# Risk, language and discourse

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This doctoral thesis consists of an introduction and Articles 1-5.

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**Article 3:** Boholm, M. 2009. Risk and causality in newspaper reporting. *Risk Analysis* 29(11): 1566-1577.

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# Abstract

This doctoral thesis analyses the concept of risk and how it functions as an organizing principle of discourse, paying close attention to actual linguistic practice.

Article 1 analyses the concepts of risk, safety and security and their relations based on corpus data (the Corpus of Contemporary American English). Lexical, grammatical and semantic contexts of the nouns *risk*, *safety* and *security*, and the adjectives *risky*, *safe* and *secure* are analysed and compared. Similarities and differences are observed, suggesting partial synonymy between *safety* (*safe*) and *security* (*secure*) and semantic opposition to *risk* (*risky*). The findings both support and contrast theoretical assumptions about these concepts in the literature.

Article 2 analyses the concepts of risk and danger and their relation based on corpus data (in this case the British National Corpus). Frame semantics is used to explore the assumptions of the sociologist Niklas Luhmann (and others) that the risk concept presupposes decision-making, while the concept of danger does not. Findings partly support and partly contradict this assumption.

Article 3 analyses how newspapers represent risk and causality. Two theories are used: media framing and the philosopher John Mackie's account of causality. A central finding of the study is that risks are "framed" with respect to causality in several ways (e.g. one and the same type of risk can be presented as resulting from various causes). Furthermore, newspaper reporting on risk and causality vary in complexity. In some articles, risks are presented without causal explanations, while in other articles, risks are presented as results from complex causal conditions. Considering newspaper reporting on an aggregated overall level, complex schemas of causal explanations emerge.

Article 4 analyses how phenomena referred to by the term *nano* (e.g. nanotechnology, nanoparticles and nanorobots) are represented as risks in Swedish newspaper reporting. Theoretically, the relational theory of risk and frame semantics are used. Five main groups of nano-risks are identified based on the risk object of the article: (I) nanotechnology; (II) nanotechnology and its artefacts (e.g. nanoparticles and nanomaterials); (III) nanoparticles, without referring to nanotechnology; (IV) non-nanotechnological nanoparticles (e.g. arising from traffic); and (V) nanotechnology and nanorobots. Various patterns are explored within each group, concerning, for example, what is considered to be at stake in relation to these risk objects, and under what conditions. It is concluded that Swedish patterns of news-

paper reporting on nano-risks follow international trends, influenced by scientific assessment, as well as science fiction.

Article 5 analyses the construction and negotiation of risk in the Swedish controversy over the use of antibacterial silver in health care and consumer products (e.g. sports clothes and equipment). The controversy involves several actors: print and television news media, Government and parliament, governmental agencies, municipalities, non-government organisations, and companies. In the controversy, antibacterial silver is claimed to be a risk object that negatively affects health, the environment, and sewage treatment industry (objects at risk). In contrast, such claims are denied. Antibacterial silver is even associated with the benefit of mitigating risk objects (e.g. bacteria and micro-organisms) that threaten health and the environment (objects at risk). In other words, both sides of the controversy invoke health and the environment as objects at risk. Three strategies organising risk communication are identified: (i) representation of silver as a risk to health and the environment; (ii) denial of such representations; and (iii) benefit association, where silver is construed to mitigate risks to health and the environment.

# Svensk sammanfattning

Avhandlingen analyserar begreppet risk och hur detta begrepp strukturerar diskurs. Ett centralt intresse för analysen är faktisk språkanvändning.

I den första artikeln analyseras de engelska begreppen *risk*, *safety* and *security* och deras relation. Analysen bygger på korpusdata (the Corpus of Contemporary American English). Lexikala och grammatiska kontexter för substantiven *risk*, *safety* och *security* och adjektiven *risky*, *safe* och *secure* analyseras och jämförs. Både likheter och skillnader identifieras vilka i stort bekräftar att *safety* (*safe*) och *security* (*secure*) är synonymer och i sin tur motsatser (antonymer) till *risk* (*risky*). Studien stödjer flera tidigare antaganden om dessa begrepp inom forskningslitteraturen, men motsäger andra.

I den andra artikeln analyseras de engelska begreppen *risk* och *danger* och deras relation baserat på korpusdata (the British National Corpus). Ramsemantik (eng. *frame semantics*) används för att undersöka antagandet att begreppet *risk* förutsätter beslutsfattande, medan begreppet *danger* inte gör det. Studien stödjer delvis detta antagande, men visar också på problem med antagandet.

I den tredje artikeln analyseras hur nyhetspress framställer risk och orsakverkansamband (kausalitet). Två teorier används. För det första används teorin om medias "inramning" av händelser (eng. *media framing*). För det andra används filosofiska perspektiv på kausala beskrivningar. En huvudsaklig slutsats är att risker framställs på många olika sätt med avseende på kausalitet. Exempelvis kan en och samma risk framställas som ett resultat av flera olika orsaker. Vidare framställer nyhetspress riskers kausalitet med olika grader av komplexitet. I vissa tidningsartiklar presenteras risker utan några kausala förklaringar. I andra tidningsartiklar presenteras risker som resultat av komplexa orsak-verkansamband. Om man betraktar nyhetsrapporteringen om risker på en övergripande nivå, så framträder en komplex bild av riskers orsakssamband.

I den fjärde artikeln analyseras framställningar av fenomen som benämns med morfemet *nano*, exempelvis nanoteknologi, nanomaterial och nanorobotar. Frågan som besvaras är på vilket sätt sådana fenomen framställs som risker i svensk nyhetspress. Teoretiskt utgår studien från den relationella teorin om risk och ramsemantik. Baserat på vilka fenomen som framställs som riskobjekt (eller hot) i tidningsartiklar, identifieras fem grupper av nanorisker: (I) nanoteknologi, (II) nanoteknologi och dess produkter (t.ex. nanopartiklar och nanomaterial), (III)

nanopartiklar (utan referens till nanoteknologi), (IV) nanopartiklar som inte är resultat av nanoteknologi (utan istället uppstår t.ex. i trafiken) och (V) nanoteknologi och nanorobotar. För varje grupp undersöks vidare mönster i framställningen av dessa risker, exempelvis, vad som beskrivs som hotat av dessa riskobjekt och under vilka förutsättningar. Studiens empiriska observationer stödjer tidigare forskning om hur nanorisker rapporteras i nyhetspress internationalt. Rapporteringen av nanorisker är influerad av vetenskapliga riskbedömningar, men också av science fiction.

I den femte artikeln analyseras en kontrovers kring användningen av antibakteriellt silver inom sjukvården och i konsumentartiklar som exempelvis träningskläder och sportutrustning. Fokus för artikeln är hur risker uppfattas i den svenska debatten som inbegriper nyhetsmedia (press och TV), regering och riksdag, myndigheter, kommuner, intresseorganisationer och företag. Vissa aktörer menar att silver är ett riskobjekt som påverkar olika värden på ett negativt sätt, till exempel, folkhälsan, miljön, och avloppsreningsindustrin. Andra aktörer förnekar dessa påståenden. De menar till och med att silver har fördelar som att motverka risker som hotar folkhälsan och miljön. Med andra ord åberopar båda sidorna av kontroversen hälsa och miljö som värden viktiga att skydda. Slutligen identifieras tre strategier för riskkommunikation som tillämpas i kontroversen: (i) framställningen av silver som en miljö- och hälsorisk, (ii) förnekande av dessa påståenden, och (iii) nyttoassociationer där silver framställs som något som motverkar miljö- och hälsorisker.

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# Contents

# 1  Introduction

The concept of risk enables an organised and organizing structure for communication and thought that has proven to be both popular and useful in today's society. According to social theory, there is in modern society an increased attention towards risks (Beck, 1992 [1986]; Giddens, 1991; Luhmann, 1993; Rosa, Renn, & McCright, 2014). Risks are of central interest to many societal actors, for example, the media, politicians, public administrators, companies, stockbrokers, scientists, and non-government organizations (NGOs).

Societal reasons for attending to risks are many. For sure, attention to risk is motivated by survival. In order to successfully handle our everyday lives, we need to plan for and manage an uncertain future, potentially holding unwanted paths. Other reasons derive from a desideratum of responsible, ethical and fair societal progress, in light of technological innovation, natural disasters (such as floods and earthquakes), climatic change, disease, crime, and terrorism. More generally, attention to the risks in society is motivated by awareness that political (in)action can have negative effects on humans and their environment (Beck, 1992 [1986]; Luhmann, 1993). No doubt, additional reasons for societal attention to risks include plain sensationalism and fascination for the dread factor of many risk issues.

In the recognition of the contingency and uncertainty of life, a differentiated and specialized conceptual apparatus has emerged. In language, lexical means of speaking, writing and thinking of potential and uncertain negative outcomes of human action, as well as natural processes, have been developed. The word *risk* and related terms, such as *danger*, *hazard*, *peril*, and *venture*, which all have "reference to *the possibility of an unwelcome outcome*" (Fillmore & Atkins, 1992, p. 79, italics in original) are specialized means to do so. Antonyms such as *safety* and *security* extend the list of words associated with a meaning of potential adversity.

With the word *risk* and its "neighbours" we can address uncertainty and potentially adverse futures. However, this vocabulary is not only "reactive" – it is not only a response to socio-cognitive needs of expression. Well in place, such a vocabulary can function to reinforce and preserve a way of thinking. It focuses on certain aspects of reality, rather than others. A *risk* vocabulary helps to re-produce attention to the contingency and misfortune of life. To conceive of an event in terms of risk, implies a certain frame by which the event is understood (Fillmore & Atkins, 1992, 1994). From that perspective, some elements of events emerge as sali-

ent (while others are not). Certain objects, processes and relations of events are understood in ways specified by the frame, fulfilling specific roles. Minimally, conceiving of an event in terms of risk involves identification of something potentially affecting something else in a negative way.

Risk research is the multidisciplinary study of risk, addressing topics such as how risks should be analysed and assessed, how they are perceived and understood, and how they are and should be communicated and managed. Disciplines that have been central to this field of study include engineering, statistics, mathematics, decision theory, psychology, philosophy, sociology, political science and media studies. Of the many scholarly facets of risk research, linguistics has so far only played a minor role. Despite massive interest in the concept of risk and communication about risk, few attempts have been made at systematic approaches informed by linguistic theory, paying close attention to actual language use. Important findings and theoretical contributions, like the frame semantic account of *risk* (Fillmore & Atkins, 1992, 1994), are not widely recognised within risk research. Indeed, this ignorance is mutual in that linguistic work on *risk* seldom acknowledges risk research; see Hamilton, Adolphs, and Nerlich (2007) for a notable exception.

The lack of systematic linguistically oriented approaches in risk research is unfortunate. Arguably, the concept of risk is highly abstract and is made available and maintained only through our linguistic ability. Risk communication and the controversies over risk issues (something that has interested so many scholars of risk research) are realized through language. Although risk communication can be non-verbal (e.g. images and diagrams), it is dominated by linguistic behaviour. Still, there has only been quite limited detailed attention directed at the linguistic structures underlying the concept of risk and its realization in discourse. Although the importance of language is indeed occasionally recognized, an accompanying systematic linguistic approach, focusing on the details of linguistic practice, is often lacking. The combination of linguistic theories with theories of risk research promises a way of analysing socio-cognitive understandings of risk issues as well as the very concept of risk itself.

# 2 Aim

This doctoral thesis aims to analyse the concept of risk and how it functions as an organizing principle of discourse. More precisely, this aim is pursued through five empirical studies, which can be divided into two groups:

A. The first two studies are detailed linguistic analyses of how the word *risk* is actually used with regard to meaning and grammar and how this use relates to the antonyms *safety* and *security* (Article 1) and the synonym *danger* (Article 2). Empirical material for Article 1 and 2 comes from corpus data and the focus is on the immediate linguistic context (phrase and sentence level) of the nouns *risk*, *safety*, and *security* as well as the adjectives *risky*, *safe* and *secure*, in Article 1, and *risk* (noun and verb), *danger* and *endanger*, in Article 2.

B. The last three studies of this thesis are analyses of discourses on specific risk issues and how the concept of risk contributes to their organization.

- Article 3 focuses on risk issues identified by newspapers in relation to the geographical area of the Göta Älv river valley. Göta Älv River is located in the south west of Sweden, connecting Sweden's largest lake with the sea. It is used for drinking water and transportation, and many industries are located on its banks, but the geology of the area contributes to the river valley of Göta Älv being one of Sweden's most frequent locations for landslides. In relation to this geographical area and its associated activities, a number of risk issues have been raised.
- In Article 4, the risk issue studied is that of nanotechnology, and related phenomena, for example, nanoparticles and nanoproducts. Nanotechnology is often defined as the study and manipulation of matter at a scale of less than 100 nanometres (a nanometre is a billionth part of a meter).
- In Article 5 the risk issue under investigation is the use of silver (including nanoparticles of silver) for antibacterial purposes in health care and in consumer products.

In Articles 3-5, the empirical focus is not limited to the immediate linguistic context of specific words. Instead, the focus is on the larger linguistic element of text (partly identified by containing the word *risk*). More precisely,

these risk issues are explored through newspaper articles (Articles 3, 4 and 5), but also through material from TV news, the government, parliament, municipalities, companies and NGOs in the case of Article 5. These studies illustrate how the concept of risk interacts with causal explanations (Article 3) and how it contributes to the organization of controversy (Article 5).

The twofold aim of this thesis – A and B – follows a distinction between the concept of risk as an abstract organizing principle for thought and communication, and risk issues which are the result of applying the risk concept to specific situations (Å. Boholm, 2003).

# 3 Theoretical background

## 3.1 Meanings of *risk*

Like most words of natural language, the noun *risk* is polysemous, i.e. it has several related meanings. In ordinary speech and writing, *risk* has three main meanings (Hansson, 2011, 2013):

(i)    a potential (or uncertain) unwanted event or situation,
(ii)   the source of potential (or uncertain) unwanted event or situation, or
(iii)  the probability of a potential (or uncertain) unwanted event or situation.

These three senses of *risk* are exemplified below (invented examples):

(1)    lung cancer is a risk for smokers [sense (i)]
(2)    smoking is a risk [sense (ii)]
(3)    for people who smoke, there is an increased risk of cancer compared to non-smokers [sense (iii)]

Apart from being a term of ordinary language, *risk* has been used with a variety of meanings in academic discourse. For example, Aven and Renn (2009) identify ten common, but different, definitions of *risk* in the risk research literature. To different

extents, academic treatments of the term *risk* correspond with its use outside of technical discourse. Often, *risk* is defined stipulatively to serve some theoretical purpose with little or no relation to existing uses of the term in ordinary language. Sometimes, however, ordinary uses of *risk* are acknowledged and definitions are construed to capture such uses (Aven & Renn, 2009; Hansson, 2013; Rosa, 1998). Unfortunately, too often the scope and aim of defining *risk* is not made explicit, leaving any evaluation (or appreciation) of the definition unattainable.

In policy and academic literature, *risk* is commonly defined along the lines of (iii) above (for discussions, see Aven & Renn, 2009; Hansson, 2011, 2013). For example, Graham and Wiener (1995, p. 30) define risk as "the probability of an adverse outcome" and the Royal Society (1983, p. 22; 1992, p. 2) defines risk as "the probability that a particular adverse event occurs during a stated period of time, or results from a particular challenge".

Rosa (1998) offers another example of a definition of *risk* that parallels ordinary language use. Corresponding to the first sense above (i.e. (i)), it reads: "[r]isk is a situation or event where something of human value (including humans themselves) has been put at stake and where the outcome is uncertain" (Rosa, 1998, p. 28). In later accounts (Rosa, 2003, p. 56; 2010, p. 240), the phrasing "has been put" has been replaced by "is".

As noted by Hansson (1989, 2013), definitions of *risk* often handle the polysemy of *risk* poorly. In a recent example, Rosa et al. (2014, p. 21) defines *risk* along the lines of Rosa (1998, 2003, 2010) (as described above), but later in the book we can read that "the expectation is that rational humans will take actions—such as avoiding tobacco smoke or wearing seatbelts—because it lowers their health and safety risks" (Rosa et al., 2014, p. 49). The use of *risk* in the quotation fits poorly with the author's own definition of the term. Rather, *risk* in the quotation is used to mean probability, i.e. sense (iii) identified above.

Besides definitions of *risk* that roughly correspond to any of the three ordinary uses distinguished above (i-iii), three additional (groups of) definitions are common. First, definitions of risk are commonly based on a combined measure of the probability of an unwanted event, cf. sense (iii) above, and a quantification of the expected severity (or magnitude) of the unwanted event (for discussion, see Aven & Renn, 2009; Hansson, 2011, 2013). Thus, essential to this definition is not only a quantification of probability (based, for example, on observed frequencies of similar events in the past), but also a quantification of the magnitude of the un-

wanted event, sometimes referred to as the "consequences" (based on measurable losses, for example, numbers of deaths or monetary cost). This idea of risk is sometimes formalized by the formula "R=P x C" (e.g., Ale, 2009, p. 7), where *R* stands for risk, *P* for probability and *C* for consequences. A related, but more sophisticated and mathematically elaborated version of this way of defining risk can be found in Kaplan and Garrick (1981).

