

SOCIOLOGY AND NATURE: AN ECOLOGICAL-SYMBOLIC ANALYSIS OF A CONTAMINATED NEIGHBOURHOOD

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PREFACE

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CHAPTER 1: THEORY AND METHODOLOGY

Introduction

While it may sound 'natural' that my dissertation is 'submitted to obtain a doctor's degree in political and social sciences, option sociology', from the start of my journey, I constantly questioned to what extent it is desirable as well as tenable to restrict sociology to a 'sociology of the social'. Therefore, my first aim is to breach the taken for granted with regard to the establishment of a 'sociology as if nature did not matter' (Murphy, 1997). I will consider the intellectual and historical climate in which sociology developed as a discipline. This contains an overview of the dominant Western worldview and anthropocentrism on the one hand, and some determinist and reductionist phobias that characterize the sociological discipline on the other hand. Secondly, an overview is given of the different positions environmental sociologists take vis-à-vis the relation between the social and the non-social. These include but are not restricted to: realism, constructivism, and anti-dualism. The internal differentiation within environmental sociology is framed in Abbott's notion of 'microcosm' (i.e. the idea that a subset of a larger unit contains scaled-down versions of structures and processes in the larger unit). Further, an ecological-symbolic approach (ESA) (Kroll-Smith & Couch, 1991) is developed to study the reciprocal relations between the natural and the social. The intermediate position of the ESA between strong constructivism or a postmodernist stance on the one hand, and the strong program on materiality on the other hand, is clarified and grounded in reconstructed realism (Rosa, 1998). Next to epistemological and theoretical responses to intra (sub)disciplinary debates, new directions on the methodological terrain are postulated. In particular, the potential of mixed-method research will be introduced as a dignified alternative for the one-sided use of qualitative or quantitative research methods. Finally, before we discuss the results (chapters 2 to 5), the specific research questions, the methods, and the data will be considered.

Social theory, sociology and nature

From the 16th century to the 18th century, the state of nature within social theory was regarded as an inferior state, a phase preceding the civilized stage (Barry,

2007). Since then, we notice with other scholars (e.g., Grundman & Stehr, 2000) that mainstream social sciences still exclude nature from their theoretical and empirical analyses. Before we look for the factors that can explain the establishment and maintenance of a purely social sociology, as well why and how environmental sociologists aim to widen the scope of mainstream sociologists, we briefly discuss some social scientists that took nature more seriously.

In *Discourse on the Origin of Inequality* Rousseau stated that “the pre-civilized stage of human development was in fact more virtuous, morally good and admirable than the so-called ‘advanced’ civilized and cultured stage of social advancement” (Barry, 2007: 53). Opposed to the children of the Age of Enlightenment, adherents of Romanticism emphasized the aesthetic and spiritual relations between people and their environment (Dickens, 2004; Benton, 2007). Since the end of the 18th century, some social thinkers started questioning the utopian visions of endless social progress. A major example of this critique traces back to Thomas Malthus’ theory of population. In *An Essay on the Principle of Population* he alerted to the prevailing ideas about unlimited progress because, while the population seemed to increase geometrically, food supply increased only arithmetically. During the mid-19th century, one of the most popular thoughts about the relation between people and the environment emanated from evolution theory as developed by Charles Darwin (1809-1882). Fitting to the organistic sociology as conceived by Social Darwinist Herbert Spencer (1820-1903), Auguste Comte (1798-1857) interpreted the society as an organism. However, whereas Comte provided an overview of the evolution of knowledge about nature, Spencer aimed to understand the evolution of humanity by focusing on the theory of natural selection and competition (Swingewood, 2000). Further, in a series of essays at the end of the 19th century, the Russian anarchist Kropotkin challenged the social Darwinist assumption that people were competitive by nature and that this competitiveness was functional to survive. In his view, the evolution of species was driven by cooperation rather than competition (Barry, 2007). According to Kropotkin, welfare in the social world should be gained by fundamental principles (e.g. solidarity) that he believed to be derivable from mechanisms in the natural world. Meanwhile social geography was separated from general geography. German geographers such as Friedrich Ratzel emphasized the influence of the physical environment on human culture

(Nelissen, 1972). Another social theory in the 19th century in which the environment played a role was Marxism and its attention for the material basis of social organization. However, although some authors quote Marx's description of nature as 'man's inorganic body' (Grundmann, 1991; Järviöski, 2001), it is more widely accepted that the nonhuman world was not considered as an important issue for Marx (cf. e.g., Goldblatt, 1996). This critique also applies to other major sociological figures like Emile Durkheim and Max Weber. In *The Consequences of Modernity* Anthony Giddens (1990: 8) notes that although these classical social thinkers "saw that modern industrial work had degrading consequences, subjecting many human beings to the discipline of dull, repetitive labour, it was not foreseen that the furthering of the 'forces of production' would have large-scale destructive potential in relation to the material environment."

During the first decennia of 20th century, more serious attempts to study society-nature relationships were made by some ecologists, rural sociologists and geographers working at the University of Chicago (Laska, 1993). From the 1920s onwards some thinkers such as Burgess, Park, Hawley and McKenzie introduced a human ecology whereby concepts from the ecology of plants and animals (e.g. succession, segregation, natural areas) were applied by analogy to the study of social phenomena like urbanization and immigration (Nelissen, 1972). Shortly after the Second World War, some of the most known works dealing with the relation between nature and society were Adorno and Horkheimer's *Dialectic of Enlightenment* (1947) and Marcuse's *One-Dimensional Man* (1964). These adherents of the Frankfurt School alerted to the one-sided treatment of the environment as a human resource (Barry, 2007). Further, during the sixties Duncan (1961) proposed to study the reciprocal relations between the population, organizations, the environment and technology (i.e. the POET-model). One year later *Silent Spring* (1962) was written by the biologist Rachel Carson. This work inspired widespread public concern for the impact of pesticides on people and the environment. In addition, in *General System Theory* Von Bertalanffy (1968) called attention for open systems and the isomorphisms between social and non-social systems. Further, the energy crisis in the 1970s and other major events like international conferences and grassroots demonstrations lay the foundation for a rising awareness of ecological constraints (cf. e.g., Earth Day (1970); The United Nations Conference on the Human

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Environment at Stockholm (1972)). In addition, Hannigan (2006) remembers that, in the early 1970s, other books and reports such as *On Man and his Environment* (Klausner, 1971) and *The Limits of Growth* (Meadows et al., 1972) helped to increase environmental concerns among academics. Economics (e.g. Daly), anthropologists (e.g. Hardesty), political scientists (e.g. Rodman), and sociologists (e.g. Catton and Dunlap) all started using an ecological paradigm.

In 1978 *The American Sociologist* published the first article on the rising field of environmental sociology. Entitled "Environmental Sociology: A New Paradigm", Catton and Dunlap (1978, 1980) provided a new perspective on human societies by stating that people are not exempted from the ecological constraints that are embedded in the web of life. By the mid-1970s the International Sociological Association, the American Sociological Association, and the Society for the Study of Social Problems, all had sections relating to environmental sociology (Krogman & Darlington, 1996). Since then, Buttel (2003) notes that, until the early 1990s, environmental sociologists were mainly examining social causes of environmental destruction. In *Environmental Sociology*, Hannigan (2006) discusses two primary approaches that provide explanations for the environmental crisis: Catton and Dunlap's model of competing environmental functions and Schnaiberg's political economy explanation. Catton and Dunlap (1993) identified three competing functions of the environment for people: living space, supply depot, and waste repository. They argue that these functions increasingly compete with one another since the beginning of the 20th century, posing serious questions about the potential to exceed our carrying capacity. Schnaiberg (1975, 1980) provides a more critical assessment in the sense that he specifies the tensions between political and economic systems on the one hand, and the environment on the other hand. He argues that the economic expansion in advanced industrial societies cause environmental problems that in turn limit economic growth. Although the capital-intensive investments of multinational firms cause several social and environmental problems, the state encourages further expansion, creating a treadmill of production (Buttel & Humphrey, 2002).

Next to theories about environmental destruction, during the 1980s and the early 1990s, sociologists produced normative theories of environmental improvement (Hannigan, 2006). The best known approaches are Beck's theory of the risk society and Mol and Spaargaren's theory of ecological modernization.

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According to Beck (1992) in a *Risk Society* risks are no longer limited to natural disasters but are often unintended consequences of human interference with nature. The pervasiveness of these modern risks challenges the societal order by a process called 'reflexive modernization'. Distinct from the first modernity, this reflexive or second modernity is characterized by "an awareness of living in a society of increasing vulnerability to the unpredictable, unfamiliar and unprecedented risks manufactured by modern science and technology" (Ekberg, 2007: 345). This in turn breaches our ontological security calling for new and more deliberative forms of democracy. Different from Schaiberg's treadmill of production and Beck's eco-alarmism, Mol and Spaargaren (1992) postulate that technological development and economic growth are not incompatible with environmental preservation. According to Mol en Spaargaren, the environmental crisis can best be solved through further advancement of technology and industrialization (Fisher & Freudenburg, 2001). Given their conclusion that production processes are increasingly based on ecological criteria, these scholars are looking forward to the development of a sustainable capitalism (Pellow, Weinberg, & Schnaiberg, 2000).

Next to developments in social theory, since the 1970s, sociologists started with the empirical study of the associations between social and environmental variables (see e.g. Burch, 1976; Freudenburg & Gramling, 1993; Gunter, Aronoff & Joel, 1999; Frank, Hironaka & Schofer, 2000). Riley Dunlap (2002: 14), one of the pioneers of environmental sociology, said that the range and diversity of work that includes environmental variables in social research "more than fulfils his early hopes that environmental sociologists would make the empirical study of relations between social and environmental conditions the defining feature of our field." However, despite major efforts and the establishment of environmental sociology as an independent subdiscipline, it is more widely concluded that mainstream sociology still excludes nature from their theoretical and empirical analyses. For example, Krogman and Darlington (1996) analysed the coverage of environmental sociology in nine mainstream sociology journals between 1969 and 1994, and found that, despite an increase during the 1990s, less than 2% of all articles published were environmental. As a result, it shouldn't surprise that, despite environmental sociology has received a certain standing in the sociological discipline, major environmental sociologists like Frederik Buttel (2002) still see little recognition of the statement that ecological

phenomena ought to play an important role in sociological analysis (see also Buttel, 1996). But how come that, despite it became difficult to deny the severity of the disturbances between societies and the environment, mainstream sociologists did not and still don't seem to be inclined to include environmental variables in sociological research?

Sociology without nature: how come?

In what follows, we address the question 'why do (did) mainstream sociologists exclude(d) ecological variables from sociological research?'. In a first section, we will focus on some external and intra-disciplinary factors that induced the establishment and the maintenance of a 'sociology as if nature does not matter'. A second series of explanations will be situated within intra-subdisciplinary disagreements about the desired epistemological/theoretical and methodological/empirical approaches.

The dominant Western worldview and the role of anti-reductionist and determinist phobias

In 1967 historian Lynn White argued that contemporary environmental problems are deeply influenced by the Christian tradition in which it developed, in particular the creation story recounted in Genesis (Minteer & Manning, 2005). This culture has a strong anthropocentric tradition in which no intrinsic value is attributed to the environment (Barry, 2007). According to White (1967) humans were viewed as separate from and superior to the rest of nature. More recently, and in line with White's assumption, Ezzy (2004: 8) notes that "it is the Christian tradition and its secularised descendant 'consumerist capitalism' that are the religious traditions that have typically devalued the natural world by ignoring it." Further, Catton and Dunlap (1978, 1980) noted that the European expansion into the New World induced a substantial increase of our carrying capacity. This 'age of exuberance' and the mechanistic conception of nature since the scientific revolution resulted in optimistic beliefs of social progress and an indifferent attitude toward nature (Catton & Dunlap, 1980). Next, during the Age of Reason, nature was considered as mainly designed for human ends (Dickens, 2004). According to Porter (1994:74) "the Enlightenment believed people could improve

themselves by improving nature, offering a programme of progress through science, technology and industry.” Optimistic beliefs and anthropocentric attitudes further enhanced during the industrial era. With the industrial revolution, Barry (2007: 45) states “the environment was transformed and reduced to being a store of raw materials for human economic purposes.” Additional advances in science and technology created the impression that people were resistant to ecological constraints. Catton and Dunlap (1980: 17-18) summarized the resulting Dominant Western Worldview as follows:

- i) People are fundamentally different from all other creatures on earth, over which they have dominion.
- ii) People are masters of their destiny: they can choose their goals and learn to do whatever is necessary to achieve them.
- iii) The world is vast, and thus provides unlimited opportunities for humans.
- iv) The history of humanity is one of progress; for every problem there is a solution, and thus progress need never cease.

These worldviews infiltrated people’s and thus also sociologists’ mind. Indeed, while mainstream sociologists “are inclined to favour the use of social engineering to achieve such goals as equality, they nevertheless fully accept the possibility of endless growth and progress via continued scientific and technological development while ignoring the potential constraints of environmental phenomena” (Dunlap & Catton, 1992: 270). This reminds one of Comte’s positivism and his aim to better control nature and society by the application of scientific knowledge (Lidskog, 2001), as well of the exclusion of environmental variables in major sociological theories. From this Catton and Dunlap conclude that the differences between theoretical perspectives such as functionalism, symbolic interactionism, and conflict theory have been exaggerated. Specifically, they argue that the differences between these theoretical perspectives are less important than the anthropocentrism underlying all of them (Catton & Dunlap, 1978). According to Catton and Dunlap (1978: 42-43) the basic background assumptions underlying all theoretical perspectives in contemporary sociology include:

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- i) Humans are unique among the earth's creatures, for they have culture.
- ii) Culture can vary almost infinitely and can change much more rapidly than biological traits.
- iii) Thus, many human differences are socially induced rather than inborn, they can be socially altered, and inconvenient differences can be eliminated.
- iv) Thus, also, cultural accumulation means that progress can continue without limit, making all social problems ultimately soluble.

This basic sociological worldview was called the "Human Exceptionalism Paradigm" (HEP) and was later modified to "Human Exemptionalism Paradigm". These basic sociological background assumptions and the dominant Western worldview in which they are embedded provide a first series of explanations for a 'sociology as if nature did not matter'. In the next section, we will discuss some factors distinctive to the sociological discipline.

The Durkheimian and Weberian tradition

To establish their new discipline, the founding fathers of sociology strongly asserted the uniqueness of its subject matter (Catton & Dunlap, 1980). The adherents of the two dominant traditions in sociology excluded nature when analysing society. A first tradition relates to the writings of Emile Durkheim, a second to that of Max Weber. While Durkheim acknowledged that the physical environment was a precondition for social life (Järvikoski, 1996), and despite he sometimes left the door open for the natural side of life (cf. his willingness to include biosocial reasoning into macro-sociology (see DiCristina, 2006) and his attention for the connection between totems and social organization in his sociology of religion), in *Les Règles de la Méthode Sociologique* Durkheim concluded that the cause of a social fact must always be another social fact (Ritzer, 2000). By introducing the norm of sociological purity, Lidskog (1998:22) notes that "Durkheim created a niche for sociology, a specific perspective which legitimated sociology as a discipline on its own." Following Durkheim's view on social facts, sociologists concluded that social behaviour and actions (and thus not only social facts) should not be explained by non-social facts (Timasheff,

1967 in: Dunlap & Catton, 1983; DiCristina, 2006). Thus, although Durkheim was mainly concerned with combating methodological individualism through the study of social forces, the anti-reductionism taboo against biological and geographical determinism resulted in a denial of biological and physical variables as explanations of social phenomena (Catton & Dunlap, 1980; Benton, 1991).

