition of a word/token. If we removed hyphenates or tokens containing a slash (*risk/reward*), the list would be dramatically reduced in size. Lemmatisation would compress this list even more.

16. Future research will centre on unpacking the kinds of agents involved in healthcare risks of HIV, AIDS, Vioxx, etc.)

17. Indeed, this is aligned with recent changes to the frame semantic conceptualisation of risk. At the time of writing the FrameNet entry for *run risk* included the following caveat: '*NOTE: This Frame is currently in the process of being changed so that some instances of at risk.n will be moved to the* $Being_at_risk frame, and some will be moved to the Risky_situation frame. In the Being_at_risk$

18. Current systems for automatic systemic functional annotation tend to rely on dependencies generated with Stanford CoreNLP

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