Second, risk is defined as exposure to a hazard (e.g., Chicken & Posner, 1998; Latter, 1985; van Leeuwen, 2007). Sometimes, definitions in terms of exposure are combined with that of probability, as in "[r]isk is the actual exposure of something of human value to a hazard and is often measured as the product of probability and loss" (K. Smith, 2012 [1991], p. 11). Underlying these definitions is the idea that hazards are potential sources of loss (cf. the second sense of *risk* above) and that risks emerge when something of value is exposed to the hazard. Following this line of reasoning potentially harmful substances (i.e. hazards) kept safe are not risks.

Third, in decision theory, following the work of Frank H. Knight (1964 [1921]), *risk* is defined in terms of known probabilities, or "measurable uncertainty", and is contrasted to *uncertainty*, which is defined in terms of unknown probabilities, or "unmeasurable" uncertainty (see Hansson, 2011). Knight (1964 [1921], p. 233) writes that "[t]o preserve the distinction [...] between the measurable uncertainty and an unmeasurable one we may use the term 'risk' to designate the former and the term 'uncertainty' for the latter". Based on Knight, Hansson (2011) identifies another meaning (or definition) of *risk* then, namely: "the fact that a decision is made under conditions of *known probabilities*". We should note that Knight (1964 [1921], p. 233) declares that his definition differs from ordinary uses of the term.

To the list of definitions of *risk* discussed above we could, no doubt, add others. However, the ones discussed above are arguably the most common ways in which risk has been understood in the risk research literature.

On a general level, true of most conceptions of risk discussed above, the concept of risk presupposes two conceptual elements, or "minimal characteristics" (Hansson, 2010): first, the concept of risk presupposes evaluation, i.e. a recognition that some value is at stake, and, second, it presupposes potentiality, which results in uncertainty (Å. Boholm & Corvellec, 2011; Garland, 2003; Hansson, 2010, 2011, 2013; Hilgartner, 1992; Möller, 2009, 2012; Renn, 1998, 2008; Rescher, 1983; Rosa,

1998, 2003, 2010; Shrader-Frechette, 1991).[1] We can use an illustration from Hansson (2010, p. 235) to clarify this: "when we talk about the risks associated with a surgical procedure we refer to that which may go wrong. The expected positive effects of the surgery are not called 'risks'". Furthermore, "[a] surgeon preparing a patient for a transfemoral amputation will probably talk to him about the risk of phantom limb phenomena. However, she will not talk to him about the 'risk' of losing his leg. Since that is a certain effect of the surgery, it is not counted as a risk" (Hansson, 2010, p. 235). In risk research these two minimal characteristics are not always recognised, as frequent discussions over whether risks are objective *or* subjective seem to indicate. To this we now turn.

## 3.2 Objective or subjective?

In the risk literature there has been a massive discussion about whether risks are objective *or* subjective (see, e.g., Bradbury, 1989; Otway & Thomas, 1982). Exactly how to understand the distinction between subjectivity and objectivity is far from generally agreed upon in philosophy. I will here adopt a version of the distinction that is common in risk research. According to an objectivist understanding, risk is (only) about objective facts independent of subjective experience and evaluations. According to a subjectivist understanding, risk is (only) about subjective experience and evaluations independent of objective facts (cf. Bradbury, 1989; Hansson, 2010; Otway & Thomas, 1982; Rosa et al., 2014).

To some extent, the schism between the two positions has been an exaggerated straw men controversy. True advocates of understanding risk as *only* objective, as a matter of fact having no subjective features, as well as advocates of understanding risk as *only* subjective, as a matter of subjects' values with no objective features, are harder to find than what is to be expected given the enormous interest devoted to the objective-subjective distinction within the academic field of risk research.[2] On the one hand, the concept of risk presupposes values. Without subjects

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[1] Of the definitions discussed, Knight's definition stands out. It does not imply a value at stake. Furthermore, the contingency involved in *risk* is supposed to be "known" in terms of its probability, in contrast with *uncertainty* where the probability is unknown. Therefore, there is for Knight a deeper lack of knowledge associated with *uncertainty* than with *risk*.

[2] However, see, for example, Slovic (2000, p. 392) who writes "… there is no such thing as 'real risk' or 'objective risk'". Another example is Ewald (1991, p. 199): "Nothing is a risk in itself; there is no

having preferences over what is more or less valuable, there are no risks; the meaning of the term *risk* in ordinary language as well as in most expert discourse presupposes evaluation. On the other hand, risks seem to be real. People face unwanted events. They die from diseases, accidents and malicious acts. Statistically, certain modes of transportation are more likely to result in death and injury than others (based, for example, on empirical observations of past events). So, although the concept of risk presupposes an act of evaluation, this socio-cognitive process of construction is not isolated from the physical world (conceived as independent of our psychological and sociological existence), but, on the contrary, attributed to it. What is, and what is not, a "risk", is not something that is (completely) up for grabs; it is not something the social subject can construct anyway s/he wishes. Rather, the concept of risk is a structured cognitive tool by which potential adversity (an evaluation), its probability and causes are attributed to an external mind-independent reality (at least, what is believed to be an external mind-independent reality). This idea that the concept of risk presupposes *both* fact and value – that risk *essentially* is both subjective and objective – is by Hansson (2010) termed "the dual risk thesis" (cf. also Shrader-Frechette, 1991).

The work of Möller (2009, 2012) can help us to substantiate the dual risk thesis. Möller (2009, 2012) uses the analytical notion of "thick concepts" to deepen our understanding of risk (for general discussions of thick concepts see, for example, Eklund (2011), Kirchin (2013), and Väyrynen (2013)). In language we have "descriptive terms" that pick out factual entities, processes, properties and relations of the world, for example, *tree* (a noun referring to an entity), *burn* (a verb referring to a process), *bark-covered* (an adjective referring to a property) and *larger than* (an adjective phrase referring to a relation). In addition, we have evaluative terms that do not seem to pick out factual phenomena, but rather express some attitude or emotion (evaluation). Paradigmatic examples would be interjections, such as *yuck*, *wow*, *yippee*, *hurrah*, and *bleh*, which seems to express nothing over and above the speaker's (dis)liking of something. Other candidates for such purely evaluative terms are suggested to be found in the domains of ethics and aesthetics, for example, *good*, *bad*, *wrong*, *right*, *ugly*, and *beautiful*. These terms express positive (e.g. *good*, *right*, *beautiful*) or negative (e.g. *bad*, *wrong*, *ugly*) values (evaluations), not facts. Such

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risk in reality. But on the other hand, anything *can* be a risk; it all depends on how one analyses the danger, considers the event".

evaluative terms have therefore been discussed as lacking "descriptive" content, having only normative (evaluative) content.[3]

In addition to non-evaluative descriptive (factual) terms and evaluative (normative) terms a third category presents itself when confronting natural language. This is the category of terms that have both descriptive and evaluative content. Examples that interested philosophers are: *coward*, *glamorous*, *lewd*, *reliable*, and *rude*. These terms seem not to be purely descriptive, nor purely evaluative, but rather represent concepts incorporating both descriptive *and* evaluative elements.

The suggestion by Möller (2009, 2012), which is accepted here, is that *risk* and related terms extend the list of thick concepts present above; *risk* is a term with both descriptive and evaluative content. Renn (1998, p. 51) makes a similar claim (without reference to thick concepts): "Risk is … both a descriptive and normative concept".

Another point can be made in relation to the distinction between subjective and objective risk, although this point has no direct relevance for the dual risk thesis. The point to be made is that many values are shared among different individuals within and across cultures and societies. A few values may even be shared to the extent that they can be considered universal (the value of life, for example). The generality (or even universality) of some values often results in them being "non-controversial" and taken for granted (Hansson, 2010). For example, although life and death is understood in many different ways around the globe, a culture which ignores survival and the value of life is yet to be seen (or extinct). The commonality (or "sharedness") of some values associated with some risks can result in a (false) sense of objectivity, due to a state of *inter*-subjectivity. This perhaps explains claims that risk is (fully) objective.

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[3] The term *descriptive* is indeed unfortunate, since, as Kirchin (2013, p. 4) writes, "we can certainly use [e.g.] 'good' to *describe* many things" (italics added). So, how then shall we address the distinction? Which pair shall we use? Several candidates are suggested: for example, *evaluative—non-evaluative*; *evaluative—descriptive*; *evaluative—factual*; *evaluative—non-evaluative descriptive*; and *normative—descriptive*. This is not merely a terminological problem, but reflects a conceptual issue at the very core of this discussion, namely what, exactly, is the nature of the difference, between terms like *tree* and terms like *good*?

## 3.3  Distinctions

In risk research, it is popular to distinguish the concept of risk from other (related) concepts. First, risk is frequently separated from hazard. In such distinctions risk is considered to be the probability of a hazard, which is considered to be an unwanted event independent of any likelihood associated to it (e.g., Löfstedt, 2011). Alternatively, as we have seen above, risk is sometimes considered to be a state of exposure to a hazard. Accordingly, a hazard is an object, event or situation with potential negative consequences, while a risk is a situation in which a person (or asset) is actually exposed to that object, event or situation (e.g., K. Smith, 2012 [1991]). Yet another distinction between risk and hazard is based on conceiving hazards as the causes (or sources) of unwanted events, i.e. risks (according to this way of doing the distinction) (e.g., Cohrssen & Covello, 1989; Kaplan & Garrick, 1981).

Related to the word *hazard* is the word *danger*. Some authors consider the terms to be synonyms (e.g., Ale, 2009). If considered to be synonyms, the distinctions between risk and hazard may be considered equally relevant for the relation between risk and danger. In his theoretical work on risk, Luhmann, however, introduces another way of distinguishing risk from danger. Note that Luhmann (1991) writes in German and there uses the word *Gefahr*, which in the English translation (Luhmann, 1993) has become *danger*. In the work of Luhmann (1993), risk is distinguished from danger in terms of decision-making; risk is the result of decisions, while dangers are not. For a more detailed discussion of Luhmann's distinction, see Article 2 of this thesis.

As we mentioned above, in decision theory, *risk* is contrasted with *uncertainty*, where the former denotes a decision situation with known probabilities (or "measurable uncertainty") and the latter a situation where the probabilities are unknown (or unmeasurable) (Hansson, 2011; Knight, 1964 [1921]).

In their work on the concept of safety, Möller, Hansson, and Peterson (2006) discuss two divergences in semantic content between the words *risk* and *safety*. First, the nature and severity of the unwanted event seems to influence our conceptions of risk and safety differently. According to Möller et al. (2006), the terms *safety* and *safe* seem to be inappropriate to use in cases of trivial, but unwanted events, such as drawing a blank in a lottery. (In parallel, we, however, need to consider the tendency of referring to such a situation as a *risk*, or *risky*.) Second, epistemic uncertainty is fundamental to safety but not for standard conceptions of risk (Möller et

al., 2006). A thought experiment is suggested to illustrate this point. Imagine two scenarios which both concern crossing a bridge in the jungle. In scenario A the innkeeper in a nearby village assesses the likelihood of the bridge breaking down to be one in ten thousand. In scenario B, a team of engineering scientists has examined the bridge and assesses the likelihood of breakdown to be one in five thousand. While the risk (in the sense of probability as well as in the sense of expected value) is higher in scenario B than A (twice as high probability for the same adverse outcome), it is according to Möller et al. (2006) not unreasonable to consider scenario B as the safer one.

Möller et al. (2006) take these semantic differences as reasons for not simply considering *safety* as the antonym of *risk*. Rather the two terms have different orientations with regard to severity and epistemic uncertainty. With regard to uncertainty, Aven (2009) disagrees with the analysis of Möller et al. (2006). According to Aven, uncertainty is an essential component of the concept of risk. Following such a definition, he, contra Möller et al. (2006), concludes that the concepts of risk and safety do not diverge with respect to uncertainty and therefore safety is the antonym of risk.

Related to the concept of safety is the concept of security. In dictionaries, the two words are often considered to be synonyms (Devlin, 1987 [1938]; Fergusson, 1992; Manser, 2005; *The Oxford dictionary of synonyms and antonyms*, 2007). In the academic literature however, the terms are distinguished in terms of (i) intentionality, (ii) the system theoretic divide between a system and its environment, and (iii) the immediacy of cause-effect relations. According to the first distinction, safety concerns accidents (unintentional harm), while security concerns intentional harm (e.g. terrorist attacks, and computer infringement). According to the second distinction, safety concerns a system harming its environment, while security concerns the environment harming the system. Following the third distinction, safety concerns immediate harmful effects, while security concerns indirect harmful effects, due to some intermediate cause. The relation between the concepts of risk, safety and security is explored in more detail in Article 1 of this thesis.

These distinctions are typically theoretically motivated apart from actual linguistic application of these terms. They are therefore variously well fitted to explain actual use of these terms (risk, hazard, danger, uncertainty, safety, security). Take, for example, the conception of hazard as the source of an unwanted event, *in contrast with risk*. This assumption fits badly with natural language data. As we

discussed above, one of the common senses of risk is that of a cause, or source, of an unwanted event. Therefore, to *distinguish* risk from hazard in this way is unsuccessful. In Articles 1 and 2 of this thesis, the relevance of some of these theoretical distinctions is explored with regard to natural language data.

## 3.4 Risk communication

Risk communication can be defined as the process of sharing information about risk. Two remarks are required in relation to this definition. First, I use *information* in a wide and neutral sense, not exclusively to denote true factual propositions, but also to include misrepresentations, as well as emotional and attitudinal content (see, e.g., Hirsch, 1989, pp. 24-25). Second, the verb *share* is preferred to verbs such as *transfer* in the definition in order to emphasize the active role of both "senders" (e.g. speakers) and "recipients" (e.g. listeners) in communication. Recipients are often both cognitively and behaviourally active in a communicative event: first, messages of communication require interpretation, which is an active process; second, in conversation recipients continuously show their reactions to the messages of senders through various feedback expressions (head movements like nods, and short words like *yeah*, *OK*, and *uhm*), so called "active listening".

The process of risk communication engages a variety of actors in society, such as government officials, scientific experts, company representatives, journalists and NGOs, as well as a long list of other ("affected") social categories, including citizens, the public, affected stakeholders, patients, risk groups (individuals "at risk"), workers, and consumers. Furthermore, risk communication can be realized by a variety of means and in a variety of settings; for instance, public meetings, government reports, information brochures, video instructions, warning signs, newspaper reporting, TV news broadcasts and spontaneous informal conversations between friends and colleagues.

Although risk communication can be defined in a quite wide sense, risk communication studies often focus on two main topics. First, there has been an interest in communication between pairs of actors having asymmetric relations in terms of power and responsibility (Hayenhjelm, 2006), for example, experts and lay people, the government and the public, and company and consumer. Often, the overarching communicative aim of the first actor of these pairs is to change what is considered to be the risky behaviour and attitudes of the latter, or to resolve conflict that it assumes to be due to misunderstandings or disagreement.

Early on, the controversial nature of much risk communication was recognized (Edwards & von Winterfeldt, 1987; Johnson, 1987; Kasperson, 1986; Keeney & von Winterfeldt, 1986; Otway, 1987; Otway & Wynne, 1989; Plough & Krimsky, 1987; Stallen & Coppock, 1987). There are several case studies that illustrate risk communication gone wrong (Å. Boholm, 2009; Flynn, Slovic, & Mertz, 1993; Leiss, 2001; Löfstedt & Renn, 1997; Stratman, Boykin, Holmes, Laufer, & Breen, 1995). Since risk communication originates from different actors holding different assumptions and interests, risk discourses can contain incompatible standpoints regarding what is dangerous, what is not, what counts as scientific evidence, whom to trust, who is responsible and accountable, what the appropriate actions might be, what values are at stake, and what the just and fair procedures and formats for decision-making are (Å. Boholm, 2009; Covello & Sandman, 2001; Endres, 2009; Kasperson, 1986; Otway & Wynne, 1989; Renn, 1992).

The divergence between how experts and the general public understand risks has been a longstanding topic of risk research (Slovic, 1987; Starr, 1969). It has resulted in attempts to bridge this gap by educating and informing the public and affected stakeholders about expert risk assessments. However, this "educational" approach to risk communication is often discredited today in favour of more deliberative and genuinely inclusive communicative processes. To achieve "effective" risk communication (Kasperson, 1986; Leiss, 2004; Rohrmann, 1992) and to reduce controversy, a number of recommendations to experts, governments and decision-makers have been suggested in the literature, for example: facilitate participation and treat the public as a genuine partner, engage in genuine two-way communication, listen, be honest, frank, open and transparent, meet the needs of the media, avoid technical language, speak clearly, use simple, graphic and concrete material, attend to citizens' information needs and actual concerns, acknowledge and explain uncertainties, account for and recognize (different) values, and encourage feedback (e.g., Covello & Sandman, 2001; Fischhoff, 1995; Johnson, 1987; Kasperson, 1986; Keeney & von Winterfeldt, 1986; Leiss, 2004; Morgan, Fischhoff, Bostrom, & Atman, 2002; Otway, 1987; Renn, 1992).