In addition to the Durkheimian tradition, with its emphasis on social facts and anti-reductionism, another major tradition in sociology has also contributed to the discipline's tendency to ignore the physical environment. Inherited from Weber and elaborated by symbolic interactionism, this tradition emphasized the importance of understanding how people define their situations to explain their actions (Ritzer, 1975). The attention for social definitions and the role of surrounding actors rather than the non-social environment, caused sociologists to reduce the environment to the social environment. As 'physical properties', according to this social definition perspective, "become relevant *only* if they are perceived and defined as such by the actors" (Catton & Dunlap, 1980: 21), they further excluded the sociological study of societal-environmental interactions.

Murphy (1997) noted that the importance of both traditions changed in the post-war period. He states that structural explanations diminished as a result of the growing emphasis on human agency. This stimulated the maintenance of anthropocentrism and, it is argued, induced sociology to neglect still more societal-environmental interactions. The social definitions perspective grew in strength during the 1950s and 1960s with the development of labeling theory (see e.g. Lemert, 1951; Becker, 1963), ethnomethodology (see e.g. Garfinkel, 1967) and the reinvention of the sociology of knowledge (see e.g. Berger en Luckmann, 1967). In addition, Ritzer (1990: 214) noted that, during the 1970s, micro theories further "threatened to replace more macro-oriented theories (such as structural functionalism, conflict theory, neo-Marxian theories) as the dominant theories in sociology." Moreover, cultural and postmodern sociology grew in importance during the 1980s and 1990s. Furthermore, the rise of social constructivism in the USA and the development of an ideological constructivist approach by European sociologists of science (e.g. the Edinburgh school), are major examples of the continuation of the Weberian tradition.

From this, Murphy (1997:14) concludes that "sociology shifted from the *social* construction of reality to the social *construction* of reality." However, since

the 1970s there was a resurgence of structural sociology (cf. e.g. Blau, 1970). In addition, while some authors pointed to the renewal of interest in qualitative research from the 1980s through 2000 (Morgan, 2007), in the last decennia other research methods developed that go beyond individuals' definition of the situation (e.g. network analysis, multi-level analysis). Furthermore, there were several theoretical efforts to combine the background assumptions of positivism and the interpretative approach. Some major examples include the theory of communicative action by Jürgen Habermas (1984, 1987), the structuration theory of Anthony Giddens (1986), and the morphogenetic approach of Margaret Archer (1995). Moreover, mainstream sociology still operates according to a basically positivist framework, examining cause and effect relations (Steinmetz, 2005). Thus, while it could be difficult to prove (or even be wrong to state) that the Weberian tradition became more important than the Durkheimian tradition, the point is that both traditions attribute a secondary role to ecological variables. As a consequence, it might be concluded that while "the Durkheimian legacy suggested that physical environment *should* be ignored, the Weberian legacy suggested that it *could* be ignored" (Dunlap & Catton, 1983: 118).

Sociology of environmental issues vs. environmental sociology

Above it was described how the dominant sociological worldview is characterized by anthropocentrism and a strong belief in endless social and scientific progress. In addition, the dominance of the Weberian and Durkheimian traditions further excluded the study of societal-environmental interactions. According to Catton and Dunlap (1978; 1979; 1980) the assumptions underlying mainstream sociology are part of a Human Exemptionalism Paradigm. While the exceptional characteristics of people were acknowledged, they denied "the belief that sociologists can still afford to suppose that the exceptional characteristics of our species exempt us from ecological principles and from environmental influences and constraints" (Catton and Dunlap, 1980: 25). From the writings of early environmental sociologists (e.g. Burch, 1971; Schnaiberg, 1975; Buttel, 1976), Catton and Dunlap (1978: 45) extracted a set of assumptions about the nature of social reality that rejects the HEP. They called this set of assumptions the "New Environmental Paradigm" or NEP and signifies that:

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- i) Human beings are but one species among the many that are interdependently involved in the biotic communities that shape our social life.
- ii) Intricate linkages of cause and effect and feedback in the web of nature produce many unintended consequences from purposive human action.
- iii) The world is finite, so there are potent physical and biological limits constraining economic growth, social progress, and other societal phenomena.

Before the NEP was written, in the early 1970s, sociologists were already applying traditional sociological perspectives to environmental issues. These scholars studied public opinions about environmental problems on the one hand, and the determinants of participation in the environmental movement on the other hand (Murch, 1971). For example, when Van Liere and Dunlap (1980) studied the social correlates of environmental concern, they concluded that younger, well-educated, and politically liberal people are relatively more concerned about environmental issues. Other studies examined the impact of environmental values and beliefs on environmental actions such as recycling, household energy use, etc. as well as on participation in the environmental movement or local protest groups (cf. e.g.: Arbuthnot, 1977; Larson, Forrest & Bostian, 1981; Manzo & Weinstein, 1987; Stern, Dietz & Guagnano, 1995; Corraliza & Berenguer, 2000; Gillham, 2008).

In contrast to this 'sociology of environmental issues', Catton and Dunlap's stated that their NEP provided the underlying assumptions of a 'real environmental sociology'. Environmental sociologists, they argued, should start with the inclusion of ecological variables in general, and stress the impact of ecological variables on people's cognitions, behaviour and their physical health in particular. Thus, while the 'sociology of environmental issues' was mainly focussing on the symbolic effects of environmental conditions, 'environmental sociology' stressed the non-symbolic effects (i.e. the study of how environmental conditions influence people independent of their perception about these conditions). Environmental variables were rarely used in sociological research during the 1970s, yet today there seems to be more empirical research that examines societal-environmental interactions (Dunlap, 2002). Recent studies

about the relation between socio-economic status and exposure to pollution (Been & Gupta, 1997; Cole & Foster, 2001; Brulle & Pellow, 2006), or about the impact of ecological variables on the psychosocial health of residents who have to cope with toxic contamination (Matthies, Höger, & Guski, 2000; Bevc, Marshall, & Picou, 2007), are just a few examples of what Catton and Dunlap would refer to as 'real environmental sociology'.

During the late 1980s, Buttel (1987) argued that the distinction between 'a sociology of environmental issues' and 'environmental sociology' should be ignored. Once the establishment of environmental sociology as a subdiscipline was ensured, Dunlap and Catton followed Buttel's advice in the early 1990s. Nevertheless, the distinction between the symbolic and non-symbolic effects of environmental conditions is still battled out between constructivist environmental sociologists and realist environmental sociologists. In the account of Riley Dunlap and William Catton (1978) of environmental sociology as a distinct field of study, a realist program was proposed (Burningham, 1998). A realist epistemological position on environmental-social problems assumes that environmental-social problems can be known in an objective manner and that these objective phenomena can have real and unmediated effects on people cognitions, behaviour and physical health. In other words environmental realism "advocates a re-naturalization of society in the sense that society's ecological basis needs to be taken into consideration by sociology – that is, biophysical aspects of reality should be included in sociology's analysis of society" (Lidskog, 2001: 117). In contrast, environmental constructionist theories suggest that all social and natural problems are constructions rather than harsh prints of objective conditions (Spector & Kitsuse, 1977). Our knowledge of the environment, it is argued, is relative to the culture and the time in which it is produced (Cudworth, 2002). For example, Greider & Garkovich (1994:1) argue that attention should be directed to "the transformation of the physical environment into landscapes that reflect people's definitions of themselves and on how these landscapes are reconstructed in response to people's changing definitions of themselves." This accords with Macnaghten and Urry's (1995: 207) when they stated that "there is no pure 'nature' as such, only natures." Realist environmental sociology objected to this kind of constructivism because it would be too relativistic and deny the independent existence of environmental problems. Some realist environmental sociologists even argue that environmental constructivism goes hand in hand

with a conservative environmental policy (see e.g. Murphy, 1997). This critique of relativism is certainly pointed at anti-dualists, i.e. those (environmental) sociologists that question the culture-nature distinction, and those scholars who argue that the material or non-social world is also socially constructed (Burningham & Cooper, 1999).

Several constructivists, from their side, argue that the realist critique is a misleading characterisation of a strong or ontological constructivism. Mild, weak or methodological constructivism does not cast any doubt on the reality of environmental problems and retains a distinction between the social and the material world (Best, 1993). Accordingly, the realist critique is refuted by stating that "the treatment of environmental problems as constructed is often the most valid approach given that the character of these problems, and how best to address them, are often contested" (Burningham, 1998: 536). However, realist environmental sociologists reply that, in practice, mild constructivist environmental sociology comes down to an exclusion of ecological variables in sociological research and further hinders the development of a real environmental sociology.

This line of fracture within environmental sociology also becomes visible when comparing the epistemological positions of European and American environmental sociologists. While European environmental sociologists are predominantly constructivists, American environmental sociologists guarded the realist camp (see Mol, 2006). It is paradoxical or at least remarkable that the Weberian and Durkheimian traditions (which were first some of the major causes to exclude ecological variables from sociological research) were later on, once the subdiscipline of environmental sociology developed, the same traditions that caused conflict between realist and constructivists environmental sociologists. In what follows, another intra-subdisciplinary development is discussed.

European vs. US environmental sociology: theory and empirical research

Intra-subdisciplinary disagreements on the epistemological level as outlined above go hand in hand with the link between theory and empirical research on the one hand, and methodology on the other hand. Environmental sociology does not seem to be an exception to this rule. Rather than combining the strengths of the Durkheimian and Weberian traditions, environmental sociology

tumbled down in the same dualisms as the sociological discipline. As Buttel (1987: 465) noted "environmental sociology has steadily taken on characteristics of the discipline as a whole, especially its fragmentation and its dualism between theory and the pursuit of middle-range empirical puzzles."

Next to the contrasting epistemological positions by European and American environmental sociologists, it is striking that, notwithstanding European environmental sociologists conduct empirical research, most empirical research is done by American environmental sociologists (Dunlap, 2002). In addition, Arthur Mol, one of the founders of the thesis of ecological modernization, noted that US environmental sociology is more strongly related to urban sociology and human ecology. European environmental sociology on the other hand, is "more strongly related to and still builds on the sociology of science and technology, of culture and of social movements, but also on inspirations and cross linkages of other social sciences disciplines, such as political science and philosophy" (Mol, 2006:11). It is more likely, as noted by Dunlap (2002: 15), that European environmental sociologists "investigate the problematic nature of conceptualizing much less measuring, environmental phenomena." In contrast to the European environmental sociologists, American environmental sociologists pay more attention to theories of the middle range that are more directly testable, and thus less related to grand narratives (Mol, 2006). In addition, although an important portion of the American environmental sociologists attend the political economy tradition such as Schauberg's theory on the treadmill of production or introduce ecological variables in Wallerstein's world systems theory (see e.g.: Gould, Pellow & Schnaiberg, 2004; Roberts, Grimes & Manale, 2003), larger and to some extent more abstract theories like the theory of the risk society are relatively less popular in the United States than they are in Europe (Mol, 2006).

Further, while more and more interpretative approaches find their way into US environmental sociology, Mol (2006) contends that the quantitative approach is still dominant in American environmental sociology. While this statement might be disputable when one considers the range of research methods used in some subfields (e.g., the study of technological disasters), this certainly applies to other research domains like those that focus on environmental attitudes wherein large-scale surveys reign supreme. The qualitative approach of European 'environmental sociologists' from their side, and some of the major European sociologists of science and knowledge in particular

(e.g. Bloor, 1999; Law & Mol, 2002; Latour, 2005), do focus more explicitly on philosophical and social theoretical issues. Other European sociologists that study societal-environmental relations like Ulrich Beck and Anthony Giddens make conclusions about the modernization of industrial society without much empirical research at all. For example, Beck's notion that new risks are equally distributed within the risk society contrasts with the empirical results of studies on environmental inequality in the United States (see e.g.: Downey, 2003; Ash & Fetter, 2004). Consequently, it is not surprising that, although these European sociologists hold some of the most prestigious positions in European sociology departments, their theories have been criticized for lacking empirical support (see e.g. Goldblatt, 1996; Mythen, 2004). Further, the use of large-scale surveys in American studies on environmental equity is not exempted from critique either. In particular, the focus on hypothetical situations does not necessarily generalize to people facing actual environmental dangers on a day-to-day basis (Baxter, Eyles, & Elliot, 1999; Lidskog, 1996). Thus, next to the importance of an epistemology that allows for the study of the symbolic and the non-symbolic effects of environmental conditions, there is a need to transgress the divide between the empirical and quantitative tradition in US environmental sociology on the one hand, and the more theoretical/conceptual and qualitative approach in Europe on the other hand.

A preliminary conclusion

Mainstream sociology locates society outside nature's boundaries and removes nature from human living conditions (Grundman & Stehr, 2000). This relocation is to some extent understandable when one considers the old need to establish sociology as a distinct field of study. However, whereas sociology's social determinism was functional one hundred years ago to enter upon the struggles with biological and geographic determinism as well as methodological individualism, today, it is argued, the exclusion of ecological variables from sociological research should be abandoned. As the sociological discipline became institutionalised, it is no longer necessary to limit sociology's territory to social facts. On the contrary, Grundmann and Stehr (2000: 159) correctly contend that "one of the threats to social science now stem from its intellectual inability to engage in interdisciplinary work." We are not, as noted previously (Popper in

Carolan, 2005: 12) “students of disciplines but students of problems” and many of these problems increasingly “cut across the borders of any discipline.” Given the discovery of hybrid problems posing severe threats for human health and the environment it is even morally irresponsible if sociologists continue with the disintegration of its knowledge (Murphy, 1997).

Since the 1970s some sociologists acknowledged the need to reconsider the dominant social paradigm that was, and still is, characterized by anthropocentrism (Lutzenhiser, 1994). These authors correctly questioned the monopoly of the Weberian and the Durkheimian traditions that deflected the attention from complex interactions between humans and their non-social environments. However, rather than unifying the strengths of the ruling sociological traditions, and subsequently connect them with the study of ecological variables, environmental sociologists started discussing the real subject matter of environmental sociology.

To establish environmental sociology as a distinct sociological subdiscipline, environmental sociologists reacted against sociology of environmental issues (Dunlap, 2002). In addition, the relative importance of the symbolic and non-symbolic effects of environmental conditions is still discussed between environmental constructivists and realists. The realism-constructivism debate within the subdiscipline of environmental sociology can be understood as a reincarnation of the debates between positivism and the interpretative approach. In contrast to constructivist environmental sociologists’ interest for social definitions, realist environmental sociologists laid emphasis on ecological constraints. In addition, whereas the former were clearly influenced by the Weberian tradition, the latter translated the Durkheimian tradition in some sort of eco-structuralism by explaining the social by natural forces or by explaining the natural by social forces.

Further, despite some overlapping between European and US environmental sociology on the one hand, and the variation within the European and US environmental sociology on the other hand, it is conspicuous that the methods in European environmental sociology are mainly qualitative in nature, while US environmental sociology has a stronger quantitative research tradition (see Mol, 2006). Once again, the continental divisions within the subdiscipline of environmental sociology, i.e. between quantitative and qualitative research, are rooted in the Durkheimian (cf. positivism) and Weberian tradition (cf.

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interpretative approach). Although the Weberian and Durkheimian traditions were criticized by environmental sociologists as they induced the development of a social sociology, later on, when environmental sociology developed as a subdiscipline, these same traditions induced divisions within environmental sociology.

The conclusion that intra-subdisciplinary debates between realist and constructivist environmental sociologists on the one hand, and the divisions between European and American environmental sociologists on the other hand, are based on similar distinctions as intra-disciplinary and interdisciplinary debates, reminds us to the role of fractal distinctions and “the idea of microcosm”, i.e.: “the idea that a subset of a larger unit can contain scaled-down versions of structures and processes in the larger unit (Abbott, 2001:3)”. The renaissance of the Weberian and Durkheimian traditions as a major subject for debate between environmental sociologists is consistent with Abbott (2001: xvi) when he stated that:

“...if we take any group of sociologists and lock them in a room, they will argue and at once differentiate themselves into positivists and interpretivists. But if we separate those two groups and lock them in separate rooms, those two groups will each in turn divide over exactly the same issue.”

The conclusion that debates between sociologists end up recapitulating old lines of dispute, leads Abbott to conclude that science is not cumulative but developing as a cyclic process (Collins, 2002; Pollard, 2003). Although it could be expected that the extent to which future sociological research will examine societal-environmental interactions will to a considerable extent result from external factors such as power-relationships and self-interests, we agree with Abbott that sociologists should also cope with its internal conflicts. However, in contrast to Abbott’s anti-cumulative view on the progress of intellectual life, we suspect with others that “the emergence of new efforts to study social-environmental relations that reflect a synthesis of the strengths of both (i.e. sociology of environmental issues and environmental sociology), can only benefit our field” (Dunlap, 2002: 16). Indeed, as noted by Randall Collins (2002: 232) when counter-claiming Abbott’s denial of the cumulation of knowledge:

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“That some aspects of intellectual life are repetitive does not mean that all are; and it is an old argument against the all-positions-are-equally-true kind of relativism that the proponent of such an argument must except one’s own statement or else refute oneself.”

Given recent serious disruptions of societal-environmental relationships, in this dissertation it is argued that a ‘sociology as if nature did not matter’, is a sociology that is incapable to understand some of the most important dimensions of our contemporary world (Lockie, 2004). Further, although we encounter Abbott’s idea of microcosm in the sociological study of the natural, we are not inclined to conclude that sociology is deemed to develop cyclical. Therefore, to transcend or bypass some of the fractal distinctions threatening mainstream sociology and environmental sociology, in the next sections new directions are postulated in the epistemological and theoretical field on the one hand, and in the methodological and empirical field on the other hand.

New directions in environmental sociology: theory and epistemology

Bridging the great divide: agnosticism vs. anti-dualism.

One of the major matters in dispute within environmental sociology concerns its background assumptions. In the previous sections it was written that discordance has arisen between environmental sociologists and sociologists of environmental issues on the one hand, and between constructivist environmental sociologists and realist environmental sociologists on the other hand. It was stated that constructivist environmental sociologists are criticized for their social determinism as their program is inclined to reduce nature to culture. Realist environmental sociologists from their side are criticized for their ecological structuralism. Given the conclusion that this intra-subdisciplinary debate hinders the development of environmental sociology (Burningham & Cooper, 1999), one must consider new epistemological positions to cope with the gaps between the idealist and the materialist, the symbolic and the non-symbolic, or the social and the natural.

One of the proposals to close the great divide came from the sociology of science and technology. An agnostic attitude toward the natural is defended. Rather than engaging with the verification of the correspondence between theories and objective facts, it is stated that sociologists should look for the social

factors that influence scientific practice. This accords with the ideas stemming from the Edinburgh School (see e.g. Bloor, Barnes, Collins) and its extension to the social construction of technology (see e.g. Pinch, Bijker). In contrast to the correspondence theory, these schools of thought contend that all so-called 'objective' theories are influenced by self-interest and the larger cultural context. The position of sociologists of science run parallel to the aim of some constructivist environmental sociologists to explain shared belief about nature, rather than nature itself. Thus, the realist critique on constructivist environmental sociology counts here as well. Given severe changes in people's relationships with their natural environment, being agnostic about any actual state of the natural can be morally irresponsible as it indirectly sustains a policy that deflects attention from environmental problems (Murphy, 1997).

Further, the strong programme has been challenged by actor-network theory and the co-constructivist tradition (Latour, 2005). As noted by Murdoch (2001: 117) "the co-constructivists have come to view that the emphasis on social factors undermines the sociologist's ability to account for the power of modern science; that is, it fails to consider the material conditions that enable scientists to act effectively in the world". On a parallel with ecologists' anti-dualism and its basic principle that humans and nature are interdependent, actor-network theorists argue that phenomena result from a network that consists of social and natural agents. Sociologists, it is argued, "must abandon the security of the 'social' in order to engage with those hybrid 'nature-cultures' that determine the shape of the modern world" (Murdoch, 2001: 120). As a consequence sociology's social jargon should be widened by concepts such as actant, enrolment, and re-assemblage (see e.g. Callon, 1986; Law & Mol, 1995; Latour, 2005).

While co-constructivism and its little brother ANT might be appealing at first sight, the retheorization of the nature/society divide in terms of anti-dualism is problematic in several ways. A first critique concerns the desire of anti-dualists to reconsider the sociological lexicon. It is argued that the co-constructivist approach is unworkable because ANT's alternative concepts fail to advance our understanding of societal-environmental interactions (Bloor, 1999). The hybridisation of the social and the natural is not only unworkable, it is also paradoxical. As noted previously (Soper, 1995; Birmingham & Cooper, 1999), making a fuss over the interdependence between the social and the natural

contrasts sharply with people's potential to cause environmental damage. This relates to the problems that come to the surface with the symmetry principle of co-constructivism, i.e. the equal treatment of the social and the natural. In *The Social Construction of What?* Ian Hacking distinguishes between interactive and indifferent kinds by which he was referring to matters of reflectivity and intentionality. In contrast to interactive kinds like people that "can become aware of how they are classified and modify their behavior accordingly" (Hacking, 1999: 32), non-social objects are indifferent to classification. In addition, some authors have argued that we should acknowledge potential differences in our perception of social and natural temporality. In particular, Tim Newton (2007) argues that social laws are not characterised by the longevity of process that we see in natural laws. While new developments in the natural sciences like quantum physics can question the stability of natural laws, it should be acknowledged that several of these natural processes can still be relatively stable despite the possibility that "this stability is itself the product of a dynamic process" (Keller, in Newton: 2007: 71). However, if constructivism or realism is insufficient, and if anti-dualism and co-constructivism are undesirable, how can environmental sociologists address the differences in epistemological positions?

Toward an ecological-symbolic approach.

In the previous section it was argued that the sociology of science, co-constructivism and ANT, do not provide the desired solutions for bypassing the great divide between the natural and the social. Moreover, in line with Abbott's application of fractal geometry to social life, we can see that, once again, these solutions recapitulate old lines of dispute. Specifically, the epistemological position of several sociologists of science is in accordance with constructivist environmental sociology. In addition, whereas co-constructivism called the principle of symmetry into being, in practice ANT's analyses frequently come down to an undervaluation of the social side of the 'co-production' equation (Newton, 1999). As a result, ANT's emphasis on the potential agency of natural objects conforms with environmental sociologists' eco-structuralism. But is there another solution? One that defends the possibility of difference on the one hand, and acknowledges the potential role of ecological constraints as well as social definitions on the other hand?

Fortunately, I'm not the first to question this. In reviewing the disaster-definition debate Couch and Kroll-Smith (1991) distinguished two contrasting definitions: the generic perspective and the event-quality perspective. Similar to the tensions between the Durkheimian and Weberian tradition, between positivism and the interpretative approach, between realist and constructivists, between strong and weak constructivist, and between sociologists of science and actor network theorists, the major differences between these perspectives can be understood by considering their background assumptions. The first approach, the generic perspective, can be identified with Quarantelli and Dynes' symbolic interactionism on natural disasters (1977, 1987), in which the qualities of the disaster agent are sociologically irrelevant (Quarantelli and Dynes 1987). The second approach, the event-quality perspective, is harder to define (Kroll-Smith and Couch 1991) though could be comprehended as a realist approach in which nonsocial factors determine social ones, thus one by which biophysical entities influence human actions and experiences independent of human actors' appraisals of the physical entities. To resolve this definitional debate, Couch and Kroll-Smith (1991, 1993a) introduced an ecological-symbolic approach.

An ecological-symbolic approach (ESA) proposes to study how the nature of an event relates to the appraisals people make of that event. The approach looks for the interdependent character of environment and society, i.e. "the reciprocal impacts of physical agents on built, modified, and natural environments and the effects that human perceptions of those impacts have on social structure" (Kroll-Smith & Couch, 1993a: 48). By doing so, the ESA recognizes the existence and the impact of material conditions and the biosphere on human cognition and actions, while recognizing the role of human agency as well (Gunter, Aronoff & Joel, 1999). An ecological-symbolic approach pays attention to symbolic and non-symbolic effects and attempts to combine the strengths of a sociology of environmental issues and environmental sociology. The ESA aims to resolve the overheated debate between realist and constructivist environmental sociologists by avoiding a relativistic view threatening strong constructivist or postmodern perspectives. It also avoids the deterministic view typical of pure realist approaches. Further, an ESA is not subject to the critiques on anti-dualism notwithstanding it acknowledges the potential agency of non-social objects.

During one of the recent annual meetings of the American Sociological Association (ASA), Steve Couch reminded me that an ecological-symbolic approach is compatible with Eugene Rosa's Reconstructed Realism (RR) (see Rosa, 1998). Reconstructed realism contains two parts, that is: ontological realism (OR) and epistemological hierarchicalism (EH), and is called the OREH-model. In parallel with an ecological-symbolic approach, Rosa's reconstructed realism seeks to preserve the best features of the positivistic and constructivist paradigm, and clarifies this by discussing contrasting risk-theories (e.g. technical risk analysis vs. cultural theory). Ontological realism (OR) acknowledges the presence of a reality independent from people's perceptions. In line with the idea behind Ian Hacking's book title *The Social Construction of What?* OR points to the conclusion that "you cannot have institutional facts (socially constructed facts) without brute facts" (Searle, 1995: 191). Further, the distinction that is made between ontological realism (OR) and epistemological hierarchicalism (EH) refers to the assumption that, while the ontology of risk (or the environment) is realist-objectivist, the epistemology of risk can range from realist to constructivist. As noted by Rosa (1998: 33):

"Knowledge claims about risk may be realist based or constructivist based depending upon the evidentiary basis of our claims to knowledge. That there is not necessarily a one-to-one correspondence between the ontology and epistemology of risk is due, at its foundation, to the intervening role of human perception and interpretation of our realist world of risk."

In a footnote of Rosa's paper on the meta-theoretical foundations for post-normal risk (1998) he states that, from the point of view of social scientific theory, his OREH-model is consistent with critical realism. One of the most systematic and popular version of critical realism is written by Roy Bhaskar. In *A Realist Theory of Science* Bhaskar (1978) distinguishes between intransitive and transitive objects. While the former refer to objects in the real world, transitive objects include ideas, concepts and observations (Gijssels, 2002). Further, a stratified ontology is assumed (Lidskog, 2001). In sum, this means that reality is stratified and that upper layers like social structures emerge from, but are not unidirectional determined by, underlying layers of reality (e.g. environmental agents) (Bhaskar, 1978). Causal relations between strata are multidirectional,

meaning that higher levels can also influence lower levels of reality (i.e. downward causation) (Carolan, 2005). Using a stratified ontology and a new concept of causality, critical realism can bridge the line of fracture between positivistic and interpretative sociology (Vermeersch, 2006).

Critical realism is not only compatible with the reconstructed realism (e.g.: they both assume that knowledge claims vary in terms of their resemblance with the real world), but also with Kroll-Smith and Couch's ecological-symbolic approach (ESA). Specifically, as an ESA proposes to study "how the nature of an event relates to the appraisals people make of that event", it avoids the epistemic fallacy that is denounced by critical realists, i.e. the assumption that ontological issues can be reduced to epistemological ones. As a result, the assumption - as inherited from the Weberian tradition - that sociologists should focus exclusively on social definitions, and consequently, could ignore ecological constraints, is - with good reason - abandoned. In addition, what makes an ESA compatible with the assumptions of critical realism is that they both stimulate the study of the reciprocal relations between the social and the natural, and thus support the development of an open sociology. In contrast to the desire for a purification of the sociological discipline in the form of a Durkheimian sociology (see e.g. Black, 2000), we think that interdisciplinary research is an opportunity rather than a threat. Given the rise of what Erikson (1991) termed "new species of trouble" (e.g. global warming, soil contamination, air pollution, etc.), we think it is even morally irresponsible if sociologists continue with the exclusion of ecological variables. As noted previously (Sayer, 1992), it is only by studying the reciprocal relations of our layered reality that we can avoid the trap of biological, geographical, psychological, social, or whatever kind of reductionism.

Further, while an important task for environmental sociology, as Lidskog (2001: 127-128) contends, "is to carry out sociological analysis of environmental problems in a theoretically informed and epistemologically conscious way", he reminds us that the study of the reciprocal relations between the social and the natural cannot be a purely theoretical challenge. To state it in Bhaskarian terms, philosophical ontology must inevitably be accompanied by an empirical analysis of the particularity and conditionality of the actual functioning of generative mechanisms (Gijssels, 2002). In other words, connections between social and natural agents are depending on the specific context in which they operate. To understand the singularities of these lived experiences, in this dissertation, we'll

focus on a real world case study whereby the relationship between people and their immediate natural and built environment is seriously disrupted.

An ecological-symbolic approach in practice

In the previous section an ecological-symbolic approach (ESA) was advocated. Attention was paid to the background assumptions of the ESA by linking its theoretical position to the OREH-model (ontological realism/epistemological hierarchicalism). In addition, it was stated that the study of the reciprocal relations between the social and the natural level is a necessity to avoid social as well ecological reductionism/determinism, yet it was added that the interdependence between these levels is varying according to the context in which they operate. To examine this large number of properties, we will carry out what Harré (1979: 132) termed an 'intensive research'. In contrast to what one might think intuitively, intensive research and the use of qualitative methods cannot be treated as equal. The distinction between intensive and extensive research rather relates to questions about scale and depth. In short, whereas an extensive research considers "common patterns and distinguishing characteristics of a population, in an intensive research the primary questions concern how some causal process works out in a particular case or limited numbers of cases" (Sayer, 1992: 242). The results that will be presented in the following chapters (Chapter 2-5) are from an assignment from the Public Waste Agency of Flanders (OVAM) to explore residents' risk perceptions and the mental burden of the process of soil decontamination in the Kouterwijk, a community contaminated by chemicals from previous industrial activities. This dissertation has two main research objectives:

- i) To investigate social and ecological correlates of residents' risk judgements and to compare residents' meanings of risk with experts' risk assessments.
- ii) To examine the association between residents' psychosocial health and risk-related variables, the process of soil decontamination, and public participation.

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To attain these goals, and to be consistent with the background assumptions of the ecological-symbolic approach as outlined above, we will have to look for emergent theories, i.e. theories that emerge from the data as it is analyzed in the research process. Further, an ESA assumes that these data may include social as well as ecological agents. Moreover, next to the importance of an epistemology that allows for the study of societal-environmental interactions on the one hand, and the role of what Glaser and Strauss (1967) termed 'grounded theories' on the other hand, we need to address other than emergent and meta-theories that can assist the ESA when it is used for empirical research.