A second main topic of interest in risk communication studies is the role of the media (especially news media) in conveying information about risks (e.g., Allan, Adam, & Carter, 2000; Hughes, Kitzinger, & Murdock, 2006; Kitzinger, 1999; Mazur, 1994, 2006; Murdock, Petts, & Horlick-Jones, 2003; Rowe, Frewer, & Sjöberg, 2000; Singer & Endreny, 1993). This interest has partly been motivated by

the assumed agenda setting role of the media and its role in forming public opinion (af Wåhlberg & Sjöberg, 2000; Kasperson et al., 1988; Kitzinger, 1999; Mazur, 1990, 2006; Rowe et al., 2000). Critically assessed, the content of news media is often accused of simplification, over- and under-estimation of real risks, and uncalled-for scares (Hughes et al., 2006; Kitzinger, 1999; Singer & Endreny, 1993). Not primarily motivated by scientific accuracy, news media reporting functions by a "media logic" (Altheide & Snow, 1979). Rather, the aim for entertainment, through appeal to sensationalism, controversy and fear, interact (or compete) with aims to provide an objective description of events, given a tight time schedule (Kitzinger, 1999).

## 3.5  Analysis of risk discourse

Risk communication produces risk discourse, that is, a set of representations related by their shared reference to risk (following the definition of *discourse* to be developed below, section 4.5). The academic field of risk communication holds both normative work on how risks should be communicated (as outlined above) and empirical work on how risk is actually communicated. Such empirical work studies the structure and content of risk discourses and can take many forms. As will be noted below (section 4.5) risk discourses overlap with other discourse types. Risk discourses are always instantiated through some medium and communicative event, for example: doctor-patient interactions (e.g., Adelswärd & Sachs, 1998; Hoffmann, Linell, Lindh-Åstrand, & Kjellgren, 2003; Jones, 2013; Linell, Adelswärd, Sachs, Bredmar, & Lindstedt, 2002; Sarangi, Bennert, Howell, & Clarke, 2003; Sarangi & Clarke, 2002), project meetings (e.g., Å. Boholm, 2010; Karlsson, 2009), information brochures administered by the government on, for example, radon (Atman, Bostrom, Fischhoff, & Morgan, 1994) or breast cancer (Davis, 2008), parliamentary bill proposals (motions) (Sjöberg, af Wåhlberg, & Kvist, 1998), warning signs (Corvellec, 2011), literature (Heise, 2002; Mairal, 2011; Manning, 1999), newspaper articles, focusing on textual content (e.g., Rowe et al., 2000), but also visual material (e.g., Å. Boholm, 1998b), television news reporting (e.g., Driedger, 2007; Singer & Endreny, 1993), and internet-based social media (Richardson, 2003), such as Twitter (Binder, 2012) and Facebook (Ledford & Anderson, 2013).

Moreover, on a meta-methodological level we can distinguish between two basic approaches to the study of risk discourses: first, studies that are interested in risk as an analytical category of the empirical material (and how this contributes to

the formation of discourse), and second studies that lack such an interest. The latter category consists of studies of how some specific phenomenon P (or set of phenomena) is represented, where P is identified as a "risk" by the analyst (author), but there is no evidence of *risk* being a central category in the discourse under analysis. Often P has uncontroversial (prototypical) status as a risk (e.g., various diseases, like cancer or HIV/AIDS). There can indeed be explicit associations between these phenomena and *risk* in the empirical material, but no such association is demonstrated in the analysis. In these studies, there is no aim to demonstrate that P is represented *as a risk* (and to what extent). Rather, the riskiness of P is presupposed by the analyst (and accepted by most readers) and the analysis focus on how P is represented, in terms of, for example, causality (Stallings, 1990), acceptance or denial (N. Weaver, Murtagh, & Thomson, 2006), or whether P is reported accurately with regard to some standard (typically scientific assessment of risk) (Singer & Endreny, 1993).

In contrast, the first kind of studies of risk discourses shows *that*, and how, P is represented as a risk and/or how *risk* is used in discourse (e.g., Adelswärd & Sachs, 1998; Hamilton et al., 2007; Young, 2001). Furthermore, such studies can explore to what extent P is represented as a risk (often in relation to other analytical categories, e.g. benefit representations), and to what extent *risk* is used (Zinn, 2010).

Analyses of news media framing which apply *risk* as an analytical category are examples of this approach. In media studies and research on political communication, framing analysis is a very popular way to analyse the content of media discourse and its interpretation (Entman, 1991, 1993; Gamson & Modigliani, 1989; Neuman, Just, & Crigler, 1992; Pan & Kosicki, 1993; Scheufele, 1999). Entman defines the process of framing in the following way (a definition that is popularly cited):

> To frame is to *select some aspects of a perceived reality and make them more salient in a communication text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation* for the item described (Entman 1993: 52, italics in original)

The procedure of framing analysis, in turn, consists in identifying the distribution of various types of frames in some media material that has been selected by reference to some particular issue (e.g. nanotechnology). From a repertoire of frames, each emphasizing its own "problem definition, causal interpretation, moral evalua-

tion, and/or treatment recommendation", the most popular ones in relation to some specific issue are explored. Given that risk is among the conceptual domains (frames) considered, such an analysis can give insight into the dominance (or marginality) of understanding a particular issue in terms of risk (or a risk frame), and to what extent it is understood in terms of other frames, for example, progress, regulation or conflict (as in D. A. Weaver, Lively, & Bimber, 2009). There is a long list of issues that have been analysed in this way and where some sort of risk frame has served as one the analytical categories, for example, nanotechnology, biotechnology, and climate change.

Besides framing analyses, there are several other methodologies (or analytical frameworks) applied when analysing risk discourses, for example: narrative analysis (e.g., Corvellec, 2011; Davis, 2008; Mairal, 2008, 2011), conversation analysis (Adams, 2001; Myers, 2007),[4] rhetorical analysis (e.g., Sauer, 2003; Stratman et al., 1995), corpus linguistics (Hamilton et al., 2007; D. E. Hardy & Colombini, 2011), critical discourse analysis (Maeseele, 2015; Marko, 2010), metaphor analysis (Young, 2001), visio-semiotic image analysis (Å. Boholm, 1998b), and gesture analysis (Sauer, 1999). In many studies of risk discourse however, the method of the study is less theoretically elaborated, following no specific methodological framework.

It is hard to derive any general results from all these different studies of risk discourse. However, three strong thematic issues emerge. First, many studies emphasize (and demonstrate) the constructive aspect of risk. They presuppose evaluations and some causal reasoning by some observer (or assessor). As such, one and the same phenomena P can be represented (or construed) as a risk (by some observer), but also as a benefit (by another). P can, as a risk, be understood to threaten health in one context, and the environment in another.

Partly following from the previous point, representations of risk vary with observers; for example, journalists, experts, government officials, and members of the lay public depict risks in different ways. These actors have different motivations, attention, knowledge, resources and "cultural background" and their representations of risk will reflect such differences (cf. results from risk perception studies; see e.g. Å. Boholm (1998a) and Slovic (2000)).

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[4] For a similar approach, although not explicitly affiliating themselves with the methodology of conversation analysis, see Adelswärd and Sachs (1998); Hoffmann et al. (2003); Jones (2013).

Considering these two points, there is a third observation of risk discourse: it often involves controversy, i.e. a situation involving two or more actors who advance incompatible standpoints (e.g. beliefs, attitudes, and goals) regarding some issue (M. Boholm & Arvidsson, 2014). In principle, risk issues are always open to negotiation. The fundamental evaluation underlying risk identification need not be shared between two observers (or assessors). The causal connections assumed by one observer can be questioned by another. Risk controversy is the specific focus of Article 5 of this thesis.

# 4  Fundamentals of theoretical framework

## 4.1  Concepts: General remarks

The nature of concepts has been debated since the birth of Western philosophy. Core questions raised from then until now include: What is the ontological status of concepts? What is the structure of concepts? What is the relation between concepts and word meanings? How should we study concepts?

These questions have been given fundamentally different answers by different authors throughout the years. Concerning the ontological status of concepts, concept realists claim that concepts are abstract entities that exist independently of cognitive agents. Plato is often ascribed such a position. Conceptualism, which is a more popular position, holds that concepts are mental entities existing only in relation to conceptual agents. Concepts are often considered fundamental elements of higher-order cognition. A third view is the nominalist (or eliminativist) one that concepts do not exist. A motivation for this position is a principle of economy, i.e. Occam's razor, according to which "one should not postulate the existence of a greater number of entities or factors when fewer suffice" (Copleston, 1952, p. 121). In contrast with nominalism (or eliminativism), we might argue that the concept of concept really is needed for a theory of cognition or language, and therefore that an ontology without concepts does not suffice. However, we should be careful in postulating concepts. Often, the explanatory power of concepts is not exactly clear.

Like the ontological status of concepts, the structure of concepts has been debated as well. According to "the classical view" (Laurence & Margolis, 1999), the

structure of concepts consists of a definition given by a set of necessary and suffi-cient conditions which determine the applicability of the concept. Whether a con-cept applies, or not, to some phenomenon is a clear cut matter. Either a phenome-non is encompassed by the necessary and sufficient conditions of the concept, or it is not. This view of the structure of concepts has been seriously criticized in both philosophy (e.g., DePaul & Ramsey, 1998; Wittgenstein, 2009 [1953]) and psycholo-gy (e.g., Rosch & Mervis, 1975), and an alternative theory has emerged: prototype theory, according to which category membership is a matter of degree. Concepts are considered structured through a set of weighted features determining category membership, or rather, the extent thereof (Murphy, 2004). Other theories of con-ceptual structure are that concepts are a kind of theories, or abilities, rather than being entities or bundles of features (Murphy & Medin, 1985) or that concepts lack any structure, that they are primitive or atomic (Fodor, 1998).

Another fundamental question concerns the relation between concepts and language. Again, different positions have crystallized, ranging from the view that concepts are nothing over and above word meanings, to the view that concepts and word meanings are notions that are referentially independent of each other. In between these extremes, intermediate positions are possible, see Figure 1.
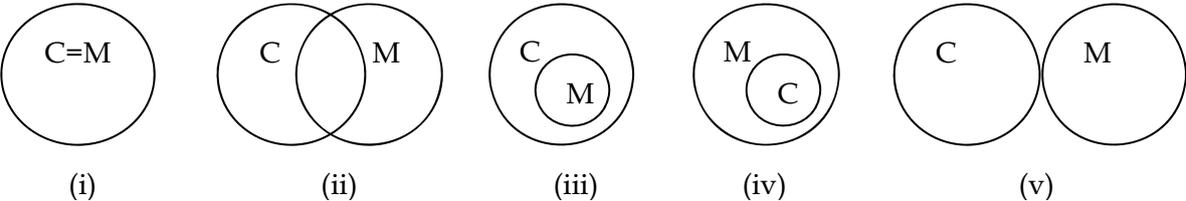


*Figure 1.* Possible relations between concepts (C) and word meanings (M): (i) the terms *concept* and *word meaning* have identical reference; (ii) concepts and words meanings partly overlap; (iii) word meanings are a proper subset of concepts; (iv) concepts are a proper subset of word meanings; and (v) concepts and words meanings are referentially inde-pendent of each other.

According to the first position (i) (Figure 1), the notion of concept is equivalent to that of word meaning. According to this view, there are no concepts over and above language (de Saussure, 1959 [1916]). Moreover, there are no word meanings

that are not conceptual.[5] Given acceptance of the rather uncontroversial idea that the conceptual system influences other aspects of the cognitive system (e.g., perception, imagination, memory, and planning), this view of concepts as word meanings is often accompanied by the idea that language abilities and the linguistic categories entertained by a cognitive agent influence cognition in general (Boroditsky, 2003; Carruthers, 2012; Sapir, 1929; Whorf, 1956 [1940]; Vygotsky, 1986 [1934]).

The antithesis of (i), is (v), that concepts and word meanings are completely independent of each other. The concept realism of Plato would be a case in point, in that, concepts are considered to be independent of both thought and language. Independence of concepts and word meaning has been advanced more recently by scholars like Fodor and Pinker, according to Margolis and Laurence (2011).

In between these two extremes, there are views that (ii) concepts and word meanings partly overlap, that (iii) all word meanings are concepts, but not all concepts are word meanings, and (iv) that all concepts are word meanings, but not all word meanings are concepts. The first two of these positions, (ii) and (iii), are motivated, if not by other reasons, by the possibility that non-human animals who lack language could be conceptual agents. Alternatives (ii) and (iv) both imply that there are word meanings that not are concepts. A possible motivation for such a view could be syntagmatic words (e.g. prepositions, conjunctions and interjections) that are considered to have meanings, but not to encode concepts (Cruz, 2009; Fraser, 1999; Wharton, 2003).

## 4.2 A dynamic conceptualist approach to concepts and word meaning

In this doctoral thesis a conceptualist understanding of concepts is adopted. Furthermore, concepts are believed to be closely related to word meanings. With reference to Figure 1, the relation is understood as (i), or perhaps as (iii). For present purposes, we need not to resolve the issue whether there are concepts over and above word meanings, for example, whether animals and pre-linguistic children are "true" conceptual agents. Having language, human beings are equipped with a creative tool for the processing of complex and abstract information. This is not a

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[5] Along the lines of Occam's razor discussed above, this identity claim indeed invites to getting rid of either the notion of concept or that of word meaning (since they both refer to the same thing).

normative claim. Linguistic cognition is not better than non-linguistic cognition, but, for sure, it is different.

Advancing from this language-near understanding of concepts, conceptual structure is here understood along the lines of "meaning potential" (J. Allwood, 1998, 2003) (for related ideas see, for example, Evans (2006, 2009); Fillmore (1976, 1985); Gries (2010); Hanks (1996, 2013); Jezek and Hanks (2010); Lakoff (1987); Langacker (1986, 2000); Noré and Linell (2007); Recanati (2004); for a somewhat different notion of "meaning potential" see Halliday (1973) and Matthiessen (2009)). The meaning potential of a word is all the information associated with it in its experienced and remembered contexts of use (J. Allwood, 1998, 2003). Both linguistic and extra-linguistic information are parts of a word's meaning potential (J. Allwood, 1998, 2003; also cf. Fillmore, 1985; Langacker, 1986).[6] On the individual level the meaning potential of a word can be seen as a person's memory of its uses, while on the social level, the meaning potential is constituted by what is collectively remembered within a language community, and hence the shared meaning of a word (J. Allwood, 2003). Therefore, the meaning potential of the same expression can differ among individuals to some extent (cf. Næss's (2005b) notion "depth of intended meaning").

In a particular use of a word, always in a context, a part of the meaning potential is activated (J. Allwood, 1998, 2003; Evans, 2009). The context of use, including the meaning potential of surrounding words, determines which parts of the meaning potential that are activated. The specific instantiated meaning of a particular token of a word in use, thus results from the structured partial activation of its meaning potential guided by cognitive operations and constrained by the meaning potential of surrounding words and the extra-linguistic context.

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[6] The meaning potential of a word is here understood to include what sometimes is referred to as the connotation of a word. The term *connotation* has been understood in many ways in linguistics and the philosophy of language. Following Backhouse (2003, p. 9) the understanding in focus here can be defined as "various aspects of the communicative value of linguistic units seen as lying outside their core, descriptive meaning". Moreover, Backhouse (2003) specifies three classes of such aspects: (i) expression of attitude and emotion (cf. the notion of value-laden terms and thick concepts discussed in section 3.2); (ii) reflection of social and situational circumstances, for example, technical terms (or jargon) reflect their association with certain activity types and the roles of such activity types (e.g. teacher and student); and (iii) cultural associations, for example, the English word *octopus* and the Japanese word *tako* refer to the same species of animal, but the words have quite different associations in the two languages (for more details, see Backhouse, 2003).

The structure of a word's meaning potential is organized through a large number of cognitive operations (J. Allwood, 1998; Evans, 2009; Lakoff, 1987). Some of these operations are strongly tied to language, while others are more general in nature. Examples of such general operations are abstraction, discrimination, similarity association, typification, reification, instantiation, division, unification, and quantification. These are operations related to the basic structure of any word meaning (or concept). Depending on perspective, each operation could be seen as a process or as a category resulting from the process. For example, abstraction can refer to a process, moving from less abstract (more concrete) to more abstract (less concrete) notions, or we can refer to the result of such a process, i.e. a mental construct being more abstract than the mental material that went into the process.

Another type of operation concerns basic semantic-epistemic categories (J. Allwood, 1998). Language provides operations and categories for a classification of phenomena that roughly correspond to the traditional word class system (nouns, verbs, prepositions, adjectives, and adverbs). These basic categories are entities, processes, relations, properties, states and events, which are related in the following way: (i) entities, i.e. objects (e.g. *cat*) and substances (e.g. *water*), take part in (ii) processes (e.g. *run*) and (iii) relations (e.g. *in*), and have (iv) properties (e.g. *furry*), which result in (v) states (e.g. *the cat is furry* and *the cat is in the water*), and (vi) events (e.g. *the cat runs*).

An example of how the context sets up conditions for these operations is that the expression *risk* results in an entity in the context of *a__* (*a risk*), but a process in *to__* (*to risk*). Processes of compounding and derivation are other examples of operations that determine the basic semantic-epistemic category, for example, an entity (noun) *risk* can be turned into a property (adjective) *risky*. A property (adjective) *risky* can, in turn, be changed into an entity (noun) *riskiness* by an operation of reification (nominalisation).