Linking theory and empirical research

Kroll-Smith and Couch's ecological-symbolic approach (ESA) descended from studies of localized environmental degradation in the United States (Picou, 1999) and previous research about social responses to natural and technological crises. Starting during the mid 1980s, the effects of natural disasters were contrasted with community responses to hazardous events related to the human interference with the biophysical environment (see Baum, Fleming, and Singer 1983; Preston, Taylor, and Hodge 1983; Kasperson and Pijawka 1985; Couch and Kroll-Smith 1985, 1993a,b; Gramling and Krogman 1997). The latter socio-environmental disruptions have been termed chronic technical disasters (CTDs). CTDs can be understood in the light of the dimensions of time and human-technological interventions. According to Couch and Kroll-Smith (1985: 566) CTDs:

"develop slowly and persists for a relatively long time. In addition, while the effects of natural disasters are often influenced by human factors, chronic technical disasters are caused by human-technological intervention in the environment, and further technical human intervention is required to contain or abate the disaster agent itself".

Several studies largely identified the comparatively high intensity of long-term strain on the CTD-affected population (see, e.g., Baum, Fleming, & Singer, 1983; Matthies et al. 2000). The delayed responses by authorities to manage CTDs' biophysical disaster agents, the development of an environmental stigma, the cleanup of an environmental danger and the recovery, and the perceived

powerlessness of residents in the decision-making processes can cause psychosocial effects such as demoralization and alienation, in addition to the stress effects of being exposed to chemicals (see e.g., Picou et al. 1992; Kroll-Smith & Couch, 1993b; Freudenburg 1997; Edelman, 2004; Couch & Mercuri 2007). In contrast to natural disasters, where the causes are allocated as "acts of god," some ethnographic studies have revealed that CTDs often induce conflicting claims about the dangers for one's health and the environment. The uncertainties surrounding the health effects of exposure to chronic contaminants can induce victims' skepticism about risk assessments and distrust of policymakers, and engender social conflicts between residents, likely to result in risks for the social fabric such as corrosive communities (cf. Short 1984; Couch & Kroll-Smith, 1985; Freudenburg and Pastor 1992; Freudenburg 1997; Picou, Marshall, & Gill, 2004).

In addition to the study of the distinguishing characteristics of CTDs and natural disaster, since the early 1990s some environmental sociologists used an ecological-symbolic approach to study the diversity of community responses to toxic contamination (Picou et al., 1992; Kroll-Smith & Couch, 1991, 1993a, 1994; Gunter, Aronoff, & Joel, 1999; Ritchie & Gill, 2007). As outlined above, in their response to the realist-constructivist debate within environmental sociology and the disaster definition debate in particular (Drabek, 1986; Quarantelli & Dynes, 1977), Kroll-Smith and Couch (1991) pointed to the need to investigate both the nature of the disruption and the appraisals people make of that disruption. In this dissertation we advocate this approach as it underscores the importance of studying the diversity of public responses across a variety of man-made environmental disruptions. In addition, the ESA allows an in-depth analysis of the ecological characteristics as well as the social responses within a specific case. This is consistent with one of our main assumptions, i.e. the interdependence between social and natural levels (rather than the presence of the natural) is varying according to the context in which they operate.

The CTD perspective has been criticized for its "deterministic bias that represents corrosion of community relationships as a virtually inevitable local CTD outcome" (Gunter et al., 1999: 625). Related to this, the ESA has been interpreted as a direct opposition to this rigidity (see e.g. Clarke & Short, 1993). However, it was never Couch & Kroll-Smiths' intention to exclude further testing and refinement of the CTD perspective (see Zvestoski et. al, 2002). Although

they noted that “the classification of aversive agents is not simply whether they are technological or natural”, they added that “this distinction remains important” (Kroll-Smith & Couch, 1993a: 50). In addition, the study on CTDs was not a purely ontological matter on the qualities of the disaster agent per se either. As one of CTD nuclei’s main characteristic is empirical ambiguity, epistemological matters played first fiddle, too. Based on case studies on an underground mine fire in Centralia, Pennsylvania, and on Love Canal in New York, Couch and Kroll-Smith (1985) stated that the community responses and the psychosocial and cultural burden should be understood in the light of the dimensions of time and the degree of human-technological intervention, with the latter as an antecedent of social change. In other words, it is not only about the disaster agents per se, but it is also about the proxy variables ‘time’ and ‘human-technological intervention’. The latter is more about social responses of nonvictims than atomistic constitutions of disasters. Moreover, although the first dimension - time - suggests that CTDs’ chronic nature is ontologically different from natural disasters, the important part of the time dimension is social as well, as it is embedded in the question “Why did it persist for a relatively long time?” Nevertheless, some questions remain unanswered and these will be addressed in the next section.

The 3rd stage of theory development

Above it is shown that it is not convincing to push the definition of CTDs into the realist or determinist corner. In addition, we did not agree to categorize the ESA as a direct opposition to the CTD perspective either. The study of CTDs was mainly based on social responses rather than objective conditions and the definition of CTDs an sich remains valid more than twenty years after its introduction in the disaster-definition debate (Freudenburg, 1997). Moreover, although the CTD perspective could be considered the first stage of theory development about community responses to toxic contamination, and the ESA-based explanations for variations among CTDs as the second stage (see Gunter et. al, 1999), there seems to be no convincing argument to exclude the co-existence of the CTD perspective and the ESA. However, in what could be termed ‘the third stage of theory development’ we will explore some new directions.

Firstly, in reviewing the literature on the use of the ESA, it is noteworthy that case studies exploring experts' definitions of the situation and their relations to residents' risk evaluations are scarce. The focus on victim responses situates within the – in our view correct – aversion to the still prevailing technocratic culture of risk definitions and the potential this has to deflect attention from the psychosocial impacts and the role of public participation (see Kroll-Smith and Couch, 1991, 1993a). However, one of the forces of the ESA is the sociological study of victim and nonvictim responses within the context of their claims. This allows considering questions like: What are the barriers and limits of community participation according to residents and non-victims? Are individual expert estimations equal to the output of their risk assessments? Or how do experts' risk estimations and their decisions relate to residents' risk perceptions? Thus, a first way to strengthen the ESA concerns the comparison of experts' and non-experts' risk judgements.

A second problem to be tackled concerns the gap between theory and research. Specifically, once the ESA has been used it is unclear how local risk understandings among a diversity of situations can be linked again to existing concepts and theories. Related to this, it is unclear what kind of approaches are "sufficiently flexible to allow for identification of unique features in particular cases, yet abstract enough to allow for systematic cross-case comparisons" (Gunter et. al, 1999: 637). We think that no single theory such as the CTD perspective will be sufficient to understand the complexity of societal-environmental interactions. Above it was already argued to go beyond disciplinary boundaries to avoid methodological individualism and social determinism. In particular, this firstly means that next to social data we should include ecological variables in sociological research. Further, we notice that other disciplines such as psychology, social psychology, anthropology, etc. contain several theories that could be relevant for (environmental) sociologists. These include but are not restricted to psychometric risk theory (Slovic, 1987; Slovic, Fischhoff, & Lichtenstein, 1980), cultural risk theory (Douglas, 1966; Douglas & Wildavsky, 1982), environmental stress theory (Lazarus & Folkman, 1984; Baum, Fleming, & Singer, 1985), and empowerment theory (Levine & Perkins, 1987; Zimmerman, 1995). Further, we agree with Dunlap and Catton (1979: 266) when they noted that:

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"...an awareness that biological and physical facts may help explain social facts has often led environmental sociologists to cross disciplinary boundaries and is likely to continue to do so; however, many of the issues that concern environmental sociologists will just as truly require similar excursions into other sociological areas."

When we look at the sections of the American Sociological Association and the Society for the Study of Social Problems we can see that environmental studies are classified under the heading 'Environment and Technology'. During these annual meetings I noticed that several environmental sociologists also participate in the sections 'Sociology of Risk' and 'Science, Knowledge, and Technology'. These labels, and the mobility by its participants across these sections, indicates that environmental sociology is inextricably bound up with other subdisciplines such as sociology of science and technology, sociology of knowledge, and sociology of risk and uncertainty. Therefore, next to (social) psychological and anthropological theories (e.g., environmental stress theory, cultural risk theory, etc.), we'll discuss in more detail some major sociological theories in the empirical part of this dissertation (cf. chapter 2 until 5).

Thirdly, next to theory triangulation and testing, more inductive approaches are required to understand the complexity and diversity of community responses to toxic contamination. In contrast to the hypothetico-deductive approach that can, for example, be found in Merton's (1967) focus on the testing of middle-range theories, Glaser and Strauss' (1967) grounded theory emphasizes that concepts and theories emerge from data observation and analysis. As noted by Derek Layder (1998: 17), Glaser and Strauss assume that "social theory must reflect the experiences, meanings and understandings of people in face-to-face interaction rather than identify the empirical 'variables' that 'externally' influence behavior which are emphasized in Merton's positivist vision of social analysis." Thus, in addition to the inclusion of concepts and hypotheses derived from existing theories like the CTD-perspective, it is important to study "the range of social relationships, worldviews, everyday practices, and shared understandings which constitute local culture" (Irwin et al., 1999, p. 1325). In sum, in the '3rd stage of theory development' we propose to integrate i) ecological data as defined by expert institutions, ii) properties that relate to existing (social) psychological, anthropological, and sociological theories,

and iii) new concepts that emerge during the research process (see Glaser & Strauss, 1967; Irwin, Simons & Walker, 1996).

Quantitative versus qualitative research: toward methodological pluralism

In line with Abbott's notion on fractal conflicts, we have shown that the line of cleavage between mainstream sociology and environmental sociology (cf. the dominance of the Weberian and the Durkheimian tradition) reappeared within environmental sociology as a subdiscipline. This not only related to differences between environmental constructivism and environmental realism on the one hand, and between dualistic thinking and co-constructivism on the other hand, but also to differences in methodological approaches. Specifically, although we acknowledged some overlap between European and US environmental sociology and recognized the diversity of research methods within the European and US environmental sociology, a gap remains between the empirical and quantitative tradition in US environmental sociology and the more theoretical/conceptual and qualitative approach in Europe.

Some critics have been arguing that methods are not inherently linked to any specific paradigm (e.g., Greene, Caracelli & Graham, 1989). However, it has been more widely accepted that worldviews, epistemological stances, or shared metaphysical beliefs do relate to research practices (Brewer, 2000; Hughes, 1990). The view that methodology is about more than just methods is consistent with the situation in the subdiscipline of environmental sociology. As noted above, the quantitative approach in US environmental sociology is more closely linked to the realist stance, while European environmental sociologists mainly use qualitative methods and defend the constructivist camp (Mol, 2006). For example, when Dunlap looked back to the origin of environmental sociology and its emphasis on a realist epistemology, he acknowledges that it "was designed to demonstrate the existence of a core of environmental sociology that did not, and would not, depend heavily on the inevitable swings in the societal salience of environmental issues" (Dunlap, 2002: 13). Despite the possibility of intersections (e.g. positivists can (and sometimes do) use qualitative methods, and adherents of the interpretative approach can (and sometimes do) use quantitative

methods), we agree that, generally speaking, methods do relate to what Alvin Gouldner (1970) termed background assumptions.

The quantitative approach is associated with positivism (Sale, Lohfeld & Brazil, 2002). On the ontological level it is assumed that an independent reality exists independent from people's definitions and perceptions. Epistemologically, a distinction between facts and values is retained. It is assumed that relationships between variables can be analyzed in a value-free framework (Denzin & Lincoln, 1994). In the methodological sphere (i.e. answers to the question "how can the inquirer go about finding out whatever he or she believes can be known?" (Guba & Lincoln, 1994: 108), emphasis is laid on the verification of hypotheses. In contrast, the qualitative approach is more closely associated with the interpretative approach (Secker, Wimbush, Watson & Milburn, 1995). Ontologically speaking, the existence of an independent reality is denied, or stated more mildly, the attention is focused on the social construction of reality (see e.g. Berger & Luckmann, 1967). On the epistemological level, a subjectivist stance is defended (Guba & Lincoln, 1994), assuming that reality has no existence prior to the activity of investigation (Sale, Lohfeld & Brazil, 2002). Methodologically, interviews and observations are used to interpret the social definitions and multiple truths.

The conclusion that methodological lines of actions relate to metaphysical assumptions and values raises questions about the possibility to reconcile the underlying assumptions of the quantitative and qualitative approaches (cf. Guba & Lincoln, 1994). The advocates of the "incommensurability thesis" contend that the quantitative and qualitative paradigms are incompatible (Tashakkori & Creswell, 2007a,b). It is argued that "realism and relativism, value freedom and value boundedness, cannot coexist in any internally consistent metaphysical system" (Guba & Lincoln, 1994: 116). However, when discussing the background assumptions of the ecological-symbolic approach (Kroll-Smith & Couch, 1991), we could see that some meta-theories like the ontological realism/epistemological hierarchicalism model (Rosa, 1998) and critical realism (Bhaskar, 1978; Sayer, 1992) do propose to bridge the line of fracture between positivistic and interpretative sociology. While it might be impossible to integrate conflicting ontological positions (i.e. there is a real reality or there is not), we agree with Kuhn (1970(1996:198-199)) when he rejected the claim that

“proponents of incommensurable theories cannot communicate with each other at all”. Moreover, the distinction that is made between ontological realism (OR) and epistemological hierarchicalism (EH), refers to the possibility that, while the ontology of risk is realist-objectivist, the epistemology of risk can range from realist to constructivist (Rosa, 1998). In addition, it has been stated previously (see e.g.: Best, 1993; Lash, Szerszynski & Wynne, 1996) that although in practice most constructivists focus on social definitions, in theory weak and milder constructivists acknowledge a realist ontology. In other words, the walls between conflicting methodological approaches are permeable and underlying assumptions of both camps are not hermetically sealed from one another.

In response to the shortcomings associated with the one-sided application of the ‘quantitative paradigm’ and the ‘qualitative paradigm’, some scholars started delineating a ‘third way’ in the form of mixed-methods research (see e.g.: Johnson, Onwuegbuzie & Turner, 2007). Greene et al. (1989: 256) define mixed method designs as “those that include at least one quantitative method (designed to collect numbers) and one qualitative method (designed to collect words).” Mixed-method research is often placed under the heading of ‘methodological pluralism’. A methodological pluralist stance assumes that “traditional scientific approaches (usually quantitative, often experimental) and their alternatives (e.g., qualitative, narrative, post-modern) all have their place and are all to be valued.” (Barker & Pistrang, 2005: 202). Most scholars who conduct mixed-method research do not have the intention to replace the quantitative and qualitative approaches. Accordingly, it is argued that the combination of qualitative and quantitative data on the one hand, and the collection of social and non-social data on the other hand, can provide a dignified alternative for the one-sided use of qualitative or quantitative research methods.

Ethnographic, case study, and intensive research

Research traditions wherein methodological pluralism holds an important position are ethnographic and case study research. In several methodology textbooks ethnographic and case study research are discussed in different chapters (e.g., Outhwaite & Turner, 2007; Feagin, Orum, & Sjoberg, 1991; Creswell, 1998). Creswell (1998: 58) defines an ethnography as “a description and interpretation

of a cultural or social group or system.” A case study is understood as “an exploration of a bounded system or a case (or multiple cases) over time through detailed, in-depth data collection involving multiple sources of information rich in context” (Creswell, 1998: 61). Apart from these general definitions, abstract self-definitions (i.e. references to other studies rather than specific assumptions), and differences in origin (i.e. anthropology and sociology respectively), not so many differences between ethnographic and case study research can be identified. In particular, most ethnographic studies seem to concern case studies and in most case studies ethnographic material is used to describe and explain systems of meanings or cultures (cf. Geertz, 1973). Given this tautological connotation, some agree with Hammersley (1992) that it is justified to use ‘ethnography’ interchangeably with the ‘case study method’. For example, both approaches underscore the importance of theory-development, context, and unfamiliarity (cf. Mitchell, 2007). However, other similarities between ethnographic and case study research seem to be overrated. For example, several scholars consider ethnographic and case study research as qualitative methods and inductive in nature (Creswell, 1998). However, while it is generally accepted that ethnographic researchers are mainly occupied with the collection of a diverse range of qualitative data, the combination of qualitative and quantitative is a common practice in case study research. In addition, while both ethnographic and case study research are more inductive compared to quantitative methods, studies in the sociology of science and knowledge that point to the interrelations between facts and values do suggest that pure induction is out of reach. Thus, rather than focusing on differences between ethnographic and case study research, it is argued that it is more useful to place them under the heading of intensive research (cf. Harré, 1979).

In contrast to extensive research where common patterns of a population are identified, the primary questions in intensive research concern “how some causal process works out in a particular case or limited numbers of cases” (Sayer, 1992: 242). Further, Sayer (1992: 244) states that “intensive research need not always use ethnographic methods to establish the nature of causal groups and surveys need not be devoid of attempts to understand the social construction of meaning.” In other words, it is possible to conduct intensive research by using quantitative methods, and to conduct extensive research by using qualitative methods. It follows that it is also possible to conduct intensive as well as

extensive research by using mixed-methods. As noted previously (Barker & Pistrang, 2005: 202) “rather than pitting one approach (qualitative) against another (quantitative), it is more productive to follow a strategy of fitting the method to the research question.” Secondly, we argue that sociologists should address the following question: “do we aim to provide more concrete explanations that are less generalizable, or less concrete explanations that are more generalizable?” Given the context in which this research developed in general (i.e. research for the Public Waste Agency of Flanders), and the explorative nature of the problem under study in particular (i.e. the Kouterwijk was only the second community that was decontaminated and the first one with a diverse distribution of chemicals), an intensive research using mixed methods was conducted. Before we detail the methods and data, in the following sections we give general and specific context for this study.

The general context

In comparison to global environmental problems like global warming and meso or local problems such as water- and air pollution, soil contamination has not received much attention. However, according to recent estimates of the European Environment Agency (EEA) no less than 250000 contaminated sites need remediation. What is even more astonishing is that if the investigation trend continues, the number of sites needing remediation will increase by 50% by 2025 (EEA, 2008). The toxic substances that creep in our soil mostly result from previous and current industrial activities and technological accidents with chemical matter. In addition, raw materials, waste products, and end products may penetrate the soil (OVAM, 2008). Based on national reports, the EEA contends that heavy metals and mineral oil are the most frequent contaminants in our soil (EEA, 2008). Given that several of these estimates are based on incomplete datasets, it will probably take decades to clean up this man-made mess.

In Flanders there are also several contaminated sites. Although Belgium has a relative long tradition of heavy industry, soil contamination has been placed on the political agenda only since the 1990s (Prokop, Schamann, & Edelgaard, 2002). Since the mid 1990s, the need to redevelop contaminated sites is embedded in the growing demand for ‘sustainable developments’ as outlined

by the General Environmental Policy Decree (DABM *Decreet houdende Algemene Bepalingen inzake Milieubeleid van 5 april 1995*). The problem of soil pollution is also regulated in more detail since the Soil Contamination Decree (22nd February 1995). This decree contains some key issues that reveal new ways to handle the issue. It explains the differences between historical and new soil pollution, and between obligation and liability for remediation. Also outlined is the necessity of a soil certificate in case of conveyance of land property. This decree was later on supplemented with the Flemish Regulations on Soil Remediation (VLAREBO: *Vlaams Reglement betreffende de Bodemsanering*, 1996).

Next to the regulation of contaminated industrial sites that have been left fallow (i.e. brownfields) there are several neighborhoods that are built on contaminated soils. As there can be several (often innocent) homeowners involved in cases of soil contamination in neighbourhoods, the decontamination of these areas is less evident. Despite the decree of 1995 concerning soil contamination - and the adjustments in 1998, 2001, and 2006 - and the activation of these Decrees in the Flemish regulation offer more protection to the environment, to the health of several residents, and to people that want to obtain new parcels, the owners of historically contaminated soils (i.e. contamination that was caused before the decree of 1995 was put into practice) need to cope with the sudden disruption of their immediate natural, built and social environment.

In 2003 the department of sociology at Ghent University was appointed by the Public Waste Agency of Flanders (OVAM) to carry out a sociological research about the responses of people confronted with the process of soil decontamination in their neighborhood. In the research announcement of the project it was written that OVAM wanted to assess "the sociological impact and consequences of the process of soil decontamination, - and the procedures that are being used in particular - on the residents of a neighborhood" (Germonprez, 2001: 10). Specific attention was asked for the positive and negative primary and secondary stressors on the one hand, and for the perceived needs and expectations of the residents on the other hand. In a first instance, the study had to include a process-evaluation (Swanborn, 1999), i.e.: an in-depth study of the social consequences of the process of soil decontamination in a neighborhood named the Kouterwijk. In addition, based on this intensive research (Harré, 1979), OVAM was looking for recommendations that could optimize the efficiency

of future soil decontaminations in Flemish neighborhoods (i.e. plan-evaluation: Swanborn, 1999).

The specific context

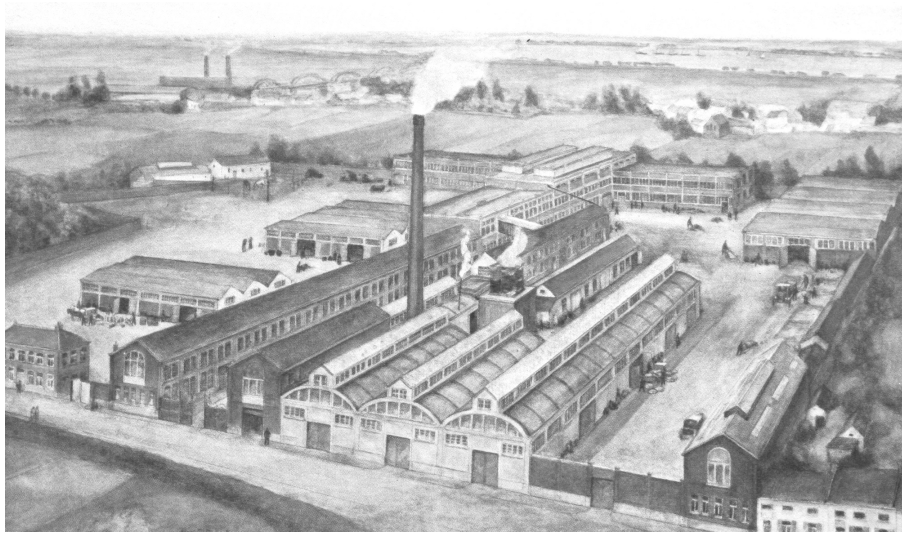
The Kouterwijk

The Kouterwijk is located in the municipal named Sint-Amands in the southwestern part of the province of Antwerp, Belgium. This small village is among other things known for its restful natural setting, conveniently situated to bicycle rides and promenades along the river de Schelde, its natural boundary. Within or close to the community are one supermarket, a post office, a sports center with two soccer fields, a hairdressing salon, and one tavern. It is a middle-class neighborhood and consists of about 100 families that are spread over eight streets. The average age of the households (children exclusive) range from 26 to 83 years, with an average of 51 years. This relatively high average dues to the conclusion that several residents have reached pensionable age (15.2%). Except for one street (with an average of 58.1 years) the average age of the households is equally distributed across the neighborhood. In about half of the families in Kouterwijk (43%) there are no (longer) children domiciled. Almost all the residents are homeowners (+/- 95%). Based on the data of the municipal register it could be identified that between 1977-1979 and 1989-1992 respectively 22.3% and 30.4% of the current population moved into the community.

The Kouterwijk was built on a dumpsite where two factories performed industrial activities in the preceding decennia. At the end of the 19th century, permission had been given to run a tannery (see Figure 1), previously known as *Tannerie et Corroierie de Saint-Amand-lez-Pures*. Fifty years later, the first complaints were registered regarding the draining of wastewater containing Na₂S and calcareous salts from the depilatory processing of pelts (see Figure 2), and the draining of rinse water from the paintbrush department. In 1965-1966, the tannery quit these activities. In addition, a fertilizers factory had opened in 1907. The *Société Anonime Pour Favoriser l'Industrie Agricole*, also known as the SAPHIA-factory, was given permission to produce superphosphate and sulfuric acid. The first complaints were noted in 1933 (Gerling Consulting Group Europe

nv, 1999). Subsequent complaints after the Second World War resulted in the council of mayor and aldermen issuing an unfavorable recommendation during the 1960s. The first houses were built during the mid 1970s (Germonprez, 2001). Next to the construction of houses, in 1980 the municipal of Sint-Amands built a sports hall.

Figure 1. The tannery of Sint-Amands



The causes of the contamination are assumed to be twofold (see the descriptive soil research report by Gerling Consulting Group Europe nv 1999). In addition to the negligent dumping of waste materials during the running of the two factories, the contamination of the soil increased through the spread of debris, installations, and other factory remnants all over the community during demolition. This polluted the soil by heavy metals (e.g., cadmium, lead, arsenic) and polyaromatic hydrocarbons (e.g., benzo(a)pyrene [BaP], naphthalene). In 1998 the OVAM detected the first signs of soil contamination in the Kouterwijk when a local inhabitant was working on the conveyance of a house, as laid down in the decrees of 1995 and 1998 concerning soil contamination. Since then, when conveying land property, it is obliged to request a soil certificate (i.e. the prove that the soil concerned is not polluted). Enacted by order of 25th February 1999 OVAM proclaimed the first security measures: inhabitants were advised to stop eating vegetables from their gardens, and every contact with the soil needed to be avoided. At the end of 1999, the residents heard the results of a second and more precise risk assessment.

Figure 2. The depilatory processing of pelts in the Kousterwijk



During the year 2000 inhabitants were officially discharged of the remediation costs and additional experts were appointed. A first expert outlined the plan for the remediation, and a second independent expert institution (i.e. Tauw, see below) was responsible for the communication between the inhabitants and the OVAM. In the following three years additional research had to detect subterranean structures and to estimate the value of resident's private property. In addition soil excavation was chosen as the most effective decontamination strategy. A soil decontamination strategy was formulated. One part of the neighborhood had to be excavated in 2004, a second part in 2005.

The Public Waste Agency of Flanders (OVAM)

The Flemish district is qualified for the environmental policy in Flanders, the Dutch speaking part of Belgium. The Flemish government takes the final decisions on the initiative of the Flemish minister of the environment. Concerning the organization and implementation of the policy, the Minister can count on several organisations, including the Public Waste Agency of Flanders (OVAM). Next to waste management, the Public Waste Agency of Flanders is, in accordance with the Soil Decontamination Decree, entitled to tackle the problem of soil contamination in Flanders. The OVAM controls if the Flemish Regulations on Soil Remediation (VLAREBO) are correctly applied. In addition, if it can be proven that the contamination is not caused by the residents (as it was the case in the Kousterwijk) than people can be officially discharged from remediation

costs. OVAM can also initiate the decontamination of sites when responsible parties ignore their liability.

While several employees of the OVAM were involved with the Kouterwijk, one engineer of the OVAM directed the situation. It was she/he who had the most frequent contacts with the residents and the risk-communicator. In addition, this person managed the different steps of the soil decontamination process. In particular, when approaching potentially polluted soil several phases can be distinguished (Germonprez, 2001): In a first soil research the hazards are assessed. Subsequently, a more extensive risk assessment is made, including an evaluation of the risks for people's health and the environment (i.e. descriptive soil research). Next, a soil decontamination project is specified. During this third step the most suitable decontamination strategy is chosen. Further, based on the instructions of the soil decontamination project, actions are taken to decontaminate the polluted soil. Finally, when the most severe risks are mitigated some additional actions can be taken during a follow-up phase (e.g. monitoring). To bring these phases to favorable conclusions in the Kouterwijk, OVAM assigned several expert institutions. After the first hazard assessments were carried out by OVAM the soil samples were analyzed by the 'Environmental Research Center' (ERC), an independent research laboratory. A more detailed risk assessment (descriptive soil research) was performed by 'Gerling Consulting Group Europe'. Later on, the independent expert institution 'Ecolas' outlined the plan for the remediation. Additional borings to assess the severity of the chemicals were carried out by 'Mava'. Further, the engineers of the company 'Soresma' detected subterranean structures. In addition, another independent expert institution named 'Tauw' was responsible for communicating between the inhabitants and the OVAM. Given its important task as a flexible interface for the residents and the Public Waste Agency, we'll discuss the latter group into more detail.

Tauw: the risk-communicator group

Tauw is an independent expert institution responsible for the communication about the decontamination of the neighborhood. Next to the residents and the representatives of the OVAM, Tauw is an important party in this case study.

Although several employees of Tauw were involved in this case, in the end it was (similar to the OVAM as a party) mainly one person named the 'residents' expert', who took care of this. Newsletters had to be sent to the residents by post in a non-technical and comprehensive language. In addition, with regard to the soil-decontamination project and its implementation, OVAM expected Tauw to pay attention to residents' concerns. In the job description of the 'residents' expert', it is written that, by increasing people's participation with regard to the soil decontamination process "the stress-factors should be reduced to a minimum without pushing aside the objective (of OVAM)" (Germonprez, 2001). Therefore, the residents' expert has to act independently and could not perform other tasks such as security coordinator. Further, the residents' expert is in a position of trust and it is expected that he or she provides an easily accessible assistance during as well as outside ordinary business hours. Moreover, by a general survey and home visits, the residents' expert has to stand up for the interests of the residents. Therefore, it is important that the residents' expert has not only knowledge of technical matter (e.g. geology, risk assessments, the legislation, etc.), but also of communication and community participation (cf. Germonprez, 2001).

Methods and data

The study design of the research project was mixed method (Scholz & Tietje, 2002; Morgan, 1998). First, in order to explore the eco-history of the site we drew on local print media and newsletters, attended meetings for the inhabitants, and held unstructured conversations with stakeholders. We collected further data from 19 in-depth interviews with the residents before the excavation started. On average, these interviews took between 60 and 90 minutes. The interviews were conducted between June and September 2003 (see Table 1). To select the residents for interviewing, a cluster analysis was performed on data from the county register. Based on the variables age, SES, and presence of children, 5 clusters were detected. Subsequently 3 residents from each cluster were randomly selected. In addition, 5 residents were selected on the basis of a theoretical sampling (e.g., a resident who had been working in one of the factories and knew the eco-history of the site, residents who knew the political past of the community, etc.). These conversations were recorded, transcribed,

and analysed using QSR Nvivo 1.2. Firstly, the interviews were coded on the basis of the main topics of the research project (i.e. risk perception, risk-communication, and site-specific concerns). In a second phase, each topic was coded in more detail on the basis of emergent sub-themes (e.g. trust in the risk management).