Another cognitive operation relevant for the structuring of meaning potentials is framing (Fillmore, 1976, 1985). The meaning potential of linguistic elements is partly organized in relation to frames (or scripts, or schemata), i.e. schematized knowledge structures that organise experience (for further discussions of frames see section 4.6 below). Furthermore, meaning potentials can have an organization along the lines of Lakoff's (1987) "idealized cognitive models", where metonymy and metaphor are central for the extension and modification of meaning (Lakoff & Johnson, 1980).

## 4.3 Definitions and word meanings

Another cognitive process that we need to consider in relation to our discussion of word meaning is the process of defining. The aim of defining is to clarify the meaning of a term. The clarification can be carried out for descriptive and/or normative reasons, that is, a definition can aim at capturing how a concept is actually used, or how it should be used (Hansson, 2006; Næss, 2005c). In practice, these two goals can be combined, such as when recommendations for how a concept should be used in a particular context are based on observations of how the concept is used in another. In order to achieve a precise and clear vocabulary, such as in academic writing, concepts are often given stipulative definitions, that is, definitions that specify the exact intended meaning of a term in a particular context (e.g. a research paper). To varying degrees, such stipulative definitions of a term overlap with the meaning of that term in spontaneous and natural discourse independent of the stipulative definition in question. In principle, a stipulative definition of a term *t*, which also occurs in natural language, does not have to share anything with the common meaning of this term *t* in ordinary language use. In such a case the two terms sound and look the same, but are in fact associated with different content. However, if terms are given definitions too distant from their uses in ordinary language, confusion and misunderstanding are likely to arise. The clarity and precision intended by the stipulative definition in the first place may in fact result in obscurity and inconsistent use.

Considering the possibility that word meanings are organized along the lines of meaning potentials, as discussed above, definitions can be more or less complete. Through definitions, we can capture the complete meaning potential of a word, its general conditions of application; or some aspect of the word's full meaning potential (e.g. its most important aspects, given some specific aim).

Given that meaning potentials of words often are quite wide, allowing many different, although related, interpretations of terms, the process of defining can, as suggested by Arne Næss, be considered an act of "precization". According to Næss (2005a, p. 67), 'a' is more precise than 'b', if:

> [t]here is no interpretation of 'a' that is not also an interpretation of 'b', whereas there is at least one interpretation of 'b' that is not an interpretation of 'a', and there is at least one interpretation of 'a'.

To fully appreciate Næss's definition we need to clarify his notion of "interpretation". For my present purposes, however, we need not do so in order to apply the gist of Næss's principle. Through precization the variety of information associated with a term (word), its meaning potential, is narrowed down in order to emphasize some aspect of this information, perhaps in order to serve some theoretical purpose. The resulting definition is more precise than the meaning potential of the same word, but it also lacks at least some information that is part of the meaning potential. So, even if the definition in question indeed captures the "general" meaning of a word, its core (schematic) semantics (say, the truth-conditional contribution the word makes in all or most of its observed uses), information in the definition will still be more meagre than the meaning potential of the word. Through definition certain nuances of word use are often lost, for example, connotations or "semantic prosody" (Stewart, 2010).

Similar to Næss, Carnap discusses the process of "explication". He describes a process in which an inexact (prescientific) concept (the explicandum) is transformed into a new exact one (the explicatum), which enables its incorporation into a scientific theory (Carnap, 1950, p. 3). Again, the not so very exact meaning potential of a word (the explicandum) can be made more exact through a definition, where the resulting definition (the explicatum) may serve theoretical purposes. The emphasis on the scientific purpose of definitions is important. Definitions are mainly motivated by theoretical and scientific purposes. In most non-scientific ordinary uses of words we do not need to define our terms in order to communicate successfully. The context of use helps restrict meaning potential of words sufficiently for successful communication.

## 4.4 The multifarious notion of discourse

Like *concept* and *meaning*, *discourse* is another of those theoretical notions that has been massively discussed. A vast amount of definitions and perspectives have emerged (for overview, see Baker & Sibonile, 2011, p. 30ff.). Within academia,[7] *discourse* has, for example, been defined as language in use (Brown & Yule, 1983); as

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[7] Confronting corpus data, it turns out that the word *discourse* is highly academic (M. Boholm, 2016). In Corpus of Contemporary American English (http://corpus.byu.edu/coca/), the word *discourse* is sixteen to twenty-seven times more common in academic contexts than it is in the other genres of COCA (i.e. spoken, fiction, magazines and newspapers). Of all its reported uses, 84% are in the academic genre.

spoken language (Baker & Sibonile, 2011); as language above the sentence or clause (Stubbs, 1983); as the topic of language use (Widdowson, 2007); as "a system of statements which constructs an object" (Parker, 1990, p. 191); and as "a particular way of representing some part of the (physical, social, psychological) world" (Fairclough, 2003, p. 17).

Among the definitions of *discourse*, we can distinguish three themes and divergences (M. Boholm, 2016). First, in many definitions, discourse is considered to be linguistic in nature, while it in other definitions is conceived to be something more general. Consider, for example, the definition by Fairclough (2003, p. 17) listed above where discourse is seen as a way of representing the world. Although language is an important way of representing the world, it is not the only way. General definitions of discourse include images, gestures and other non-verbal communication in addition to verbal representations. Gee (1999) makes a distinction between *discourse* (with a non-capital *d*) and *Discourse* (with a capital *D*), where *discourse* refers to language in use, while *Discourse* includes discourse (non-capital *d*), but widely exceeds it, by integration of "one's body, clothes, gestures, actions, interactions, ways with things, symbols, tools, technologies (be they guns or graphs), and values, attitudes, beliefs and emotions" (Gee, 1999, p. 7). As such, Discourse (with a capital *D*) is not limited to verbal representations. Elsewhere, this wide conception of discourse, allowing for combinations of different communicative means over and above language, is referred to as "multimodal discourse" (Kress & van Leeuwen, 2001).

It should be emphasized, though, that despite these wider conceptions of discourse there is a strong association between discourse and language. In most cases, I would argue, discourse is understood in linguistic terms, and the wider conceptions discussed above include language *in addition to* other communicative means.

Given a linguistic interpretation of discourse, a second divide among definitions of *discourse* follows from the type of language considered. Sometimes, discourse is restricted to spoken language (cf. Baker & Sibonile, 2011), but more often it is not. Linguistic conceptions of discourse that not are restricted to spoken language, in principle, also include written language and sign language. There is often a focus on "text", as the prime medium in which discourse is realized. However it should be noted that *text* is sometimes understood very inclusively, far exceeding written language. For example, Parker (1990, p. 193) writes: "[s]peech, writing, non-verbal behavior, Braille, Morse code, semaphore, runes, advertisements, fash-

ion systems, stained glass, architecture, tarots cards and bus tickets are forms of text".

A third line of demarcation concerns the productivity of discourse. According to such definitions, discourse is understood as something that, for example, "forms", "produces" and "constructs" something (Burr, 1995; Foucault, 1972; Parker, 1990). For instance, Foucault (1972, p. 49) defines discourse as "practices which systematically form the object of which we speak". Moreover, Burr (1995, p. 48) defines discourse as "a set of meanings, metaphors, representations, images, stories, statements, and so on that in some way together produce a particular version of events". Also, re-consider Parker's (1990, p. 191) definition of discourse listed above, which falls within this category: "a system of statements which constructs an object". Discourse is according to this perspective considered to be a cause, or a source of (re)production of power and social relations; it is understood to preserve certain ways of conceiving the world, in contrast to others (Fairclough, 2001 [1989]; Foucault, 1990; Laclau & Mouffe, 1985).

Besides this view of discourse as source, the "resultative" character of discourse can instead be emphasized. From this point of view, discourse is the result (or effect) of communicative action and behaviour. For example, defined as language in use, as spoken language or as language above the sentence or clause, discourse is the result of communicative actions of some actor(s). As will be further discussed below, these two perspectives on discourse are not mutually exclusive. On the contrary, discourse as a product can, in turn, function as a source.

## 4.5  An inclusive semiotic definition of discourse

Against the background of the three issues presented above, in this section I outline an inclusive semiotic definition of discourse which is adopted in this thesis (see M. Boholm, 2016). Based on the definition, I propose a framework for classifying different types of discourses and how they can overlap. Through this framework I intend to clarify what is meant by the notion of risk discourse, which is of special interest in this thesis, and how it is related to other types of discourse, such as, linguistic discourse, media discourse and nano discourse.

On a conceptual level, the referential scope of *discourse* need not be limited to either language or spoken language. To embrace the variety of ways that *discourse* has been understood, it is here defined in a general way as *a set of related representations*. Depending on (a) the type of representations in the set and (b) the type of

relationship between them, more specific concepts can be derived, mapping onto more specific definitions of *discourse*, serving some particular purpose. Let us try to elaborate a framework of discourse based on these two paths.

The concept of representation can be spelled out along the lines of Charles Sanders Peirce (1839-1914). Following Peirce, a sign (or representation) is a trifold relation between: a signifying element (signifier), a signified element, and an interpretation (interpretant) that relates the signifier with the signified element (see e.g. Peirce, 1992 [1867], 1998 [1894]). Since an interpretation implies an interpreter, we can add an interpreter as a fourth element of our model of representation.

A classic example to illustrate this structure is smoke (signifier) being a sign of (representing) fire (signified element) given the understanding that fire causes smoke (interpretant), by some cognitive agent (interpreter), for example, a forest ranger. When considering linguistic signs, the application of the Peircian model is slightly more complicated. Throughout the history of philosophy of language, it has been recognized that we need to consider two aspects of meaning of linguistic signs: sense and reference (Baltzly, 2013; Buroker, 2014; Carnap, 1947; Frege, 1997 [1892]; Nöth, 1990). Semantic analysis of linguistic signs (e.g. *Evening star*) needs to assume (a) the reference of a term, that is the object referred to by the term (Venus); and (b) the sense of a term, which is the way in which one conceives of the extension, i.e. a concept (e.g. "the star that shines in the evening"). Returning to our discussion of Peirce's model, the reference of a term corresponds to the signified element and the sense corresponds to Peirce's notion of interpretant (Nöth, 1990). For example, the written form *eld* (signifier) represents fire (signified element) via the conventional concept of fire (interpretant) for speakers of Swedish (interpreter).

Based on (a) the type of signifier, (b) the type of signified element, and/or (c) the relation between signifier and signified element, a taxonomy of signs is possible to construct (J. Allwood & Andersson, 1976). Of special interest in Peirce's work is the third aspect. He suggests three types of signs: icons, where the signifier represents the signified through similarity; indices, where the signifier represent the signified through continuity in time and space (physical connection); and symbols, where the signifier represent the signified through convention (Peirce, 1992 [1867], 1998 [1894]). Words are the typical example of symbols, although iconic and indexical elements are sometimes parts of words (for example, onomatopoetic words resemble their referents, and deictic expressions refer through continuity in time and space).

The representations of a discourse can be related in many ways (M. Boholm, 2016). At a fundamental level, the representations of a discourse (like the elements of a sign) can be related by (a) continuity in time and space and/or (b) similarity, by sharing, for example:

(i)     the source (producer) of the representations
(ii)    the recipient of the representations
(iii)   the context and institutional setting of the production of the representations
(iv)    the type of signifier and its relation to the signified element of the representations
(v)     the type of signified element of the representations
(vi)    the effect, or function, of the representations

Different senses and sub-types of discourse can be distinguished based on these dimensions. For example, *media discourse* is a set of representations produced by the media. *Public discourse* is a set of representations addressed to the public (i.e. a discourse having the public as a recipient). (The public can also be the source of public discourse, but need not to be.) *Spoken discourse* is a set of representations having speech as its signifying element. *Written discourse* is a set of representations having orthographic signifiers. *Environmental discourse* is a set of representations about the environment, i.e. the environment is the signified element. Similarly, *risk discourse* is a set of representations referring to risks (and having *risk* as a signifier). *Stigmatizing discourse* is a set of representations having the effect that, for example, a social group becomes stigmatized; and so on.

Representations of a discourse can be related by more than one of the dimensions (i–vi) above. For example, *poetic discourse* is a discourse where we expect certain forms of representation (e.g. verse forms, rhyme, and sound symbolism), but also certain forms of content (e.g. love, despair, natural beauty and the conditions of human existence). *Political discourse* can be a set of representations from politicians (source), about politics (signified), produced in a political context, or all of these.

The dimensions of (i–vi) are not independent of each other. For example, the content of a discourse, i.e. what the discourse is about, depends directly on the signifying elements. As noted above, a risk discourse is about risks *and* typically has

*risk* as a signifier. However, various signifying elements can be used to refer to a similar content. For example, talk about *climate change*, *sustainability*, *ecological footprint*, and things being more or less *eco-friendly*, can all be signifiers of an environmental discourse, unified by associated meanings. Similarly, terms like *risk*, *danger*, *hazard*, *safety* and *security* can all be regarded as signifiers of risk discourse. Another example of how dimensions (i–vi) can be strongly related in discourse is that the effects of a discourse are tightly connected to its signifying element and signified element, as well as its producer, its recipient and institutional context. Sometimes, discourse types that are referred to incorporate several of the dimensions above. Sometimes, they focus on only one such dimension.

Furthermore, discourse types are not mutually exclusive. The same set of representations, say, a set of newspaper articles, is a case of *linguistic discourse*, i.e. the representations in the articles are systematic associations between signifying and signified elements based on the (arbitrary) conventions of some language community; *written discourse*, i.e. the representations are visual and follow orthographic conventions of some language community; and *media discourse,* i.e. the representations are produced by "the media". Moreover, the same set of articles can be considered, for example, a *political discourse*, in the sense of being about politics (signified); a *risk discourse*, i.e. in that the representations may represent risks and risk issues; and so on.

Although, discourse can be defined very broadly as "a set of related representations" in order to encompass the variety of meanings associated with the term, the focus of this doctoral thesis is exclusively on linguistic discourse. More precisely, there is a focus on written language, although the corpus data used for conceptual analysis (Articles 1 and 2) includes transcribed spoken data.

Furthermore, this thesis focuses on *risk discourse*, i.e. representations sharing reference to the risk concept, by use of the word *risk*, but also through other words such as *danger*, which share reference to potential adversity. More specifically, this thesis investigates how risk discourse is organized with regard to the structure of the risk concept, its relation to causality (Article 3), and how it overlaps with nano discourse, that is a set of representations in which the linguist unit (morpheme) *nano* is applied (Article 4 and 5). There is a growing trend to apply the morpheme in association with all sorts of concepts, for example, *nanotechnology*, *nanometre*, *nanoparticle*, *nanomaterial*, and *nanorobot* (M. Boholm, 2014; M. Boholm & Boholm, 2012). Although the many applications of the morpheme *nano* may seem quite het-

erogeneous, its various uses are clearly related (cf. M. Boholm & Boholm, 2012), motivated by, for example, metonymic extensions (Lakoff, 1987). Furthermore, due to the hype surrounding nanotechnology (Berube, 2006), the shortened form *nano* has served as a reference point for all sorts of associations (M. Boholm, 2014). In Article 4 and Article 5, the association between *nano* and the risk concept is explored.

News media discourse is also analysed in this thesis. Mainly newspaper media is analysed, although in Article 5 a few TV news tokens are analysed alongside newspaper articles, and the corpora used for analysis in Article 1 and 2 include data from transcribed TV news reporting as well as newspapers.

Concerning the issue of whether discourse is produced or productive discussed above, the view adopted here is that it is both. Discourse is both produced by communication (an effect) and productive (a cause) by shaping communication, social interaction and relations. Discourse both reflects and constrains thought. As a product of thought it is indicative of it. Discourse reflects ways of understanding the physical, psychological and sociological world. Lexical and grammatical choices illustrate perspective, the "framing" of a situation, what is salient (or important), and, in reverse, what is not.

As a set of (related) representations, discourses can have effects (Fairclough, 2003). Linguistic discourses (re)produce social relations and institutions (Fairclough, 2001 [1989]; Searle, 2010). Discourses form the foundations and primary instruments of ideology, in turn forming thought and behaviour. Power relations are re-produced and maintained through linguistic practice, but are also resisted and reacted against by the very same means. Perceptions and understandings of the physical, psychological and social worlds do not take place in a vacuum. Rather, such processes take place in a context of prior knowledge, beliefs, attitudes, value dispositions, and emotions. Such contexts are preserved from their moment of production, through time, by their preservation in various representations (e.g., on paper, audio recordings, video recordings, computer storage, and memory). Discourses are the results of humans' representative (intentional) ability (e.g., language), but well in place these discourses also take part in the further formation of social life and thought. This productive power of linguistic discourse has been of central interest to some authors working on discourse analysis and in certain domains of linguistics. More details on the approach to *analysis* of discourse will be addressed below (section 5.1).

## 4.6  Linguistic studies of *risk*

There is a growing body of analyses of the structure and use of the word *risk*, both the noun and the verb. This work has, however, been largely neglected within risk research. Similarly, reference to risk research is often absent from these linguistic studies (for notable exceptions see Hamilton et al. (2007) and Zinn (2010)).