Table 1. Decontamination phases and moments of data collection

Data collection and decontamination phases	Year	Period
- Interviews residents	2003	June – September
- Excavation part 1	2004	April – August
- Structured questionnaires	2004	September – December
- Excavation part 2	2005	April – August
- Interviews experts	2006	February - March

Next to the inclusion of variables relating to current knowledge, the interviews were used as an input to the site-specific measures of the survey instrument. In other words, the survey included standardized scales related to general mental well being as well as some single-item measures or short scales specific to the local context. The questionnaires were collected between September and December 2004. These questionnaires were collected halfway through the excavation of the community. One part of the soil in the community had undergone excavation (postimpact), and the second part would be decontaminated the following year (preimpact). Questionnaires from 109 residents were collected, representing approximately 85% of the community at the household level. The average age was 51.88 (SD = 11.96) and the people in the sample were 42.2% male. 37.5% of the respondents are higher educated and the average duration of residence is 18 years.

Further, the responses of the experts were assessed. Therefore in-depth interviews were conducted between February and March 2006. These interviews lasted on average 70 minutes with each of the eight experts involved with this case. The two experts who were most involved gave three interviews, with breaks, which together took almost 7 hours. The interviews were transcribed and coded on the basis of the main topics of the questionnaire. The latter consisted of three general themes: In a first phase we asked experts' view about the

results of the sociological study on residents' responses (e.g. "The quantitative study has shown that more than 85% of the people perceived the risks to be low. Do you think that people are acting irrationally by accepting the risks?"). Further, we asked several questions about the risk assessments and the process of risk mitigation in the Kouterwijk (e.g. "How do you explain the differences between the first and the second risk assessment?"). Finally, in a third part, more general questions were asked concerning the soil policy in Flanders (e.g. "In Flanders there are several contaminated communities that can not be decontaminated all at once. How is the urgency to decontaminate determined?"). Next to interviews with the experts, some expert meetings were attended and a laboratory was visited. Likewise with the residents, I guaranteed the experts their anonymity.

Using a mixed method design, we intended to connect the strengths of different methods. More specifically, whereas the qualitative study aimed to give a thick description of the site-specific stressors and residents' risk perceptions, the data from the survey provided more detailed information on the distribution and the relative importance of these variables. As such, the combination of qualitative and quantitative data was used in a complementary manner since the interviews with the residents were partially an input for the site-specific measures of the survey instrument, and, once the data were collected and analyzed, they also provided an abundance of local perspectives to help interpret the statistical results. In addition, the qualitative and quantitative study about residents' experiences and perceptions were partially an input for the qualitative study about experts' meanings of risk.

Analysis

As noted previously, this dissertation has two main objectives, i.e.: i) to compare residents' meanings of risk with experts' risk assessments, and to investigate the social and ecological correlates of residents' risk judgements, and ii) to examine the association between residents' psychosocial health and risk-related variables, the process of soil decontamination and public participation. Each objective will be examined in two empirical papers: In a first paper qualitative data are used to understand residents' and experts' risk perceptions (chapter 2). Next, quantitative data will be used to examine the social and ecological determinants

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of people's hazard perception, risk perception and need for decontamination (chapter 3). Then, we will examine the stressful nature of the process of soil decontamination (chapter 4). Subsequently, we will focus on the association between residents' psychosocial health and risk exposure on the one hand, and between people's mental well being and the role of public participation on the other hand (chapter 5). Finally, the methodological, policy, and theoretical implications of this study will be discussed (chapter 6).

References

- Abbott, A. (2001). *Chaos of disciplines*. Chicago: University of Chicago Press.
- Arbuthnot, J. (1977). Roles of attitudinal and personality-variables in prediction of environmental behavior and knowledge. *Environment & Behavior, 9*(2), 217-232.
- Archer, M. (1995). *Realist social theory: The morphogenetic approach*. Cambridge, New York: Cambridge University Press.
- Aronoff, M., & Gunter, V. (1992). Defining disaster: Local constructions for recovery in the aftermath of chemical contamination. *Social Problems, 39*(4), 345-365.
- Ash, M., & Fetter, T. (2004). Who lives on the wrong side of the environmental tracks? Evidence from the EPA's risk-screening environmental indicators model. *Social Science Quarterly, 85*(2), 441-462.
- Barker, C., & Pistrang, N. (2005). Quality criteria under methodological pluralism: Implications for conducting and evaluating research. *American Journal of Community Psychology, 35*(3-4), 201-212.
- Barry, J. (2007). *Environment and social theory*. London: Routledge.
- Baum, A., Fleming, R., & Singer, J. E. (1983). Coping with victimization by technological disaster. *Journal of Social Issues, 39*(2), 117-138.
- Baxter, J., Eyles, J., & Elliott, S. (1999). Something happened: The relevance of the risk society for describing the siting process for a municipal landfill. *Geografiska Annaler, 81*, 91-109.
- Beck, U. (1992). *Risk society: Towards a new modernity*. London: Sage.
- Beck, U. (1994). The reinvention of politics: Towards a theory of reflexive modernization, in: U. Beck, A. Giddens, & S. Lash (Eds.), *Reflexive modernization: Politics, tradition and aesthetics in the modern social order*. Stanford, CA: Stanford University Press.
- Becker, H. (1963). *Outsiders: Studies in the sociology of deviance*. New York: The Free Press.
- Been, V., & Gupta, F. (1997). Coming to the nuisance or going to the barrios? A longitudinal analysis of environmental justice claims. *Ecology Law Quarterly, 24*(1), 1-56.
- Benton, T. (1991). Biology and social science: Why the return of the repressed should be given a (cautious) welcome. *Sociology, 25*(1), 1-29.
- Benton, T. (2007). Humans and nature: From Locke and Rousseau to Darwin and Wallace, in: Pretty et al. (Eds.), *The Sage handbook of environment and society*. London: Sage.
- Berger, P., & Luckmann, T. (1967). *The social construction of reality: A treatise in the sociology of knowledge*. New York: Anchor books.
- Best, J. (1993). But seriously folks: The limitations of strict constructionist interpretation of social problems, in: G. Miller & J. Holstein (Eds.), *Constructionist controversies: Issues in social problems theory*. New York: Aldine De Gruyter.

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- Bevc, C., Marshall, B., & Picou, J. (2007). Environmental justice and toxic exposure: Toward a spatial model of physical health and psychosocial well-being. *Social Science Research, 36*(1), 48-67.
- Bhaskar, R. (1978). *A realist theory of science*. Hassocks: Harvester Press.
- Black, D. (2000). Dreams of a pure sociology. *Sociological Theory, 18*(3), 343-367.
- Blau, P., Scott, W., & Smith, J. (1970). *Formal organizations: A comparative approach*. London: Routledge.
- Bloor, D. (1999). Anti-Latour. *Studies in History and Philosophy of Science, 30*(1), 81-112.
- Brewer, J. (2000). *Ethnography*. Buckingham: Open University Press.
- Bulle, R., & Pellow, D. (2006). Environmental justice: Human health and environmental inequalities. *Annual Review of Public Health, 27*, 103-124.
- Burch, W. (1971). *Daydreams and nightmares: A sociological essay on the American environment*. New York: Harper & Row.
- Burch, W. (1976). The peregrine falcon and the urban poor: Some sociological interrelations, in: P. Richerson & J. McEvoy (Eds.), *Human ecology: An environmental approach*. North Scituate: Duxbury.
- Burningham, K. (1998). A noisy road or noisy resident? A demonstration of the utility of social construction for analysing environmental problems. *Sociological Review, 46*(3), 536-563.
- Burningham, K., & Cooper, G. (1999). Being constructive: Social constructionism and the environment. *Sociology, 33*(2), 297-316.
- Buttel, F. (1976). Social science and the environment: Competing theories. *Social Science Quarterly, 57*(2), 307-323.
- Buttel, F. (1987). New directions in environmental sociology. *Annual Review of Sociology, 13*, 465-488.
- Buttel, F. (1996). Environmental and resource sociology: Theoretical issues and opportunities for synthesis. *Rural Sociology, 61*, 56-76.
- Buttel, F., & Humphrey, C. (2002). Sociological theory and the natural environment, in: R. Dunlap & W. Michelson (Eds.), *Handbook of environmental sociology*. Westport, CT: Greenwood Press.
- Buttel, F. (2003). Environmental sociology and the explanation of environmental reform. *Organization & Environment, 16*(3), 306-344.
- Callon, M. (1986). Some elements of a sociology of translation: Domestication and the scallops and the fishermen of St. Briec Bay, in: J. Law (Ed.), *Power, action and belief: A new sociology of knowledge?* London: Routledge.
- Carolan, M. (2005). Society, biology, and ecology: Bringing nature back into sociology's disciplinary narrative through critical realism. *Organization & Environment, 18*(4), 393-421.

Chapter 1: Theory and methodology

- Catton, W. & Dunlap, R. (1978). Environmental sociology. A new paradigm. *The American Sociologist*, 13(1), 41-49.
- Catton, W. & Dunlap, R. (1980). A new ecological paradigm for post-exuberant sociology. *American Behavioral Scientist*, 24(1), 15-47.
- Clarke, L., & Short, J. (1993). Social organization and risk: Some current controversies. *Annual Review of Sociology*, 19, 375-399.
- Cole, L., & Foster, S. (2001). *From the ground up: Environmental racism and the rise of the environmental justice movement*. New York: New York University Press.
- Collins, R. (2002). Chaos of disciplines (book review). *Contemporary Sociology*, 31(2), 230-233.
- Corraliza, J. & Berenguer, J. (2000). Environmental values, beliefs, and actions: A situational approach. *Environment and Behavior*, 32(6), 832-848.
- Couch, S., & Kroll-Smith, S. (1985). The chronic technical disaster: Toward a social scientific perspective. *Social Science Quarterly* 66, 564–575.
- Couch, S., & Kroll-Smith, S., Eds. (1991). *Communities at risk: Collective responses to technological hazards*. New York: Peter Lang.
- Couch, S., & Kroll-Smith, S. (1994). Environmental controversies, interactional resources, and rural communities: Siting versus exposure disputes, *Rural Sociology*, 59(1), 25-44.
- Couch, S., & Mercuri, E. (2007). Toxic water and the anthill effect: The development of a subculture of distress in a once contaminated community. *Research in Social Problems and Public Policy*, 14, 117-137.
- Creswell, J. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks: Sage.
- Cudworth, E. (2002). *Environment and society*. London: Taylor and Francis.
- Denzin, N., & Lincoln, Y. (1994). *Handbook of qualitative research*. Thousand Oaks: Sage.
- Dickens, P. (2004). *Society & nature. Changing our environment, changing ourselves*. Cambridge, UK: Polity Press.
- DiCristina, B. (2006). Durkheim's latent theory of gender and homicide. *British Journal of Criminology*, 46(2), 212-233.
- Douglas, M. (1966). *Purity and danger: An analysis of concepts of pollution and taboo*. London: Routledge.
- Douglas, M., & Wildavsky, A. (1982). *Risk and culture*. Berkeley: University of California Press.
- Downey, L. (2003). Spatial measurement, geography, and urban racial inequality. *Social Forces*, 81(3), 937-954.
- Drabek, T. (1986). *Human system responses to disaster: An inventory of sociological findings*. New York: Springer.

Chapter 1: Theory and methodology

Dunlap, R., & Catton, W. (1979). Environmental sociology, *Annual Review of Sociology*, 5, 243-273.

Dunlap, R., & Catton, W. (1983). What environmental sociologists have in common (whether concerned with 'built' or 'natural' environments). *Sociological Inquiry*, 53(2-3), 113-135.

Dunlap, R. (1993). From environmental problems to ecological problems, in: C. Calhoun and G. Ritzer (eds.), *Social Problems*, New York: McGraw Hill.

Dunlap, R. (2002). Environmental sociology. A personal perspective on its first quarter century. *Organization & Environment*, 15(1), 10-29.

Edelstein, M. R. (2004). *Contaminated communities: The social and psychological impacts of residential toxic exposure* (2nd ed.). Boulder, CO: Westview.

Ekberg, M. (2007). The parameters of the risk society. A review and exploration. *Current Sociology*, 55(3), 343-366.

Erikson, K. T. (1991). A new species of trouble, in: S. R. Couch & J. S. Kroll-Smith (Eds.), *Communities at risk: Collective responses to technological hazards*. New York: Peter Lang.

Ezzy, D. (2004). Old traditions and new ages: Religions and environments, in: R. White (Ed.) *Controversies in Environmental Sociology*. Cambridge: Cambridge University Press.

Feagin, J., ed. (1991). *A case for the case study*. Chapel Hill: University of North Carolina Press.

Fisher, D., & Freudenburg, W. (2001). Ecological modernization and its critics: Assessing the past and looking toward the future. *Society & Natural Resources*, 14(8), 701-709.

Frank, D., Hironaka, A., & Schofer, E. (2000). The nation-state and the natural environment over the twentieth century. *American Sociological Review*, 65(1), 96-116.

Freudenburg, W., & Pastor, S. (1992). Public responses to technological risk: Toward a sociological perspective. *Sociological Quarterly*, 33(3), 389-412.

Freudenburg, W., & Gramling, R. (1993). Socioenvironmental factors and development policy: Understanding opposition and support for offshore oil. *Sociological Forum*, 8(3), 341-364.

Freudenburg, W. (1997). Contamination, corrosion, and the social order: An overview. *Current Sociology*, 45, 19-39.

Garfinkel, H. (1967). *Studies in ethnomethodology*. Englewood Cliffs: Prentice-Hall.

Geertz, C. (1973). *The interpretation of cultures: selected essays*. New York: Basic Books.

Germonprez, N. (2001). Sociologische opvolging en evaluatie van de betrokkenen bij een bodemsanering in een woonwijk. OVAM, bestek SI010901.

Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory: strategies for qualitative research*. New York: Aldine de Gruyter.

Giddens, A. (1986). *Central problems in social theory: action, structure and contradiction in social analysis*. London: MacMillan.

Chapter 1: Theory and methodology

- Giddens, A. (1990). *The consequences of modernity*. Cambridge: Polity press.
- Gijssels, C. (2002). Kritisch realisme en sociologisch onderzoek. *Tijdschrift voor Sociologie*, 23(1), 21-44.
- Gillham, J. (2008). Participation in the environmental movement: analysis of the European Union. *International Sociology*, 23(1), 67-93.
- Goldblatt, D. (1996). *Social theory and the environment*. Cambridge: Polity press.
- Gould, K., Pellow, D., & Schnaiberg, A. (2004). Interrogating the treadmill of production. *Organization & Environment*, 17(3), 296-316.
- Gouldner, A. (1970). *De naderende crisis van de Westerse sociologie*. Bilthoven: Amboboeken.
- Guba, E., & Lincoln, Y. (1994). Competing paradigms in qualitative methods, in: N. Denzin & Y. Lincoln (Eds.), *Handbook of qualitative research*. Thousand Oaks: Sage.
- Greene, J., Caracelli, V., & Graham, W. (1989). Toward a conceptual framework for mixed-method evaluation designs. *Education, Evaluation and Policy Analysis*, 11, 255-274.
- Greider, T., & Garkovich, L. (1994). Landscapes: the social construction of nature and the environment. *Rural Sociology*, 59(1), 1-24.
- Grundmann, R. (1991). Nature and the blind spot. Potential of marxist theory for an understanding of ecological problems. *Deutsche Zeitschrift für Philosophie*, 39(9), 1026-1042.
- Grundmann, R., & Stehr, N. (2000). Social science and the absence of nature: uncertainty and the reality of extremes. *Social Science Information*, 39(1), 155-179.
- Gunter, V., Aronoff, M., & Joel, S. (1999). Toxic contamination and communities: Using an ecological-symbolic perspective to theorize response contingencies. *The Sociological Quarterly*, 40(4), 623-640.
- Habermas, J. (1984). *The theory of communicative action. Reason and the rationalization of society* (transl. by T. McCarthy). Boston: Beacon.
- Habermas, J. (1987). *The philosophical discourse of modernity: twelve lectures* (transl. by F. Lawrence). Cambridge: Polity Press.
- Hacking, I. (1999). *The Social Construction of What?* Cambridge: Harvard University Press.
- Hammersley, M. (1992). *What's wrong with ethnography? Methodological explorations*. London: Routledge.
- Hannigan, J. (2006). *Environmental sociology* (2nd ed.). London: Routledge.
- Harré, R. (1979). *The explanation of social behaviour*. Oxford: Blackwell.
- Hughes, J. (1990). *The philosophy of social research*. London: Longman.
- Irwin, A., Simmons, P., & Walker, G. (1999). Faulty environments and risk reasoning: The local understanding of industrial hazards. *Environment and Planning A*, 31, 1311-1326.