The most detailed and elaborated linguistic account of *risk* is found within the research tradition of frame semantics (Atkins, 1995; Fillmore, 1992, 1994; Fillmore & Atkins, 1992, 1994; Hasegawa, Ohara, Lee-Goldman, & Fillmore, 2006). The fundamental assumption of frame semantics is that meaning and interpretation of linguistic behaviour depend on frames.[8] Within frame semantics, the notion of *frame* has been defined in slightly different ways, at different places, but for our present purposes frames can be understood as ordered cognitive structures (stored in memory) that organize (or structure) human experience and function as conceptual backgrounds against which linguistic material is produced and understood (Fillmore, 1976, 1982, 1985, 2003; Fillmore & Atkins, 1992; Fillmore & Baker, 2009). This idea of frames can be developed somewhat further by discussing their origin and development, function, and internal structure.

Through their lives, humans experience a multitude of physical, biological, and socio-cultural phenomena, for example, daily and annual cycles, objects responding to gravity and other physical forces, basic spatio-temporal relations (e.g. containment and succession), natural kinds, artefacts, emotions, values, social institutions and events, symbols, and language (Fillmore, 1976; Fillmore & Baker, 2009). Through cognitive abilities of abstraction and categorization, these experiences can be stored in memory in schematized form, where the core elements, properties, processes and relations of physical, biological, and socio-cultural events and situations are extracted (Fillmore, 1976; Rumelhart, 1975, 1980; Schank & Abelson, 1977).

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[8] The term "frame", and related terms such as "schema" and "script", are central to several other theories in, for example, sociology (Goffman, 1974), cognitive science and artificial intelligence (Minsky, 1975), cognitive psychology (Rumelhart, 1975, 1980; Schank & Abelson, 1977), media studies (Entman, 1991, 1993; Neuman et al., 1992; Pan & Kosicki, 1993; Scheufele, 1999), and anthropology (Bateson, 2000 [1972]; Frake, 1977). Above in section 3.5, we mentioned that frames and framing have been central for analysing media's representation of risk. For sure, there are many overlapping assumptions of these theories; as well as there are differences. These similarities and differences will not be addressed in detail here (for overview, see Tannen, 1979).

Once a cognitive system has acquired a schematized knowledge structure – i.e. a frame – it can organize (new) experiences in accordance with it. So, frames originate from *previous* experience and have as their function to impose structure on *new* experience, enabling predictions, expectations, coherence and holistic understandings despite limited information. In frame semantics, the function of frames is specifically related to language use. In both production and understanding, communicators rely on frames as background knowledge against which linguistic forms appropriate meaning.

Furthermore, according to frame semantics, frames have an internal structure consisting of specific elements, their properties and relations; some elements are more central to the frame than others. Particular words activate particular frames. As Fillmore sometimes says, words "evoke" their frames (Fillmore, 1982, 1985, 2003; Fillmore & Baker, 2009). In the literature, numerous examples have been provided for various frames, their core elements and their internal structure. For instance, the commercial transaction frame consists of a Seller, a Buyer, some Goods transferred from the Seller to the Buyer in the exchange of Money (given from Buyer to Seller). Words such as *buy*, *sell*, *charge*, *spend*, *pay*, *buyer*, *seller*, *goods*, *money*, and *cost*, evoke the commercial transaction frame (Fillmore, 1976, 1982, 1985; Fillmore & Atkins, 1992). As this list of word illustrates, many different words can be associated with the same frame. However, different words and constructions activate different aspects of the frame. Through lexical and grammatical choices some part of the frame is highlighted, or foregrounded, while the frame as a whole serves as a background for interpretation. In the words of Langacker (2000), words and constructions "profile" some aspects of the frame they evoke. For illustration, consider the following examples:

| | | |
|---|---|---|
| (4) | John sold his car | [S (active); G] |
| (5) | John sold his car to Mary | [S (active); G; B (passive)] |
| (6) | John sold his car for £5 000 | [S (active); G; M] |
| (7) | John sold his car to Mary for £5 000 | [S (active); G; B (passive); M] |
| (8) | Mary bought a car | [B (active); G] |
| (9) | Mary bought a car from John | [B (active); G; S (passive)] |
| (10) | Mary bought a car for £5 000 | [B (active); G; M] |
| (11) | Mary bought a car from John for £5 000 | [B (active); G; S (passive); M] |

According to frame semantics all eight sentences are interpreted against one and the same frame (the Commercial Transaction Frame), which involves four core elements: Seller (S), Goods (G), Buyer (B) and Money (M). However, each of the eight sentences highlights (profiles) different aspects of the frame. In sentences (4) to (7), the subject of the verb *to sell* instantiates the Seller. The Seller is also realised in (9) and (11) through the prepositional phrase *from John*, but in a less active and prominent manner than in (4) to (7). The Goods are realised as an object in all the sentences, while the Money is only realised in sentences (6), (7), (10) and (11); in all cases by the prepositional phrase *for £5 000*. The Buyer is realised in an active manner (subject of *buy*) in sentences (8) to (11), and in a less active way in (5) and (7) by the prepositional phrase *to Mary*.

An important part of the frame semantic project is to map out such relations between frame structure and grammatical and lexical choices; for instance, the Buyer can be realised as subject of the verb *to sell* or as adjunct in sentences with the verb *to buy*. In this regard, frame semantic analysis is a dual process of (i) proposing (defining) a conceptual structure – a frame – and its elements and then (ii) empirically investigating how the components of the frame are realised in actual language use, and by which lexical and grammatical means (Fillmore, 1992, 2003; Fillmore & Atkins, 1992, 1994; Fillmore & Baker, 2009). The first process is highly intuitive. It is about identifying and making explicit assumptions that are held in relation to the use of certain words (cf. the task of classic conceptual analysis; see section 4.1 above and section 5.1 below). The second process is more empirical, where intuitions from the first process are tested and refined on the basis of patterns identified in language use.

Moreover, in frame semantics, descriptions of frames and their relations to surface structures of language use are conceived as mandatory for a complete account of linguistic meaning (Fillmore, 1976, 2003; Fillmore & Atkins, 1994). Having frames in view, Fillmore and Atkins, for example, write: "a word's meaning can be understood *only* with reference to a structured background of experience, beliefs, or practices, constituting a kind of conceptual *prerequisite* for understanding the meaning" (Fillmore & Atkins, 1992, pp. 76-77, emphasis added).

As already mentioned, several frame semantic analyses have been carried out on a variety of linguistic expressions and clusters of words related by being associated with the same frame. Fillmore and colleagues have even developed an Internet database of frames, i.e. FrameNet (https://framenet.icsi.berkeley.edu). Among

these frame semantic analyses, there are studies of the word *risk* (both noun and verb) and the associated Risk Frame, which besides *risk* is also intended to explain the meaning of related terms such as *danger*, *endanger*, *peril*, *hazard*, *venture*, *jeopardy*, and *jeopardize*, sharing some reference to "the possibility of an unwelcome event" (Fillmore & Atkins, 1992, p. 79). According to frame semantics, synonym or antonym word pairs activate the same frames. Words are synonyms and antonyms by virtue of their co-activation of frames (Fillmore, 1982, 1985; Fillmore & Baker, 2009).

The frame semantic account of *risk* (and related words) has changed somewhat throughout the years. Here, the Fillmore and Atkins' 1994 account is the main focus. Divergences from this account in other work will be discussed in passing.

The risk frame is organized according to (i) three sub-frames (alternatively discussed as "schemas" or "situations"), (ii) a set of frame elements and (iii) the basic background assumption that "the future is uncertain, and that among the alternative possible futures that one faces are some that one might not want" (Fillmore & Atkins, 1992, p. 79).

Fillmore and Atkins (1994, pp. 367-368) suggest the following list of frame elements (also in Atkins, 1995, pp. 30-31; Fillmore, 1994, pp. 110-111):[9]

(i)    Protagonist (Pr): the central person of the frame
(ii)   Bad outcome (Ba): the possible bad outcome, or harm
(iii)  Decision (De): the decision (or action) that could trigger the Bad outcome
(iv)   Goal (Go): the desired outcome (or the beneficiary)
(v)    Setting (Se): the situation within which the risk exists
(vi)   Possession (Po): something or someone valued by the Protagonist and endangered in the situation

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[9] Fillmore and Atkins (1992) suggest a longer list, while Fillmore (1992) suggests a shorter one, and yet other elements are found in FrameNet (FrameNet, 2014a, 2014b, 2014e, 2014f). Overall, the basic idea is the same, though. What differs are the names of the elements, and that elements are split or merged. What in one account is one element is in another divided into two, and what are two elements in one account is in another merged into one. For example, in Fillmore and Atkins (1992) we find the two elements Gain and Beneficiary, but in Fillmore and Atkins (1994) only Goal, encompassing both categories. In FramNet, we again find two categories: Beneficiary and Purpose, corresponding to the two categories of the 1992 account (FrameNet, 2014b, 2014f).

(vii) Source (So): something or someone which could cause harm (other than the Protagonist and the Decision, we might add)

Examples of how these elements are realized in discourse are presented below (12)-(19). The examples derive from Fillmore (1994) and Fillmore and Atkins (1994), in turn originating from corpus data.[10] There are examples of the verb, see (12)-(14), and the noun, see (15)-(19).

(12)   I$_{Pr}$ risked **my life$_{Po}$ for you$_{Go}$**

(13)   you$_{Pr}$ would risk death$_{Ba}$ **doing what she did$_{De}$**

(14)   he$_{Pr}$ was being asked to risk **his good name$_{Po}$ on the battlefield of politics$_{Se}$**

(15)   he$_{Pr}$ ran the risk **of falling down$_{Ba}$**

(16)   he$_{Pr}$ took the risk **of jumping off the cliff$_{De}$**

(17)   the health$_{Po}$ risk **from apples$_{So}$** was 'minuscle'

(18)   there are, in fact, profound risks **in the situation$_{Se}$**

(19)   **you do so$_{De}$** at risk **of losing your job$_{Ba}$**

In the work of Fillmore and Atkins, there are no examples of the verb *risk* where the element of Source is realized. This may indeed be a semantic difference between the noun and the verb. The subject of the verb can realize a Protagonist who put him/herself in danger. The noun *risk* easily enables constructions in which this not is the case, for example, *he$_{So}$ put them$_{Po}$ at risk*.[11] However, we can construe the following example: *due to **the heavy traffic$_{So}$**, he$_{Pr}$ ran a risk **of getting run over$_{Ba}$**, when **he stumbled into the street$_{De}$**.*

Besides frame elements, the Risk Frame, as it is presented in Fillmore and Atkins (1994), consists of three sub-frames, which schematize potentiality and in-

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[10] The empirical data of Fillmore's and Atkins' studies derive from a 25 million-word corpus provided by the American Publishing House for the Blind, and the Collins Cobuild corpus (7,3 million words, at that time according to Fillmore and Atkins).

[11] The example brings terminological and methodological problems to the fore: first, who should be considered the "the central person of the frame" (Fillmore's and Atkins' definition of Protagonist) when there are two persons referred to; and secondly, the term *Possession* is misleading to describe the meaning of the grammatical object in the example, since it refers to a person arguably not possessed by anyone. Article 2 of this thesis, partly handling problems like these, suggests a slightly modified list of frame elements (and their definitions).

tentionality of action or decision-making in different ways.[12] These sub-frames are graphically represented by borrowing symbols from decision theory (Raiffa, 1970); circles represent chance and squares represent choice.
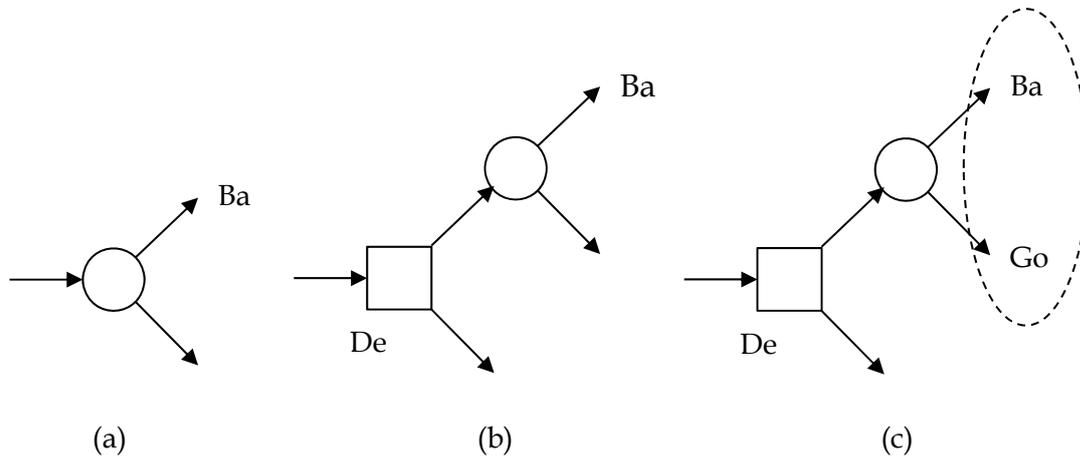


*Figure 2.*     Three sub-frames of the Risk Frame. Source: Fillmore and Atkins (1994).

The first and simplest of the three sub-frames (Figure 2a) represents a situation with a potential bad outcome. In the second sub-frame (Figure 2b), there is in addition to chance a decision, such that one of the decision alternatives has the potential to result in a bad outcome. In this situation, there is no awareness of the actor (decision-maker, protagonist) that his/her decision involves an alternative with a potential bad outcome. This lack of awareness is the fundamental difference between the second sub-frame and the third one (see Figure 2c) in which the actor (decision-maker, protagonist) is aware of the potential bad outcome of his/her decision making, as well as the potential benefits that can possibly result.

In Fillmore (1994), these sub-frames are verbalized under the headings of "risk: passive" (cf. Figure 2a), "risk: active" (cf. Figure 2b), and "risk: intentional"

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[12] In Fillmore and Atkins (1992) only two sub-frames are suggested. In the present version of FrameNet, the architecture is somewhat different, where the frames Being at Risk (FrameNet, 2014a), Risky Situation (FrameNet, 2014e) and Run Risk (FrameNet, 2014f) are seen as different perspectives of the Risk Scenario Frame (FrameNet, 2014d). In addition, the Daring Frame (FrameNet, 2014b), a sub-frame of the Intentional Action Frame (FrameNet, 2014c), is another frame used to explain the semantics of *risk*, both noun and verb, as well as *dare*, *chance*, *hazard*, and *venture*.

(cf. Figure 2c). The difference between "active" risk and "intentional" risk, then consist in the actors' awareness of the potential unwanted outcome of the decision or actions; in both cases the decision (or action) itself is active. In "passive" risk scenarios (Figure 2a), on the other hand, there is no such intentional (active) decision-making (or action) of any protagonist or victim, that results in the unwanted outcome. The following examples illustrate the three schemas:

(20)  Babies run the risk of hypothermia there [Schema a]
(21)  Because of air pollution that we knew nothing about, we've been risking serious damage to our health these last few years just by living in this town [Schema a]
(22)  I had no idea I was risking my life [Schema b]
(23)  By stepping into the street just then, you risked your life [Schema b]
(24)  It was stupid of me to risk my inheritance on lottery tickets [Schema c]
(25)  I'm going to risk crossing the channel in spite of the storm [Schema c]

In (20) and (21), there is no decision, or agency, on part of the protagonist (victim) of the situation (referred to by *babies* and *we*) potentially leading to a bad outcome (hypothermia or serious damage). In (22) and (23), in contrast, the protagonists (*I* and *you*) are agents, and there is some action that potentially results in a bad outcome (where the protagonists' lives are at risk). However, the agency involved is not intentional with regard to the bad outcome, since the agent is not aware of it. In (24) and (25), not only is there agency, the protagonist (agent) is aware of the potential bad outcome of the decision (agency). Also note that (16) above, i.e. *He took the risk of jumping off the cliff*, instantiates Schema c.

Much work has been put into mapping out how the risk frame and its risk elements are realized in language use, through various grammatical and lexical choices. For details on such realization-structures, see Fillmore and Atkins (1992), Fillmore and Atkins (1994, especially Appendix C), and Fillmore (1994). Two aspects of this work will be mentioned here.

First, Fillmore and Atkins (1994) explains the semantic difference between the idiomatic expressions *run a risk* and *take a risk*. The idiom *run a risk* can activate all three schemas discussed above (passive, active and intentional, see Figure 2), while *take a risk* never activates Schema a (risk: passive). For example, in (20) and (21), *run the risk* and *risking* are not acceptably exchangeable with *take the risk* and *taking the*

*risk of*. For illustration, the invented sentence (26) below is awkward (indicated by the initial question marks).

(26)   ??Babies take the risk of hypothermia there.

Furthermore, if the complement of *risk* is the frame element of Decision, only *take* is acceptable, not *run*. We cannot exchange *take* with *run* in sentence (16) without an awkward result, or a completely different interpretation, where the *jumping off the cliff* is understood as Bad outcome rather than Decision; see invented example (27).