Chapter 1: Theory and methodology

- Järvikoski, T. (1996). The relation of nature and society in Marx and Durkheim. *Acta Sociologica*, 39(1), 73-86.
- Johnson, R., Onwuegbuzie, A., & Turner, L. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, 1(2), 112-133.
- Kasperson, R., & Pijawka, K. (1985). Societal response to hazard and major hazard events: Comparing natural and technological hazards. *Public Administration Review*, 45, 7-18.
- Klausner, S. (1971). *On Man and his Environment*. San Francisco: Jossey-Bass.
- Krogman, N. & Darlington, J. (1996). Sociology and the environment: An analysis of journal coverage. *The American Sociologist*, 27(3), 39-55.
- Kroll-Smith, J. S., & Couch, S. R. (1987). A chronic technical disaster and the irrelevance of religious meaning: The case of Centralia, Pennsylvania. *Journal of the Scientific Study of Religion*, 26, 25-37.
- Kroll-Smith, J. S., & Couch, S. R. (1991). What is a disaster? An ecological-symbolic approach to resolving the definitional debate. *International Journal of Mass Emergencies and Disasters*, 9(3), 355-366.
- Kroll-Smith, J. S., & Couch, S. R. (1993a). Symbols, ecology, and contamination: Case studies in the ecological-symbolic approach to disaster. *Research in Social Problems and Public Policy*, 5, 47-73.
- Kroll-Smith, J. S., & Couch, S. R. (1993b). Technological hazards: Social responses as traumatic stressors, in: J. P. Wilson & B. Raphael (Eds.), *The international handbook of traumatic stress syndromes*. New York: Plenum Press.
- Kuhn, T. (1996). *The structure of scientific revolutions*. (3rd ed.) Chicago: University of Chicago Press.
- Larson, M., Forrest, M., & Bostian, L. (1981). Participation in pro-environmental behavior. *Journal of Environmental Education*, 12(3), 21-24.
- Lash, S., Szerszynski, B., & Wynne, B., eds. (1996). *Risk, environment and modernity: Towards a new ecology*. London: Sage.
- Laska, S. (1993). Environmental sociology and the state of the discipline. *Social Forces*, 72(1), 1-17.
- Latour, B. (2005). *Reassembling the social. An introduction to actor-network-theory*. Oxford: Oxford University Press.
- Law, J., & Mol, A. (1995). Notes on materiality and sociality. *Sociological Review*, 43(2), 274-294.
- Law, J., & Mol, A. (2002). *Complexities*. Durham and London: Duke University Press.
- Layder, D. (1998). *Sociological practice. Linking theory and social research*. London: Sage.
- Lazarus, R. S., & Folkman, S. (1984). *Stress, Appraisal, and Coping*. New York: Springer.
- Lemert, E. (1951). *Social pathology: A systematic approach to the theory of sociopathic behavior*. New York: McGraw-Hill.

Chapter 1: Theory and methodology

Levine, M., & Perkins, D. (1987). *Principles of community psychology: Perspectives and applications*. New York: Oxford University Press.

Lidskog, R. (1996). In science we trust? On the relation between scientific knowledge, risk consciousness and public trust. *Acta Sociologica*, 39, 31–56.

Lidskog, R. (1998). Society, space and environment. Towards a sociological re-conceptualization of nature. *Scandinavian Housing & Planning Research*, 15(1), 19-35.

Lidskog, R. (2001). The re-naturalization of society? Environmental challenges for sociology. *Current Sociology*, 49(1), 113-136.

Lockie, S. (2004). Social nature: The environmental challenge to mainstream social theory, in: R. White (Ed.) *Controversies in Environmental Sociology*. Cambridge: Cambridge University Press.

Lutzenhiser, L. (1994). Sociology, energy and interdisciplinary environmental science. *The American Sociologist*, 25(1), 58-79.

Macnaghten, P. & Urry, J. (1995). Towards a sociology of nature. *Sociology*, 29(2), 203-220.

Manzo, L., & Weinstein, N. (1987). Behavioral commitment to environmental protection: A study of active and nonactive members of the Sierra club. *Environment & Behavior*, 19(6), 673-694.

Matthies, E., Höger, R., & Guski, R. (2000). Living on polluted soil: Determinants of stress symptoms. *Environment and Behavior*, 32(2), 270-286.

Meadows, D., Meadows, D., Randers, J., & Behrens, W. (1972). *Limits to Growth*. Washington: Potomac Associates.

Minteer, B., & Manning, R. (2005). An appraisal of the critique of anthropocentrism and three lesser known themes in Lynn White's "The historical roots of our ecologic crisis". *Organization and Environment*, 18(2), 163-176.

Mitchell, J. (2007). Ethnography, in: W. Outhwaite & S. Turner (Eds.), *The Sage handbook of social science methodology*. London: Sage.

Mol, A. (2006). From environmental sociologies to environmental sociology? A comparison of US and European environmental sociology. *Organization & Environment*, 19(1), 5-27.

Morgan, D. (2007). Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of Mixed Methods Research*, 1(1), 48-76.

Murch, A. (1971). Public concern for environmental pollution. *The Public Opinion Quarterly*, 35(1), 100-106.

Murdoch, J. (2001). Ecologising sociology: Actor-network theory, co-construction and the problem of human exemptionalism. *Sociology*, 35(1), 111-133.

Murphy, R. (1997). *Sociology and Nature. Social Action in Context*. Oxford: Westview Press.

Chapter 1: Theory and methodology

- Mythen, G. (2004). *Ulrich Beck: A critical introduction to the risk society*. London: Pluto Press.
- Nelissen, N. (1972). *Grondbeginselen van de sociale ecologie*. Utrecht: Spectrum.
- Newton, T. (2007). *Nature and sociology*. New York: Routledge.
- Outhwaite, W., & Turner, S., eds. (2007). *The Sage handbook of social science methodology*. Thousand Oaks: Sage.
- Pellow, D., Weinberg, A., & Schaiberg, A. (2000). Putting the ecological modernization thesis to the test: Accounting for recycling's promises and performance. *Environmental Politics*, 9(1), 109-137.
- Picou, J. S., Gill, D. A., Dyer, C. L., & Curry, E. W. (1992). Disruption and stress in an Alaskan fishing community: Initial and continuing impacts of the Exxon Valdez oil spill. *Industrial Crisis Quarterly*, 6, 235-257.
- Picou, S. (1999). Theoretical trends in environmental sociology: Implications for resource management in the modern world. Paper presented at the *Social and Economic Planning Conference, Minerals Management Service*, Park City, Utah.
- Picou, S., Marshall, B., & Gill, D. (2004). Disaster, litigation and the corrosive community. *Social Forces*, 82(4), 1493-1522.
- Pollard, V. (2003). Chaos of disciplines (book review). *Futures*, 35(5), 531-534.
- Porter, R. (1994). The Enlightenment, in: *The Hutchinson Dictionary of Ideas*. Oxford: Helicon.
- Preston, V., Taylor, S. M., & Hodge, D. C. (1983). Adjustment to natural and technological hazards: A study of an urban residential community. *Environment and Behavior*, 15(2), 143-164.
- Prokop, G., Schamann, M., & Edelgaard, I. (2002). *Management of contaminated sites in Western Europe*. Copenhagen: European Environment Agency.
- Quarantelli, E., & Dynes, R. (1977). Response to social crises and disaster. *Annual Review of Sociology*, 3, 23-49.
- Quarantelli, E. (1987). What should we study? Questions and suggestions for researchers about the concept of disasters. *International Journal of Mass Emergencies and Disasters*, 5, 7-32.
- Ritchie, L., & Gill, D. (2007). Social capital theory as an integrating theoretical framework in technological disaster research. *Sociological Spectrum*, 27(1), 103-129.
- Ritzer, G. (1975). *Sociology: A multiple paradigm science*. Boston: Allyn and Bacon.
- Ritzer, G. (1990). *Frontiers of social theory: The new syntheses*. New York: Columbia University Press.
- Ritzer, G. (2000). *Sociological Theory*. New York: McGraw-Hill.
- Roberts, T., Grimes, P., & Manale, J. (2003). Social roots of global environmental change: A world-systems analysis of carbon dioxide emissions. *Journal of World-Systems Research*, 9, 277-315.

Chapter 1: Theory and methodology

- Rosa, E. (1998). Metatheoretical foundations for post-normal risk. *Journal of Risk Research*, 1(1), 15-44.
- Sale, J., Lohfeld, L., & Brazil, K. (2002). Revisiting the quantitative-qualitative debate: Implications for mixed methods research. *Quality & Quantity*, 36(1), 43-53.
- Sayer, A. (1992). *Method in social science: A realist approach*. London: Hutchinson.
- Schnaiberg, A. (1975). Social analysis of the societal-environmental dialectic: The role of distributional impacts. *Social Science Quarterly*, 56(1), 5-20.
- Schnaiberg, A. (1980). *The environment: From surplus to scarcity*. New York: Oxford University Press.
- Scholz, R. W., & Tietje, O. (2002). *Embedded case study methods. Integrating quantitative and qualitative knowledge*. London: Sage.
- Searle, J. (1995). *The construction of social reality*. New York: Free Press.
- Secker, J., Wimbush, E., Watson, J., & Milburn, K. (1995). Qualitative methods in health promotion research: Some criteria for quality. *Health Education Journal*, 54(1), 74-87.
- Short, J. (1984). The social fabric at risk: Toward the social transformation of risk analysis (American Sociological Association, 1984 Presidential Address). *American Sociological Review*, 49(6), 711-725.
- Slovic, P., Fischhoff, B., & Lichtenstein, S. (1980). Facts and fears: Understanding perceived risks, in: R. C. Schwing & W. A. Albers (Eds.), *Societal Risk Assessment*. New York: Plenum Press.
- Slovic, P. (1987). Perception of risk. *Science*, 236, 280-285.
- Soper, K. (1995). *What is nature? Culture, politics, and the non-human*. Oxford : Blackwell.
- Spaargaren, G., & Mol, A. (1992). Sociology, environment, and modernity. Ecological modernization as a theory of social change. *Society & Natural Resources*, 5(4), 323-344.
- Spector, M., & Kitsuse, J. (1977). *Constructing Social Problems*. Menlo Park: Cummings Pub. Co.
- Steinmetz, G. (2005). *The politics of method in the human sciences: Positivism and its epistemological others*. Durham: Duke University Press.
- Stern, P., Dietz, T., & Guagnano, G. (1995). The new ecological paradigm in social-psychological context. *Environment and Behavior*, 27(6), 723-743.
- Swanborn, P. (1999). *Evalueren : Het ontwerpen, begeleiden en evalueren van interventies: een methodische basis voor evaluatie-onderzoek*. Amsterdam: Boom.
- Swingewood, A. (2000). *A short history of sociological thought*. New York: St. Martin's Press.
- Tashakkori, A. & Creswell, J. (2007a). Editorial: The new era of mixed methods. *Journal of Mixed Methods Research*, 1(3), 3-7.
- Tashakkori, A., & Creswell, J. (2007b). Editorial: Mixed methodology across disciplines. *Journal of Mixed Methods Research*, 2(1), 3-6.

Chapter 1: Theory and methodology

Van der Pligt, J., & De Vries, N. K. (1995). *Opinies en attitudes. Meting, modellen en theorie*. Amsterdam: Boom.

Van Liere, K., & Dunlap, R. (1980). The social bases of environmental concern: A review of hypotheses, explanations and empirical evidence. *Public Opinion Quarterly*, *44*, 181-197.

Vermeersch, H. (2006). *De schone en het beast. Sekse, gender en risicogedrag: Een biosociale analyse*. Doctoraal proefschrift, Universiteit Gent.

White, L. (1967). The historical roots of our ecological crises. *Science*, *155*, 1203-1207.

Zavestoski, S., Mignano, F., & Agnello, K., et al. (2002). Toxicity and complicity: Explaining consensual community response to a chronic technological disaster. *Sociological Quarterly*, *43*(3), 385-406.

Zimmerman, M. (1995). Psychological empowerment: Issues and illustrations. *American Journal of Community Psychology*, *23* (5), 581-599.

CHAPTER 2: TUMBLING INTO THE EXPERT–LAY GAP. UNDERSTANDING RISK DISBELIEF IN A CONTAMINATED NEIGHBOURHOOD*

Abstract: The objective of this study is to understand meanings of risk and to compare laypeople's with experts' risk judgements. In contrast to a-contextual risk approaches (i.e. the psychometric paradigm, cultural risk theory, and the risk society thesis), in this article we build on interpretative risk research to understand the socio-cultural dynamics of risk perception. In particular, concerns about health risks by people living on chemically polluted soil are explored in a manner that is sensitive to the social contexts of everyday life (cf. Irwin, Simmons & Walker, 1999). Interview-data with area victims and experts provide several explanations for residents' risk disbelief. These relate to three main topics: i) the controversies surrounding the 'discovery' of the dangers, and the long period between the 'discovery' and the risk-mitigation, ii) the conclusion that residents could make a difference between health risks and the seriousness of the contamination as it is irrespective of decisions, and iii) the disagreements between and within expert institutions about risk acceptability and risk mitigation.

Keywords: soil contamination, expert-lay gap, hazard awareness, interpretative risk research

Introduction

It is generally assumed that scientific rationality is superior to social rationality. This science-centred framework is accompanied by a knowledge deficit model, i.e.: the assumption that the best way to bridge differences in risk definitions is by educating laypeople with the scientists' hard facts. The latter assumption can also be found in one of the most influential risk approaches, i.e.: the psychometric paradigm. Building on studies in behavioural economics where risky choices were analysed in a laboratory context (see e.g. Tversky & Kahneman, 1974), Slovic, Fischhoff and Lichtenstein (1980) started eliciting perceptions and expressed preferences by using psychometric techniques. In contrast to the adherents of the rational-action paradigm, their empirical studies illustrate that matter of risk acceptance cannot be reduced to the weighing up of costs and

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benefits, and suggest that differences between the real risks and lay perceptions partially result from laypeople's lack of knowledge (the "familiarity" factor, cf.: Slovic, 1987), faulty memory, and an inability to consider the probability of an outcome (Jasanoff, 1998).