(27)   He ran the risk of jumping off the cliff

As noted by Sven Ove Hansson when commenting on a previous version of this introduction, (27) can indeed be given a perfectly reasonable (non-awkward) interpretation. Imagine a person who jumps around close to the ledge of a cliff in, for example, the Grand Canyon. Of this situation it would make perfect sense to use (27). However, in this latter use the complement *of jumping off the cliff* is not naturally interpreted as a Decision, but rather as a Bad outcome. This situation can be compared with another situation in which an adventurous person decides to parachute (base jump) off the cliff. For this latter situation, we would prefer the formulation (16) above (*he **took** the risk of jumping of the cliff*) over (27).

A second aspect of Fillmore and Atkins' work to be mentioned is their analysis of the polysemy of the verb *risk* (Atkins, 1995; Fillmore, 1994; Fillmore & Atkins, 1992, 1994). The verb *risk* has three complementation patterns, corresponding to three senses: the (direct) object of *risk* can instantiate (i) Bad outcome, see (13), (ii) Possession, see (12) and (14), or (iii) Decision, as in (25): $I_{Pr}$*'m going to risk **crossing the channel**$_{De}$ in spite of the storm*). Furthermore, another explanation of the polysemy is based on the three schemas (a-c) in Figure 2 (Fillmore, 1994; Fillmore & Atkins, 1994). Depending on the schema evoked by *risk* in its context of use, three different senses follow: passive, active, and intentional.

Frame semantics provides an empirically verified account of how *risk* and related terms are used in discourse. It suggests a structure of the meaning of *risk*—the concept of risk—consisting of elements of potentiality (chance), unwelcome events, sources of unwanted events, values at stake in unwanted events, and more. Furthermore, this structure (frame) provides a tool for further analysis of distinc-

tions between constructions with *risk* (e.g. *run a risk* vs. *take a risk*), *risk*-related terms (e.g. *danger*, see Article 2), as well as analysis of how particular risk issues are articulated in discourse (see Article 3-5), by exploring the details of how abstract categories of the frame are realized in actual language use.

Although not recognized in frame semantics, its account of *risk* has a clear resemblance with conceptual work done elsewhere. Contingency (or uncertainty) and adversity (unwantedness) are recognized as essential components of the risk concept by both frame semantics and risk theory (Å. Boholm & Corvellec, 2011; Hansson, 2011, 2013; Rescher, 1983; Rosa, 1998). Furthermore, evaluations are central to the frame semantic account of *risk* (cf. elements of Possession and Bad outcome) and other theoretical work on the risk concept (Å. Boholm & Corvellec, 2011; Hilgartner, 1992; Rosa, 1998; Shrader-Frechette, 1991). Also, in the frame semantic account of risk there is a tight association between risk and decision-making (agency) (cf. the element Decision as well as the schemas b and c). A similar connection has been identified elsewhere (Beck, 1995; Fischhoff & Kadvany, 2011; Luhmann, 1993).

There is some other linguistic work on *risk*, which is more or less related to the frame semantic approach. Strongly related works by Kjellmer (2007), Pustejovsky (2000), and Zaefferer (2002) are in part critical reactions to the frame semantic account of *risk*. They all identify linguistic data of *risk* which is problematic to interpret straightforwardly along the lines of Fillmore and Atkins (1992, 1994). For example, Zaefferer (2002) identifies two problems with Fillmore and Atkins' (1992) account of the polysemy of the verb *risk*. He identify cases of the verb *risk* from corpus data where the direct object fits all three frame elements discussed by Fillmore and Atkins, i.e. Bad outcome (or harm), Possession (or valued object) and Decision (or deed) (see above). Furthermore, he identifies cases where the direct object fits neither of these elements. Based on such findings, Zaefferer (2002) develops an alternative (modified) account of the semantics of *risk*.

Also strongly related to Fillmore's and Atkins' work is the work of Lopez and Valenzuela (1998). They explore the applicability of the Risk Frame on Spanish (e.g. *arriesgarse*, *exponerse*, and *atreverse*) and its theoretical value in translation (English and Spanish). Their conclusion is that the Risk Frame is useful for such issues.

Although they make use of the frame semantic analysis of the polysemy of the verb *risk*, a linguistic study that is slightly less related to the frame semantic account is that of Duffley and Arseneau (2012). They study "verbs of risk", i.e.

verbs that can be paraphrased with *risk* in at least one of their uses (e.g., *risk*, *venture*, *hazard*, *chance*, *dare* and *jeopardize*). More precisely, they study these verbs in catenative constructions, i.e. constructions where a matrix verb has another (non-finite) verb as a complement (Huddleston & Pullum, 2005, p. 215), for example, *risk losing*, as in *she risked losing me* (Duffley & Arseneau, 2012, p. 31). With respect to the verbs, Duffley and Arseneau (2012) explore the interactions between the grammatical subject of the matrix (being animate or non-animate), the grammatical type of catentative complement (gerund or *to*-infinitive), and the semantic category (from Fillmore & Atkins, 1992) of the complement (harm, deed, or valued object). They find various patterns for how the verbs differ and relate these variations to different interpretations of control and the temporal relationship between the matrix verb and its complement (for details, see Duffley & Arseneau, 2012).

Other studies that are less related to the frame semantic account of risk are the corpus linguistic analyses of *risk* by Hamilton et al. (2007), D. E. Hardy and Colombini (2011) and Zinn (2010). They investigate collocates of *risk* in corpora and come to similar conclusions, namely that risk is strongly associated with health and medicine. Hamilton et al. (2007) and Zinn (2010) also identify associations to finance. Zinn (2010) studies how frequent *risk* is in newspaper reporting since World War II. He observes an increased usage of the term, confirming the assumption of social theory that the relevance of risk has grown in society (e.g., Beck, 1992 [1986]).

# 5 Methodology

## 5.1 Concept and discourse analysis: General remarks

Methodologically this thesis engages in two forms of analysis:

- Conceptual analysis, which is the analysis of the structure and features of concepts
- Discourse analysis, which is the analysis of the structure and features of discourses

Given a wide definition of discourse (section 4.5), there are many sorts of approaches and methodological frameworks that count as analysis of discourse, i.e. discourse analysis. Likewise, content analysis is very inclusive when considered in a general sense, encompassing all sorts of more specific approaches to the "systematic reading of a body of texts, images, and symbolic matter, not necessary from an author's or user's perspective" (Krippendorf, 2004, p. 3). In their widest senses, discourse analysis and content analysis are roughly equivalent and it is hard to clearly distinguish them.

In contrast with this view, there is a tendency to associate discourse analysis with "qualitative" research methods and content analysis with "quantitative" ones (see, e.g., C. Hardy, Harley, & Phillips, 2004). However, the distinction between qualitative and quantitative research methods is not a very clear one (C. M. Allwood, 2012; Bryman, 1984), so a clear cut divide between content analysis and discourse analysis based on this distinction seems hard to uphold. Much work done under the heading of "content analysis" has features that are considered to be "qualitative". In fact there is frequent reference to "qualitative content analysis" (e.g., Mayring, 2000). Likewise, work done under the name of "discourse analysis" fulfils what is sometimes considered "quantitative" research; consider, for example, recent work in corpus-oriented discourse analyses (Baker, 2006).

Other criteria than the qualitative-quantitative divide have been suggested for distinguishing content analysis from discourse analysis (cf. C. Hardy et al., 2004; Hopf, 2004; Neuendorf, 2004). The association between discourse analysis and the ambition to critically assess power relations in society is one such criterion (Hopf, 2004; Laffey & Weldes, 2004). However, the basic problem will arguably reoccur for any suggestion: the phrases *discourse analysis* and *content analysis* are used to refer to a great variety of methods and considering this general application, the notions overlap to such an extent that trying to find any criteria to meaningfully separate them seems hopeless.

Discourse (or content) analysis in a wide sense includes a long list of more specific approaches among which the following can be mentioned: framing analysis (e.g., Entman, 1991, 1993; Goffman, 1974; Neuman et al., 1992; Pan & Kosicki, 1993), argumentation analysis (e.g., M. Boholm & Arvidsson, 2014; van Eemeren, Grootendorst, & Henkemans, 2002), critical discourse analysis (Fairclough, 2013 [1995]; van Dijk, 1993; Wodak & Meyer, 2001), conversation analysis (e.g., Ochs, Schegloff, & Thompson, 1996; Psathas, 1995), grounded theory (Glaser, 1998;

Glaser & Strauss, 2006 [1967]), and discourse world analysis (M. Boholm, 2014; Chilton, 2004). Each of these can be seen as a specific form of discourse (or content) analysis, focusing on a specific form of discourse (e.g. textual or spoken) or approaching it in a particular systematic way — or both.

In line with the many understandings of discourse that exist (see section 4.4), discourse analysis is sometimes understood as something much more specific than the general understanding of this term that is adopted here. For example, following a linguistic conception of discourse (see section 4.4), discourse analysis is restricted to the analysis of language (excluding, e.g., images or other non-verbal representations). Gee (1999, p. ix) defines discourse analysis this way: "[d]iscourse analysis is the study of language-in-use". Like Gee, this thesis focuses exclusively on language.

In the tradition of discourse analysis of Foucault (1972, 1990), Laclau and Mouffe (1985), and others (e.g., Fairclough, 2001 [1989]; Hopf, 2004; Laffey & Weldes, 2004), there is a strong interest in power relations and hegemonic discourses believed to be essential in shaping society. This interest is often accompanied by a critical stance towards the hegemonic discourses uncovered (e.g., Fairclough, 2001 [1989], 2013 [1995]; van Dijk, 1993). From this perspective discourse analysis is not the same as any analysis of discourse (whatever that might include). Discourse analysis is something more specific, necessarily involving a critical stance towards the hegemonic discourses displayed. For our present purposes, this critical element is not seen as an essential component of discourse analysis. Arguably, any of the above methods and forms of analysis can be complemented by a critical stance or can relate empirical descriptive findings to macro sociological structures, although such endeavours will not be of any central interest here.

Given such more specific conceptions, discourse analysis is another entry on the list above, not a general term to encompass them all. However, we will stick with our wide general notion and specify below which form of discourse analysis is of central interest here. But first we will introduce the other form of analysis that is central to this thesis, namely conceptual analysis.

Traditionally, conceptual analysis is a process of determining necessary and sufficient conditions guiding the application of a concept. This process of determination is based on the use of intuitive judgments and critical reflection upon tentative examples and counter-examples of the concept under investigation. As dis-

cussed above (section 4.1), this methodological approach is accompanied by the theoretical assumption of "the classical view" that concepts are structured accordingly, i.e. as a set of necessary and sufficient conditions (DePaul & Ramsey, 1998; Laurence & Margolis, 1999; Murphy, 2004). The procedure of identifying necessary and sufficient conditions has been applied for both descriptive and normative purposes, i.e. addressing both how concepts are used and how they should be used.

In contrast with the classical intuition-based approach to concepts, there are methods for studying concepts that are more empirical in nature. Indeed, the classical procedure based on intuition is empirical in a sense, but it is potentially quite subjective and its findings are sometimes hard to generalize. One such empirical approach is to experimentally study concepts by studying behaviour in tasks which are assumed to involve concept use. For example, categorizing objects (e.g. various birds) can indicate an underlying conceptual structure (e.g. the concept of bird). Assuming that word meanings are concepts, linguistic behaviour can be studied in order to determine underlying concepts. This has been done experimentally, through interviews or by looking at the natural spontaneous production of language. Through the growth of computer capacity, linguists have gained new tools for studying linguistic patterns. Corpus linguists look at text corpora (comprising millions of words) in order to determine words' systematic patterns of use, arguably reflecting a semantic/conceptual structure (J. Allwood, 1998, 2003; Fillmore & Atkins, 1992, 1994; Hanks, 2013; Stewart, 2010; Stubbs, 2002).

Broadly, then, there are two methodological approaches to conceptual analysis: first, the classical philosophical method of determining necessary and sufficient conditions through intuitive critical reflection on thought-up (counter)examples of how a word associated with a concept is used. Secondly, approaches have been developed where actual (assumed to be) concept-involving behaviour, over and above intuitive judgment, is taken as the main empirical source for determining conceptual structure. These two branches of conceptual analysis are not necessarily in conflict. On the contrary, they may interestingly complement each other.

Given the above considerations, the initial listing of two methods relevant for this thesis can be specified. This thesis adopts, first, a *conceptual and linguistic form of discourse analysis* (Article 3, 2 and 5) and second, a *discourse-oriented (usage-based) form of conceptual analysis* (Article 1 and 2).

## 5.2 Language- and concept-oriented discourse analysis

There are two important features of the form of discourse analysis adopted in this thesis (more precisely in Articles 3-5): it is linguistic and conceptual. Let us start by explaining what is meant by the first of these attributes.

First, the discourse (or content) analyses of this thesis focuses on *actual* language use, and tries to closely anchor any generalized categories (pre-analytic or derived) in actual expressions used in the texts under analysis. The analyses here are, in this sense, text-near. This may sound trivial, but it is not. Fairclough (2003, p. 2) makes the observation that "[t]here are many versions of discourse analysis […] One major division is between approaches which include detailed analysis of texts […], and those which don't". Despite much emphasis on "language" and "discourse" in social science and the humanities regarding understanding social structures and behaviour, detailed analysis of language use is far from paradigmatic for the work carried out under the name of "discourse analysis". As Fairclough (2003, p. 2) notes regarding the tradition of discourse analysis strongly inspired by the work of Foucault, "social scientists working in this tradition generally pay little close attention to the linguistic features of texts". However, taking the emphasis on discourse and language seriously (or any "linguistic turn" that has been referred to), actually studying language use closely and applying concepts of linguistic theory seems to be promising a path to take. Here, the analytical categories used for analysis derive in part from linguistic theory, such as frame semantics (Fillmore & Atkins, 1992, 1994), cognitive grammar (Langacker, 2000) and elementa of linguistics (the word class system, syntactic functions, etc.). However, the analytical frameworks that have guided analysis and the categories, or concepts, of those frameworks do not derive from linguistic theory alone.

The discourse (or content) analyses of this thesis are theoretically motivated by the analysis and structure of certain concepts. Most importantly, the analyses presuppose a conception of risk as associated with a specific frame of reference involving certain elements, or roles. Minimally, the frame involves a phenomenon X which has some negative effects on some valued phenomenon Y (Å. Boholm & Corvellec, 2011). Based on observations of the linguistic behaviour of the word *risk*

(and related terms), the frame can be extended and made more elaborated, as we have seen above (section 4.6).[13]

Another concept used for analysis is that of cause, as it is understood by the philosopher John L. Mackie (1965, 1974) (mainly Article 3, but also Article 4 and 5). According to Mackie, when we speak about causes, we typically refer to parts of complex conditions. In a statement of the type "A causes P", A is an INUS-condition for P to occur, that is, A is an *i*nsufficient but *n*on-redundant (or necessary) part of a complex condition which itself is *u*nnecessary but *s*ufficient for the occurrence of the effect P. This view of causality is useful for the analysis of how we speak (or write) about causes and what we mean when doing so.

The function of the discourse (or content) analysis is to identify realizations (or instantiations) of the categories of the theoretical framework in the empirical material (which in our case is linguistic in nature, namely words constituting texts). As such the analysis here is top-down. This procedure is indeed a quite general characteristic of discourse (or content) analysis. However, it is not universal. In Grounded Theory, "concepts" (analytical categories of the empirical material) are supposed to be discovered through the analyst's systematic and iterative encounters with the data (Corbin & Strauss, 1990; Glaser, 1998; Glaser & Strauss, 2006 [1967]). Grounded Theory is a strictly bottom-up approach to data analysis.[14] My approach to discourse (content) analysis is not.

There are, however, two important bottom-up processes in my work. First, there *are* derived categories within pre-analytic categories. For example, the analytical category of Object at Risk can be realized in many ways. These realizations can, in turn, be differentiated and grouped together according to semantic similarity; cf. semantic field analysis (Lehrer, 1974) and "lexical sets" (Hanks, 1996). For example, the words *waterfleas*, *marine organisms*, and *living organisms* may be grouped togeth-

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[13] Here, a terminological and conceptual clarification is needed. In Article 3, the relational nature of risk was ignored for reasons of space and a limited focus. There, "risk" (or "risk issue") is applied as an analytical category. This should be understood as that of "risk object" applied in other articles (cf. the "source of an unwanted event" sense of *risk*, see section 3.1). Moreover, there is no reference to "objects at risk" in Article 3. However, there is a forerunner of Article 3, written in Swedish (M. Boholm, 2008). In this work the relational structure of risk representations is made explicit.

[14] Well, Grounded Theory is at least as bottom-up as it gets. Complete elimination of bias and preconceptions in interpreting data is, of course, impossible. However, note that the Grounded Theory framework systematically tries to minimize preconceptions. For example, Glaser (1998) even recommends not conducting any literature review before analysis.

er under a super-ordinate category of Organism (see Article 4). In this sense, there are bottom-up "inductive categories" in use in the analyses of this thesis (Mayring, 2000; C. P. Smith, 2000).

Secondly, the framework for analysis must be open to revision based on empirical findings. For example, categories that make sense from some analytical point of view, but are never identified in the empirical material, should not have a central role in the analytical framework. Moreover, categories may need revision. Categories that are hard to apply in coding should be re-assessed. While keeping the basic idea, categories can be split into sub-types or two related categories can be merged in order to better capture the presence or absence of distinctions in the material. In this light, the categories used for analysis in this thesis are not exact replications of its original inspiration (Å. Boholm & Corvellec, 2011; Fillmore & Atkins, 1992, 1994; FrameNet, 2014a, 2014b, 2014e, 2014f; Mackie, 1965, 1974), rather they are the result of critical reflection, analysis and development for the specific purpose of each particular study.

A final note to be raised is that Fillmore's and Atkins' work on the risk frame has been developed at the sentence level, while in the language- and concept-oriented approach to discourse analysis used here, it is applied at the textual level. This means that categories of the risk frame are not only identified in *sentences* directly containing *risk* (or related terms), but are considered in the whole text containing such words. Although this is an extension of Fillmore's and Atkins' specific work on the risk frame it is perfectly compatible with the frame semantics program, as it has been formulated elsewhere (Fillmore, 1985; Fillmore & Baker, 2001).

## 5.3 Discourse oriented (usage-based) conceptual analysis

In this thesis, concepts are analysed through explorations of how words associated with the concepts in question are used in discourse. Uses of words are taken to reflect the structures and features of underlying concepts. So, by paying systematic attention to linguistic practice (language use; discourse) the structures and features of concepts can be identified.

A number of methods have been developed to systematically address linguistic practice. In corpus linguistics, linguistic features – morphemes, words, phrases and extra-phrasal constructions – are addressed by studying the use of the linguistic feature in question in large bodies of texts, i.e. corpora. The word *corpus* is Latin for *body*.

The development of information technology and the increased computer capacity in recent years have made large corpora available for analysis. Today many corpora contain hundreds of millions of words. In this thesis two corpora are used. First, in Article 2, the British National Corpus (BNC) is used (BNC, 2007). BNC has many features (see Burnard, 2007). It is a 100 million-word corpus of British English, with material from, for example, novels, newspapers, magazines, political speeches and sport commentaries. It covers the three time periods 1960-1974, 1975-1984 and 1985-1993, where the main part of the corpus is from the last interval. It is tagged for various analytic features, including part-of-speech (POS), i.e. word class.

Secondly, in Article 2, the Corpus of Contemporary American English (COCA) (http://corpus.byu.edu/coca/) is used (Davies, 2009). It is a 450 million word corpus of American English, containing material from five main sections: transcribed spoken data from TV shows, fictional material including novels and movie scripts, newspapers, magazines, and academic journals. The texts cover a twenty-three years period, from 1990 to 2012. Like BNC, COCA contains POS-tagging. Unlike BNC, COCA is fully available on the Internet, although a user account is needed.

A central notion of corpus approaches is (linguistic) *context*, i.e. the linguistic features that surround the word or phrase under analysis. The scope of context considered can be more or less extensive. In collocation analysis, the words (collocates) that frequently co-occur with a target word (node) are often identified within a span of four to five words left and right of the node. In key word in context (KWIC) listings (concordances), wider spans are often applied. Basically, a KWIC concordance is a set of lines, where each line represents a use of a node (key word) in a limited context, say ten words or 100 characters on each side. The concordance can be analyzed in a number of ways (see below). Yet another way to determine context is to follow the boundaries of grammatical structures in which the word or phrase under analysis occurs, such as phrases, clauses and sentences. Such restrictions require that such classifications are available in the corpus used.

The context is analysed with regard to the type of linguistic features it contains. This analysis can focus on lexical types (collocations), grammatical types (e.g. word classes and syntactic functions), and semantic types (e.g. attribution of lexical and grammatical units to "lexical sets" (Hanks, 1996) or "frame elements" (Fillmore & Baker, 2009)). Also, considering analysis of words and phrases, the

grammatical type (e.g. word class and syntactic function) of the word or phrase under analysis derive from its relation to other linguistic elements of its context. For example, *risk* has different syntactic functions in (28) to (30) below; it even constitutes different word classes.

(28) The risk is high    (*risk* is the nominal subject of the clause)

(29) He risked everything  (*risk* is the verb of the clause)

(30) He was at risk      (*risk*, noun, is the complement of the preposition *at*; the prepositional phrase *at risk*, in turn, functions as the predicative complement of the clause)

Ultimately, a corpus enables analysis of patterns and distributions of various lexical, grammatical and semantic categories as they occur in actual and spontaneous discourse. Taking the idea of meaning potential (section 4.2) seriously, as I intend to do here, such patterns of use and distributions of contextual categories are fundamental to forming the meaning of a word, and hence the structure of concepts. The "behavioural profile" of a word (or construction) is an important aspect of understanding its meaning (Atkins, 1987; Gries, 2010; Stubbs, 2002). We can even argue that the meaning of a word emerges from its uses in various contexts, together with other words and grammatical structures. It therefore makes sense to investigate those contexts in order to say something about meaning.

The usage-based approach adopted here is not as much in conflict with more traditional intuition-based approaches to semantics as it might seem. Rather, the two approaches preferably complement each other. In fact, interpretation and intuitive judgment are constantly needed in the processes of empirical semantics. In order to systematically analyse patterns of use, the analyst attributes analytical categories to contextual elements and associates lexical elements to semantic fields. Such decisions are based on linguistic intuitions (cf. Fillmore, 1992).

# 6 Preview of papers

This doctoral thesis contains the following articles:

1. Boholm, M., N. Möller, & S. O. Hansson. 2015. The concepts of risk, safety and security: Applications in everyday language. *Risk Analysis*, Early View (Online Version of Record published before inclusion in an issue), DOI: 10.1111/risa.12464.

2. Boholm, M. 2012. The semantic distinction between 'risk' and 'danger': A linguistic analysis. *Risk Analysis* 32(2): 281-293.

3. Boholm, M. 2009. Risk and causality in newspaper reporting. *Risk Analysis* 29(11): 1566-1577.

4. Boholm, M. 2013. The representation of nano as a risk in Swedish news media coverage. *Journal of Risk Research* 16(3): 227-244.

5. Boholm, M., R. Arvidsson, Å. Boholm, H. Corvellec, & S. Molander. 2015. Dis-Ag-reement: The construction and negotiation of risk in the Swedish controversy over antibacterial silver. *Journal of Risk Research* 18(1): 93-110.

Below these articles are summarized.

## 6.1 The concepts of risk, safety and security: Applications in everyday language

In Article 1, the concepts of risk, safety and security and their relation are analysed. These concepts have received substantial academic interest. However, they are also commonly applied in everyday language, for example, in media discourse. Article 1 explores the concepts of risk, safety and security, and their relation, based on empirical observation of their actual everyday use. Through this approach, technical definitions of *risk*, *safety* and *security* can be compared with actual everyday usage of the terms. This analysis thus enables evaluation of previous academic definitions of the concepts of risk, safety and security, with regard to their anchoring in natural ordinary language.

Methodologically, Article 1 explores the "behavioral profiles" (Gries, 2010) of the nouns *risk*, *safety* and *security* and the adjectives *risky*, *safe* and *secure* in the Corpus of Contemporary American English. A behavioural profile is the distributional patterns of a word with regard to its lexical and grammatical contexts of use (Gries,

2010). In this study, the following lexico-syntactic features have been coded for both adjectives and nouns: basic sense, compounding (single or compound), words in compound, syntactic function (e.g. subject, object, predicative complement, or modifier), verb of clause, complementary syntactic functions (i.e. arguments and adjuncts of the verb in addition to the phrase containing the target word), complementation pattern of clause (intransitive, transitive, di-transitive, copula, complex-transitive), modifiers (adjectives and adverbs), and complements (e.g. prepositional phrases and relative clauses). In addition, for the adjectives the features inflection (comparison form), attributive vs. predicate use, and noun modified in attributive use are coded. For each of the words (i.e. *risk*, *safety*, *security*, *risky*, *safe*, and *secure*) a random sample of 500 contexts is analyzed. Thus, 3 000 contexts are analyzed in total.

There are four main findings of Article 1. First, the three nouns *risk*, *safety*, and *security*, and the two adjectives *safe* and *secure* have widespread use in different senses. The polysemy of the terms makes any attempt to define them in a single unified manner difficult to implement. Most often, academic definitions focus on only one of the several senses of the terms.

Second, the relationship between the concepts of risk, safety and security is complex and only partially confirms the conceptual distinctions commonly made in specialized terminology. In the literature, safety and security are distinguished in terms of intentionality (e.g., Ale, 2009; Piètre-Cambacédès & Chaudet, 2010) and the distinction between a system and its environment (e.g., Line, Nordland, Røstad, & Tøndel, 2006). While the first of these ways of distinguishing safety from security can at least partly be supported by our analysis, i.e. safety concerns unintentional harm and security intentional harm, the latter distinctions is less supported by corpus material of everyday use.

Third, quantitative understandings of risk, i.e. in terms of probability and expectation value, are quite rare in everyday language and strictly numerical meanings are extremely rare. Rather, non-quantitative (qualitative) meanings of risk dominate (i.e. understanding risk as an unwanted event or a source thereof, see section 3.1 above). This contrasts with the focus on defining risk as the probability of unwanted events or as expectation values, which is found in the specialized terminology (see, e.g., Ale, 2009; Graham & Wiener, 1995).

Fourth, the three adjectives *safe*, *secure*, and *risky* are often used in comparative form. This speaks against interpretations that would take them as absolute, all-

or-nothing concepts, such as the definition of *safety* as "no harm" (Miller, 1988) or as "the absence of accidents" (Tench, 1985).

Article 1 is co-authored by Max Boholm, Niklas Möller and Sven Ove Hansson. Boholm is the main contributor to the paper and therefore the first author. The text is mainly written by Boholm but is throughout improved by comments from Hansson and Möller with regard to language, structure, and needs of clarification. The themes ("lessons") that organize the concluding discussion (the section titled "Four lessons for risk, safety and security research") were suggested by Möller and Hansson. This section was then written jointly based on this structure. The framework for empirical analysis and the coding scheme was designed by Boholm. Empirical analysis and coding was conducted by Boholm, although critically discussed with Möller and Hansson.

## 6.2 The semantic distinction between *risk* and *danger*: A linguistic analysis

In Article 2 another conceptual analysis is carried out. In this article, the concept of risk is compared with the concept of danger. Sometimes, the words *risk* and *danger* are considered to be synonymous (Douglas, 1992, p. 24). However, the sociologist Niklas Luhmann (1993) has suggested that *risk* and *danger* have different meanings: the concept of risk presupposes a decision (cf. also Beck, 1995; Fischhoff & Kadvany, 2011), while the concept of danger does not. Luhmann (1993, p. 16) suggests that "we speak of risk only if we can identify a decision without which the loss could not have occurred". We speak of dangers, on the other hand, in "the case where future losses are seen not at all as consequences of a decision that has been made, but are attributed to an external factor", according to Luhmann (1993, pp. 101-102).

The article critically assesses these assumptions by exploring actual language use. Corpus data from British English of the nouns *risk* and *danger* and the verbs *risk* and *endanger* are analysed. For each word 100 contexts are analysed. The article explores the four words' explicit associations with decision-making in corpus data, and more implicit forms of association using frame semantics as an analytical framework. Frame elements of the risk frame (section 4.6) are identified in the contexts of *risk* (noun), *danger*, *risk* (verb) and *endanger*.

If Luhmann's distinction between risk and danger is relevant to ordinary language use of the terms, we would expect *risk* (noun and verb) to be explicitly associated with *decision* (and *choice*) to a greater extent than *danger* (and *endanger*). Furthermore, we would expect the frame elements of Decision and Goal to be more frequently realised with *risk* (noun and verb) than with *danger* and *endanger*, while the element of Source would be more common in contexts of *danger* and *endanger* than it is in contexts of *risk* (noun and verb).

Corpus data on *risk* and (*en*)*danger* partly support Luhmann's ideas, and partly contradict them. Supporting Luhmann, agency and decision-making is highly relevant for understanding how *risk* is used in ordinary language. Furthermore, (*en*)*danger* is used more often than *risk* to represent situations where external non-actions are the source of unwelcome situations. Contradicting Luhmann, the strong association to agency is not unique to *risk*, but is an important aspect of describing the meaning of *danger* as well. In ordinary language use both risks and dangers are represented as results of actions. Given a dynamic view of word meaning (cf. section 4.2), we can describe the meaning of *risk* and (*en*)*danger* in relation to two tendencies: (*en*)*danger* tends to represent non-agency situations to a greater extent than *risk* (although both concepts are used to represent agency-involving situations); and *risk* tends to represent planned and calculated goal-oriented agency to a greater extent than (*en*)*danger* (although this form of representations far from dominates the uses of *risk*).

## 6.3  Risk and causality in newspaper reporting

Article 3 analyses a news media discourse held together by (i) reference to a geographical region, namely the Göta Älv river valley in south west of Sweden, and (ii) reference to the Swedish word *risk*, or related words *fara* (danger/hazard), *säkerhet* (security/safety) and *hot* (threat). The general research problem addressed is how news media represent causal explanations of risk. More specifically three research questions are raised: What are identified as risk objects? Which causal conditions are cited for the risks? And, what relationships are identified between causal conditions?

Theoretically, the analysis takes as its starting point the work on causality by the philosopher John L. Mackie. According to Mackie (1965, 1974), the concept of cause can be understood in terms of necessary and sufficient conditions. Given a statement of the form *A causes P*, for example *rain causes landslides*, rain is insuffi-

cient for landslides to occur, since rain in itself does not cause landslides; several other factors need to be met (e.g. there need to be a certain angle of the slope for land to slide, the ground must have a certain degree of instability in relation to its weight, etc.). However rain is a necessary part of a more complex condition (including rain, angle of slope, instability, etc.) that results in landslides. This complex condition is, in turn, sufficient for a landslide to occur, but it is not necessary for there to be landslides, i.e. landslides can occur due to other complex conditions (e.g. earthquakes, etc.). An important lesson from Mackie's reasoning is that when we speak of causes we often select some condition and present that as *the* cause of some event, even though this event would not be possible without a much more complex set of conditions. Hence, statements of causes are often simplifications. Moreover, many different (complex) causal conditions can have the same effect. As such, Mackie's insights fit well with the theory of framing, i.e. how we in communication focus on some aspect of perceived reality rather than others (Entman, 1993; Murdock et al., 2003).

Methodologically, 166 Swedish newspaper articles are analysed, namely those that refer to *Göta älv* and at least one of the terms *risk*, *fara* (danger/hazard), *säkerhet* (safety/security) and *hot* (threat). They were coded based on the general categories of causal condition and risk (i.e. risk object), in turn encompassing specific sub-categories not known prior to the analysis.

There are three main risks reported in the media coverage of Göta Älv river valley: landslide, flooding and polluted water. With respect to causality, newspaper media frame the risks in various ways. At an abstract level, events can be represented (framed) as risks or as causal conditions of other risks, for example, landslides and flooding can be represented as risks themselves (e.g., *risk of landslides*) or as causes of the risk of polluted water. Furthermore, risks can be represented with various degrees of causal complexity. No causal conditions may be provided, a single cause may be provided, or a more complex set of causal conditions may be provided. Also, at a very concrete level, one and the same risk can be presented as the effect of different causes, for example, landslides can be represented as caused by rain, a steep slope, quick soil, or erosion (in turn caused by maritime traffic).

In the risk communication literature focusing on media reporting of risk it is often assumed that media simplify risk issues. This assumption can be (partly) confirmed: newspaper media often provide simple explanations of risks, referring to single causes. However, considering media coverage as a whole, including the

causal explanations provided by several articles, much more complex pictures of risk issues emerge. When considering the causal conditions provided for risk issues on an overall aggregated level of media reporting, similarities are identified with scientific assessment of landslides and flooding.

## 6.4 The representation of nano as a risk in Swedish news media coverage

In the Article 4, another news media discourse is under analysis. This discourse is held together by its reference to (1) the abstract notion of *nano*, and (2) *risk* or *fara* (danger/hazard). This discourse refers to a wide variety of phenomena, for example, *nanotechnology*, *nanometre*, *nanoparticle*, *nanomaterial*, and *nanorobot* (M. Boholm, 2014; M. Boholm & Boholm, 2012; Joachim, 2005), which however are clearly related. The morpheme *nano* derives from the Greek word for dwarf. Through metonymical extension, *nano* is applied as a prefix of the SI-system, meaning billionth part. For example, a nanometre is a billionth part of a meter and a nanosecond is a billionth part of a second. The morpheme *nano* has received yet another derived meaning. Nanotechnology is the study and manipulation of matter at the scale of less than 100 nanometres. It is associated with great benefits for society and mankind, but also risks and potential risks, ranging from the asbestos-like properties of nanoparticles to nanorobots extinguishing mankind.

Previous work on *nano* in the media has concluded that nano-phenomena are represented as risks (e.g., Anderson, Petersen, Wilkinson, & Allan, 2009). However, there is limited work on exactly how nano-phenomena of various kinds (e.g. nanotechnology, nanorobots, and nanoparticles) are represented as risks. Article 4 sets out to improve our knowledge in this respect.

Under analysis are 141 articles of Swedish newspapers that refer to some nano-phenomena as a risk. Categories for analyses mainly derive from Å. Boholm's and Corvellec's (2011) relational theory of risk and Fillmore and Atkins' (1992, 1994) frame semantics, with some modifications.

Articles on *nano* and *risk* fall into five main categories based on what are identified as risk objects: (I) nanotechnology, without reference to nanoparticles, materials and products (10%); (II) nanotechnology and its particles, materials and products (24%); (III) nanoparticles in products (e.g. sunscreens, food and cosmetics), without reference to nanotechnology (28%); (IV) nanotechnology and nanorobots

(10%); and (V) non-nanotechnological nanoparticles, i.e. particles originating from, for example, traffic or household combustion (23%). In each group various patterns emerge regarding what are represented as objects at risk (e.g. health), bad outcomes (e.g. cancer), conditions under which the risk exists (e.g. inhalation of particles), areas of application (e.g. sunscreens), properties of risk objects (e.g. airborne), other types of objects to which the risk is compared (e.g. asbestos) and persons (or institutions) according to whom there is a risk (e.g. scientific experts). For example, articles in Group I often lack specifications of an object at risk, but sometimes refer to rather vague bad outcomes, such as, problems and misery. This contrasts with articles in Group II, III and V in which health and the environment are articulated concerns. In these articles, various medical conditions, like cancer and respiratory problems, are commonly presented as potential bad outcomes. Articles in Group IV address quite different issues in a rather dystopic manner. In these articles, human freedom, life on earth, and the planet Earth are articulated as objects at risk. Bad outcomes specified include the end of mankind. Associations are made to the atomic bomb. In the articles in Group I, II and V, scientific experts of often cited as the sources of risk claims. This contrasts with Group III in which this is rare, and NGOs and regulators are more often cited as sources instead. Also, the citing of scientific experts contrasts with the articles in Group IV, where the celebrity Bill Joy is the main cited source.[15]

Overall, the patterns identified fit some global trends on nanorisk media reporting (Friedman & Egolf, 2011), for example, a science-based narrative involving uncertainty and the potential health risk of nanoparticles, but also science fiction-based apocalyptic scenarios involving nanorobots destroying the world.

## 6.5 Dis-Ag-reement: The construction and negotiation of risk in the Swedish controversy over antibacterial silver

Risk communication is often controversial. Article 5 analyses the construction and negotiation of risk in a Swedish controversy over the use of antibacterial silver in consumer products and health care. Since the metal silver has antibacterial proper-

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[15] In 2000, the computer scientist and entrepreneur Bill Joy authored a magazine article entitled "Why the future doesn't need us" which depicted a dystopian future scenario where mankind was threatened by technological development, including nanotechnology (Joy, 2000). Joy's article received substantial media attention worldwide.

ties, it has been applied in a number of products to kill bacteria and thus to reduce, for example, infections and bad smell. In Sweden and elsewhere, this use of silver has, however, been criticised. Concerns have been raised that antibacterial applications of silver have negative effects on the environment and human health. In response, claims have been made that silver is beneficial with respect to exactly the same domains (e.g. environment and health).

In Sweden, the controversy involves a number of actors. Under analysis in this study are a number of texts in Swedish: newspaper articles (*n*=88), transcribed television news features (*n*=2), and documents from companies (*n*=10), government agencies (*n*=28), municipalities (*n*=15), NGOs (*n*=23), and Swedish parliament and government (*n*=6).

In order to analyse how this controversy over antibacterial silver is organised with respect to risk, a simple set of four categories is used: silver-associated risk objects, objects at risk from silver, risk objects managed by silver, and objects at risk from risk objects managed by silver. These four categories derive from the two notions of Risk object and Object at risk of the relational theory of risk (Å. Boholm & Corvellec, 2011), which are roughly equivalent to the categories Source (cf. risk object) and Possession (cf. Object at Risk) of frame semantics.

In the controversy analysed, silver is construed as a risk object negatively affecting a long list of objects (at risk): for example, *the environment*, *our water*, *ecosystems*, *nature*, *health*, *organisms*, *animals*, *bacteria*, *microorganisms*, *fish*, *algae*, *children*, *the body*, *life in water*, and *digested sludge*. (Note that the empirical material is in Swedish and that these examples are translations.) In contrast, other actors in the controversy deny that silver poses a risk to such values, and silver is instead claimed to manage (mitigate) a long list of risk objects, for example, *bacteria*, *E.coli*, *fungus*, *avian flu*, *spread of contagion*, *infections*, *bad smell*, and *stinky sports gear*; which in turn, are related to various objects at risk, for example, *the environment*, *nature*, *health* and *natural resources*. Hence, silver is claimed to pose a risk to the environment and public health by some actors, while it is claimed to be beneficial to exactly the same values, by other actors.

Based on the findings of how risks are construed and negotiated in the controversy by different actors, three general strategies of risk communication are identified: first, affirmative risk communication (ARC), in which something is construed as a risk object having negative effects on an object at risk, for example, *silver is a risk to the environment*; secondly, denial, i.e. the associations in ARC are de-

nied; and thirdly, benefit association, i.e. the object construed as a risk object in ARC is instead associated with benefits, thus the associations established in ARC is implicitly denied. These findings partly confirm principal classifications of risk communication strategies (Å. Boholm & Corvellec, 2013; Corvellec & Boholm, 2008). These strategies are believed to be relevant not only to understand the controversy at hand, but also to understand the structure of risk controversies more generally.

Article 5 is a co-authored paper by Max Boholm, Rickard Arvidsson, Åsa Boholm, Hervé Corvellec and Sverker Molander. Max Boholm is the main contributor to the paper and therefore the first and corresponding author. The introduction is largely the result of joint work by all authors. The literature review of risk communication in the introduction was conducted by Max Boholm and Åsa Boholm. The section on the analytical framework was written by Max Boholm, Åsa Boholm and Hervé Corvellec. The theory applied derives from the work of Åsa Boholm and Corvellec (Å. Boholm & Corvellec, 2011). The paragraph on linguistic practice was mainly written by Max Boholm. The background passage on antibacterial silver was written by Arvidsson, Max Boholm, and Molander. However, it is mainly the expertise of Arvidsson and Molander that has guided this section. Coding was carried out by Max Boholm, although discussed with co-authors. The categories of the methodological framework are based on Max Boholm's specific adoption of Åsa Boholm's and Corvellec's theory (Å. Boholm & Corvellec, 2011). The section on method was written by Max Boholm. The discussion and the conclusion are the result of joint work by all authors.

# 7 Conclusion and discussion

Risk research has undergone a series of phases (Renn, 1998; Strydom, 2002). In its initial phase, the dominant focus was on the technical assessment of risk (Strydom, 2002), involving probability estimates of catastrophic events, paradigmatically a nuclear meltdown (e.g., Otway & Erdmann, 1970; Rasmussen, 1975). Although public attitudes and concerns have been of interest since the early phase of risk research (Rasmussen, 1975; Starr, 1969), this interest has grown in later phases. Socio-cognitive aspects of risk have become key areas of interest in risk research.

Numerous studies in risk perception and risk communication have established that risks can be understood very differently depending on socio-cultural background, beliefs and values. Controversy often evolves as a result of such differences. Technocratic chauvinism, lack of trust, and lack of genuinely participatory decision-making processes can deepen such controversies.

Given such challenges, a long standing issue of risk research has been to formulate generic frameworks for technically, ethically and democratically sound ways of assessing and managing risks in society (NRC, 1983; Renn, 2008; Renn & Graham, 2005; Rosa et al., 2014; Stern & Fineberg, 1996). Such frameworks typically emphasise analytic-deliberative approaches to risk management, where rigorous scientific methods and evaluations interact with and complement inclusive communicative processes with "interested and affected parties", to "discuss, ponder, exchange observations and views, reflect upon information and judgements concerning matters of mutual interest, and attempt to persuade each other" (Stern & Fineberg, 1996, p. 4). Stern and Fineberg (1996, p. 2) emphasise the importance of taking "significant concerns of the interested and affected parties" into account in risk characterisation. Similarly, the risk governance framework of Rosa et al. (2014) specifies the step of "pre-estimation" in their model to involve:

> … *screening* to winnow from a large array of actions and problems that are risk candidates. Here it is important to explore what political and societal actors (e.g., governments, companies, epistemic communities, and NGOs) as well as citizens identify as risks. Equally important is to discover what types of problems they identify and how they frame them in terms of risk and in terms of uncertainty, complexity, and ambiguity. This step is referred to as framing, how political and societal actors rely on schemes of selection and interpretation to understand and respond to those phenomena that are relevant risk topics (Rosa et al., 2014, p. 159, italics in original).

Rosa et al. (2014) encourage analysis of how various actors identify risks, and how they frame them. Such an analysis is the first step of their framework for organising risk governance processes, subsequent steps being: risk appraisal, or risk estimation, risk evaluation, and risk management (see Rosa et al., 2014, ch. 9).

The approach developed in this thesis can be seen in the light of such ambitions to "explore what political and societal actors … identify as risks" (Rosa et al., 2014, p. 159) or the "significant concerns of the interested and affected parties" (Stern & Fineberg, 1996, p. 2), in that it provides theoretical and methodological

tools for analysing varying societal actors' representations of risk, paying close attention to their actual language and the ways they articulate problems. In this context, this thesis makes both theoretical and methodological contributions.

This thesis contributes to our understanding of the concept of risk and how this concept functions in the organisation of discourse. The concept of risk presupposes evaluation. Such evaluations are realised in the context of the word *risk*. At a minimum analytical level, accounts of risks are organised against a relational structure (Å. Boholm & Corvellec, 2011; Hilgartner, 1992), involving a risk object and an object at risk, where the risk object under certain causal circumstances potentially negatively influences the object at risk. Here, the notion of "object" should be understood very generally as including artefacts (e.g. nanorobots) and substances (e.g. silver), but also persons and reified processes and events (e.g. flooding and landslides), as well as properties and states (e.g. being antibacterial or 1-100 nanometre in diameter). Expanding our analytical understanding, the concept of risk is organised in relation to a wider cognitive frame (Fillmore & Atkins, 1992, 1994), differentiating various sources of risk situations based on the persons involved, their actions and valued assets, the level of intentionality, other sources of risky situations, potential unwelcome outcomes, and intended gains.

The risk concept and its associated frame provide structure to discourse. In the articulation of risk issues and risk controversies, conceptual elements are realised through actual linguistic practice. Controversy arises due to different constructions and realisations (or instantiations) of conceptual elements.

The framework developed here suggests a unified concept of risk with a particular systematic relational structure. It is not the case that there are a myriad of risk concepts employed in society. There is basically one structure (although the word *risk* indeed is polysemous), but this very structure enables negotiation of risks and a diversified articulation of risk issues. Depending on perspective and context, one and the same basic structure can give rise to different instantiations.

The concept of risk shares part of its structure with related concepts, for example, those of danger, safety and security. However, there are also semantic contrasts to be noted. For example, *risk* and (*en*)*danger* tend to differ with respect to the type of agency in the situation they describe. While the concept of risk has an orientation towards health and relies heavily on quantification, the concept of safety is associated with traffic, work and food, and the concept of security is associated

with domains of international relations, prevention of violence and information technology.

This thesis contributes methodologically to how risk issues and risk controversies can be analysed. Taking the linguistic nature of the concept of risk and risk communication seriously, the thesis demonstrates how a language-near approach can be used to understand the concept of risk, its relation to related concepts, and the structure of risk issues in a discourse.

Paying close attention to linguistic practice and to the very structure of the risk concept, realisation of risk issues and risk controversies can be understood in detail. General questions that can be raised in relation to all risk discourses are: What is actually communicated as being at stake, from what source, under what circumstances, and by whom? Based on a unified view of the risk concept, the same basic analytical tools can be applied in a wide variety of contexts (e.g. risk issues of a restricted geographical area, such as the Göta Älv river valley, or the risks associated with *nano* or *silver*). The analytical tools minimally include identification of something negatively affecting something else, and more extensively, identification of causal reasoning including agency, degrees of intentionality, and unwanted outcomes.

Moreover, the concept of risk is defined in many ways (Aven, 2012; Aven & Renn, 2009; Hansson, 2011, 2013). In the literature it is often far from clear what should serve as criterion for evaluating definitions. Are the definitions normative or descriptive? Are they stipulated to explain an author's intended meaning of a term in a limited context or recommendations on how a term should be applied more generally by others?

Without knowing answers to such questions it is hard to evaluate if one definition is better than another. In order to anchor definitional discussions of risk, it is time to seriously consider actual linguistic practice of *risk* and related terms (Hansson, 2006, 2013). Arguably, definitions that proximate actual uses of terms have a potential to be systematically implemented and successfully understood, reducing possible misunderstandings. This thesis shows how linguistic approaches and consultation of corpus data can be used in order to inform definitional discussions of risk.

Building on the theoretical and methodological contributions of this thesis, an outlook towards future research is possible. This thesis outlines two paths to be followed:

- Empirical investigations of the semantic field of risk: besides concepts analysed in this thesis (risk, danger, safety and security), other central concepts of this field include, for example, the concepts of hazard and peril. In more peripheral parts of this field we find, for example, the concepts of vulnerability, resilience, benefit and luck. How is the concept of risk positioned in this field? What semantic dimensions does it share with these other notions? How is risk different from other notions of this field?

- Analysis of risk issues and risk controversies paying close attention to language use and the structure of the risk concept: the list of risk issues in today's society is immense. There are ever emerging association between *risk* and various phenomena. By paying close attention to the language use and how the concept of risk structures such issues in terms of sources of harm, assets at stake, causal conditions, and agency, specific risk issues and controversies can be understood in more depth. Such an approach will systematically illuminate of what controversy consists, how various risk issues differ, and how they resemble each other. Such analysis can be part of risk management frameworks that address conceptualisations of risk issues as part of their program (Renn 2008; Rosa et al 2014).

Moreover, it would be interesting to extend the approach developed here along three additional lines:

- Language comparison: national languages (e.g. Swedish, English, Finnish and Vietnamese) can differ with respect to the resources they provide for the articulation of thought, in having different grammatical structures and vocabularies that make different distinctions in conceptual, social and physical space. To investigate how semantic fields organised around potential adversity differ in different languages would be a truly intriguing task. Are the associations between risk and health observed in English (Hamilton et al., 2007; D. E. Hardy & Colombini, 2011) as strong in other languages? Perhaps, other associations have a more central role in other languages (e.g. associations to the environment; cf., for example, the early emergence of green parties in Belgium, Germany and Sweden).

- Systematic genre comparisons: a long standing issue in risk research is the difference in perception and communication by different actors of society (e.g. experts, lay public, politicians and news media). The approach developed in this thesis could be extended to systematically investigate how the concept of risk and discourses on risk differ between such actors and between the various text genres in which they operate. What sources of harm, unwanted events, assets at stake, and causal conditions (and complexity) are found in the discourse produced by different actors in society? How do societal actors articulate risks linguistically in communication?
- Temporal dynamics: for example, Zinn (2010) and Lupton (1999) observe an increased interest in risk in media reporting and academic writing. Does this increase in attention correlate with any semantic shift? Are attention to certain sources of harm, unwanted events, assets at stake, and causal conditions shifting or are they constant?

The concept of risk is a linguistic abstraction enabling systematic cognition and communication about potential adverse events of the future. As such, this thesis intends to take seriously this linguistic nature of the risk concept and the discourses in which it is applied. I hope that the thesis illustrates how such an approach can take shape and how such a path can be followed.

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# 9 Minor errata in printed articles

**Article 2:** Boholm, M. 2012. The semantic distinction between 'risk' and 'danger': A linguistic analysis. *Risk Analysis* 32(2): 281-293.

- Page reference of the second quote on p. 282 is incorrect. It should be *pp. 101-102*, not "pp. 101-1102".
- On page p. 288 (left column, 23rd line, including blank ones) the pronoun should not be "its" but *it*.

**Article 3:** Boholm, M. 2009. Risk and causality in newspaper reporting. *Risk Analysis* 29(11): 1566-1577.

- On p. 1570, in example 2, it should say *Göta älv*, not "Gäta älv".
- The last point of the list on p. 1572 is ambiguous between examples in the article and entries of the numbered list in which it is presented. The information within parenthesis should read *e.g., example 1 vs. 2 vs. 4 vs. 5*, not just "e.g., 1 vs. 2 vs. 3 vs. 4 vs. 5" as it stands now.
- In Fig. 2 (p. 1573) the dashed line between "shipping" and "erosion" should be grey, not black.

**Article 4:** Boholm, M. 2013. The representation of nano as a risk in Swedish news media coverage. *Journal of Risk Research* 16(3): 227-244.

- Following the convention established in the paper (see pp. 233), the category in the paragraph before the section "Group III: …" on p. 237 should be represented as *[regulators]* (square brackets), not "(regulators)" (standard parenthesis) as is the case in the published version of the paper.
- The same is true of "(motor vehicle tyres)" (standard parenthesis) on p. 239 (the second last line) and "(motor vehicles)" on p. 240 (second line) – it should be *[motor vehicle tyres]* (square brackets) on p. 239 and *[motor vehicles]* on p. 240.
- The name of Åsa Boholm is miss-spelled in the "Acknowledgments" section. There should be capital letter on her first name, i.e. *Åsa*, not "åsa".