However, during our late-modern era developments in science and technology are no longer perceived as instruments to save humanity and the environment but as potential problem-solvers and creators at the same time. The rise of several man-made hazards and catastrophes (e.g. Bhopal, Chernobyl, Love Canal, etc.) produced a state of mind whereby the ideas of endless social progress and human controllability are to an increasing extent mixed with (rather than replaced by) feelings of interconnectedness and a decline in deference to scientific knowledge. This trend not only demanded a revision of the infallibility of technical risk analyses, but induced changes in the way social scientists study issues of risk and the environment (cf. Taylor-Gooby & Zinn, 2006; Krinsky & Golding, 1992). For example, since Catton and Dunlap's (1978, 1980) introduced their 'new ecological paradigm' several sociologists started with the study of societal-environmental interactions (see e.g. Burch, 1976; Kroll-Smith & Couch, 1991, 1993; Frank, Hironaka & Schofer, 2000). In addition, whereas early economic and psychological studies of risk emphasized the potential of instrumental-rational actions, the clear boundary between science and non-science, and the cognitive limitations of non-experts, socio-cultural approaches to risk emphasize the importance of communicative rationality and the socially constructed dimensions of risk.

Although the sociological theories of risk (e.g. the risk society thesis) and anthropological approaches to risk (e.g. cultural risk theory) in our view correctly point to the conditionality of knowledge forms by analysing the social and cultural influences on risk perception, the paper begins with a discussion of the limitations of these supra-individual approaches. In response to these critiques, we build on interpretative risk research that stresses the locally embedded nature of risk and the active manner in which people define risky situations (cf. Irwin, Simmons & Walker, 1999). We then give a brief overview of the community context before describing the methods and the data. Next, based on interview-data with area residents and experts, we will explore residents' and experts' risk judgements. Finally, the implications of this case study are discussed.

Theoretical background

To understand the selection of risk and other than scientific criteria for risk acceptance (e.g. worldviews, political networks, financial interests, etc.), anthropologists and sociologists started with the study of societal and group-related factors next to cognitive variables and hazard characteristics. While a diverse range of social theories of risk have been developed (for an overview see: Krimsky & Golding, 1992; Taylor-Gooby & Zinn, 2006; Zinn, 2008) two European theorists of risk have been placed to the forefront: the German sociologist Ulrich Beck and the British anthropologist Mary Douglas. In *Risk Society* Beck (1992) argues that late modern risks such as nuclear power, chemical production and global warming, challenge the societal order by a process called "reflexive modernization." The latter, as Beck understands it, "signifies not an increase of mastery and consciousness, but only a heightened awareness that mastery is impossible" (Latour, 2003, p.36). In response to the failure of modern institutions to cope with the side effects of modernization, Beck hopes for the democratization of science and politics by grassroots subpolitics.

In contrast to Beck's exploration of the discontinuities between the risk society and earlier stages of modernization, Douglas (1982, 1985) focuses on the continuities between past and present cultures (Wilkinson, 2001). In *Risk and Culture* (1982) Douglas and Wildavsky argue that perceptions of risk are induced by worldviews and myths of nature that can be linked to four ways of life, namely: individualists, egalitarians, hierarchists, and fatalists. The variation in risk perceptions are not explained by cognitive variables or by societal transformations, but by the institutional structure that is based on grid and group characteristics (e.g. networks, specialization, etc., cf.: Rayner, 1992). For example, people with hierarchic orientations are assumed to tolerate environmental risks as long as government or expert institutions use the best available techniques to select these risks (Rippl, 2002). In contrast, it is assumed that egalitarians oppose environmental risk because they fear them to threaten their group solidarity and their capabilities to act independent from the risk decisions made by expert institutions.

Although the risk society thesis and cultural risk theory consider the social context of risk perceptions more seriously than technical risk analyses and psychometric studies, there remain some important shortcomings. A first

limitation concerns the challenge response model underlying Beck's thesis of the risk society. Although Beck describes his epistemological position as constructivist realist, he assumes that, despite science's lack of social authority, laypeople's risk consciousness of manufactured uncertainties like chemical pollution is a direct outcome of the real nature of risks (Scott, 2000). Despite experts and governmental authorities need to cope with incalculable threats, Beck seems to give the benefit of the doubt to the interpretation of the concerned citizens. In other words, it is unclear how reflexive modernization could occur without reflection or why 'the real' overwins 'the symbolic'. As a result, Beck's notion of the risk society has been contested because it would rest on contradictory meta-theoretical assumptions (cf. Hogenboom, Mol & Spaargaren, 2000).

In addition, because of the coming age of the regulations of environmental risks by government agencies, some sociologists noted that Beck's eco-alarmism could to an increasing extent be accompanied by less distrust in institutional actors to carry out their responsibilities (Freudenburg, 1993; Zvestoski et al., 2002). The extent to which laypeople and experts perceive and accept environmental dangers has been studied thoroughly (see e.g., Slimak & Dietz, 2006; Lazo, Kinnel, & Fisher, 2000; Kraus, Malmfors, & Slovic, 1992). However, these studies were largely based on situations whereby experts are the risk-deniers and non-experts the risk alerters (Baxter & Lee, 2004; Sjöberg et al., 2005). In addition, with few exceptions (Gunter, Aronoff, & Joel, 1999; Baxter & Lee, 2004), little is known about responses to toxic contamination when it is placed on the agenda by public authorities and when citizens are less concerned than the government officials and their consulted experts. This lack of empirical research certainly poses questions when looking at perspectives other than Beck's version of the Risk Society (see e.g.: Spaargaren & Mol, 1992; Lash, 2000; Cohen, 1997; Furedi, 1997), and specifically when the hypothesis is considered that risk deniers rather than risk alerters could be a silent majority among the public (Sjöberg et al., 2005).

Furthermore, although Mary Douglas' cultural risk theory avoids Beck's eco-structuralism by pointing to the socially constructed nature of experts' and non-experts' risk perceptions, several scholars have criticized cultural risk theory for lacking empirical support. For example, based on quantitative risk research, Sjöberg (1997, 2000) concluded that risk judgements follow similar rank orders in different cultures like Sweden and Brazil, and that cultural theory could explain

no more than 5-10% of the variance in risk perception within the national samples. This reservation is supported by other critiques (Wynne, 1992; Lash, 2000; Wilkinson, 2001; Rayner, 1992; Boholm, 1996; Renn, 1992) that state that the cultural theory is too fixed to be useful because i) cultural bias is not unavoidable, ii) people's identity consists of a personal identity and several social identities, iii) people can use values and beliefs from different forms of social organizations, and iv) it is possible that, as time goes by, people can change their beliefs and values.

In this article it is postulated that some of the answers to the critiques directed at the most influential social theories of risk (i.e. the psychometric approach, cultural risk theory, and the risk society thesis) might relate to a limitation underlying all of them, i.e.: the a-contextual nature of these approaches. Although cultural risk theory and the risk society thesis pay relatively more attention to the social contexts in which people understand and actively (de)construct risks, it has been noted previously that both approaches offer "highly partial accounts of the social perception of risk which are either beyond the scope of empirical verification, or, rather, have severely underestimated the complexity and uncertainty of the 'reality' which they seek to understand" (Wilkinson, 2001: 9). Therefore, the theories of Slovic, Beck, and Douglas are criticized as they all intend to deflect attention from the complexity of risk perceptions (Pidgeon, Simmons & Henwood, 2006).

Interpretative risk research takes the limitations as outlined above seriously by studying "the symbolic and locally embedded nature of the sociocultural elements to risks, as well as the active interpretation of people in the generation of risk understanding" (Pidgeon, Simmons & Henwood, 2006: 103). For example, in a study about people living close to a chemical industry site in Jarrow, Irwin et al. (1999) describe how people's risk understandings are linked to personal experiences, worldviews, local memory, and moral judgements. Based on focus-group discussions, this interpretative research shows that "pollution issues do not stand alone but form part of a larger web of constructed meanings" (Irwin et al., 1999: 1323).

In another study about sheep-farmers who had to cope with the contamination of their pastures near the Sellafield nuclear facilities at Cumbria, Brian Wynne (1992, 1996) describes how the farmers correctly questioned scientists' authority. The radioactive contamination, which was caused by the

radioactive fall-out from Chernobyl in 1986, and the nuclear reactor accident at the Sellafield-Windscale site in 1957, caused severe disputes between scientists and lay people. Despite several scientific errors and the farmers' local knowledge and experiences, the risk understandings of the farmers were ignored. This resulted not only in heavy financial burdens but also in severe threats to the farmers' social identity (Wynne, 1996). Similar to Irwin's study in Jarrow, this study pointed to the "unacknowledged reflexive capability of lay people in articulating responses to scientific expertise" (Wynne, 1996: 43).

In contrast to the prominent social theories of risk as discussed above (i.e. the psychometric paradigm, the risk society thesis, and cultural risk theory), interpretative risk studies show that concerns about risk can not be uncoupled from people's everyday lives. However, in contrast to the large-scale production of a-contextual risk research, there is a lack of in-depth research about the multidimensionality of non-experts' and experts' risk perceptions (Baxter & Lee, 2004). Within this context, the case study that follows describes low concerns about the health risks of chemical contamination with a focus on residents' and experts' interpretations of not only the hazard, but the symbolic elements of risk that shape those definitions.

Context

The Kouterwijk is a middle-class community of about 100 households located in the village of Sint-Amands aan-de-Schelde in Belgium. This small village is known for its restful setting, situated to bicycle rides and promenades along the river de Schelde, its natural boundary (see Figure 1). The allotment started during the 1970s, built on a dump site where two factories performed industrial activities in the preceding decennia. There are two notable periods in which many of the present residents since moved into the community; respectively, 22.3% and 30.4% of the current population took possession between 1977-1979 and 1989-1992. Almost all the residents are homeowners (+/- 95%).

At the end of the 19th century, permission had been given to run a tannery. Fifty years later, the first complaints were registered regarding the draining of wastewater containing Na₂S and calcareous salts from the depilatory processing of pelts, and the draining of rinse water from the paintbrush department. In 1956-1966, the tannery quit these activities. A second factory

had opened in 1907, with permission given to produce superphosphate and sulfuric acid, the latter estimated at 20,000 tons a year. The first complaints were noted during the 1930s. Subsequent complaints resulted in the council of mayor and aldermen issuing an unfavorable recommendation during the 1960s. The company was sold to a demolition firm, followed shortly by the start of the allotment.

Figure 1. Aerial view of the Kouterwijk



Although to some extent disputable, the causes of the contamination are assumed to be twofold (see the descriptive soil research report by Gerling Consulting Group Europe nv 1999). In addition to the negligent dumping of waste materials during the running of the two factories, the contamination of the soil increased through the spread of debris, installations, and other factory remnants all over the community during demolition. This transformed the soil into an “invisible chemical cocktail” consisting of both heavy metals (e.g., cadmium, lead, arsenic) and polycyclic aromatic hydrocarbons (e.g., benzo(a)pyrene [BaP], naphthalene).

Methods and data

The analysis in this paper is based on several qualitative data. To explore the site’s history, we drew upon local print media, newsletters, newspaper articles,

pictures, and books from the local library. To explore residents' responses before the excavation, 20 semi-structured interviews were held that took between 60 and 90 minutes. To select the residents for interviewing, a cluster analysis was performed on data from the county register. Based on the variables age, socio-economic status, and presence of children, 5 clusters were detected. Subsequently 3 residents from each cluster were randomly selected. In addition, 5 residents were selected on the basis of a theoretical sampling (e.g., a resident who had been working in one of the factories and knew the eco-history of the site, residents who knew the political past of the community, etc.). The results of this qualitative study were summarized and sent to the inhabitants by post. If desired, residents could ask questions and give remarks about the results by post, e-mail, or telephone. To assess the responses of the experts, in-depth interviews were taken lasting on average 70 minutes with each of the eight experts involved with this case. The two experts who were most involved gave three interviews, with breaks, which together took almost 7 hours. In addition, we attended public and expert meetings. Notes of several unstructured and informal conversations (chats, telephones, e-mails) were taken with stakeholders (engineers, local officials, epidemiologist, constructors). Likewise with the residents, we guaranteed the experts their confidentiality.

Findings

The results are discussed in four sections. Firstly, an overview is given of the social construction of the risks. We then describe the primary concerns of Kouterwijk residents. In a third section, based on the interviews with the residents, a first series of explanations are given for people's low concerns about the health risks. Finally, in a fourth section experts' risk assessments will be deconstructed by analysing individual expert estimations of risk.

The construction of risk: "Um...what risks? Suddenly, there's a problem!"

Several residents heard about the contamination for the first time when it aired on local and national radio. One resident remarked: "At 7:15 a.m., my husband called me to ask if I heard the regional news at 6:30 a.m. Personally I did hear it one hour later on the national radio, at 7:30 a.m., the 3rd of September 1998."

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Later, authorities acknowledged a leak in the press. Some months before this sudden amplification, a soil analysis was performed by request of a local inhabitant working on the conveyance of a house, as laid down in decrees concerning soil contamination. Thus the Public Waste Agency (OVAM) knew the potential danger but remained silent to avoid creating needless anxiety for residents. The way the message “soil pollution in the Kouterwijk” spread into the ether remains a mystery.

At that moment, most residents couldn't believe the messages they heard via the media and thought the problem was exaggerated. Expressions such as “Well, everything will blow over,” “It won't be that serious,” or “There are only rumors, no facts,” were recurring reactions. Several residents had been living in the community for more than twenty years, so why would their soil suddenly be problematic? Although several residents had known that there were industrial activities before the allotment, thought of environmental damage didn't occur to residents due to a different political context back then. Until recently, environmental issues didn't matter much (or, better, not at all), and the discourse on sustainability hadn't been created. The Flemish government applied the precautionary principle to soil contamination in communities only since the first decree on soil contamination (1995).

Shortly after the press leak, a public meeting was organized. It gave an overview of the potential physical health risks of the contaminated soil, and some recommendations: Every contact with the soil must be avoided, and inhabitants were advised to stop eating vegetables from their gardens. As the situation became defined as a problem, and as the possibility to decontaminate became increasingly plausible, inhabitants sought out the culprit. Both factories were demolished in the 1960s, and their former owners were no longer alive. The “blame issue” did not direct toward the activities per se, but to the former local government due to the lack of regulation during the demolition of the factories and the fact that they gave permission to start the allotment. Residents also questioned the timing of the announcement of the contamination, only months after the end of the 30-year liability of the local government to permit the allotment. Some residents, suspecting that this was not a coincidence, reasoned that if the problem had been constructed some months or years earlier, the local government would have had to pay the decontamination costs and this would probably have meant bankruptcy.

Nonphysical risks as primary concerns

In glaring contrast to experts' alarming risk assessments, most residents didn't worry about the chemicals in their soil. What residents mentioned as most stressful was the long period between the announcement of the contamination and the start of the excavation, resulting from the juridical obligations for the paper mill and the time taken for technical assessments induced by the uncertainties that the soil experts confronted in quantifying and categorizing the properties of chronic contaminants. Meanwhile, as residents weren't sure if their parcels would be decontaminated (or still couldn't believe it), they doubted whether to maintain their well-kept garden.

Probably most stressful were the financial risks induced by the decontamination. Initially residents feared that as their area was stigmatized as a "polluted place" through media attention, their homes' values would be affected forever. This became a main concern since residents were told that their parcels would be reported in the Flemish register of polluted soil even after they were decontaminated. In addition, residents worried about the decontamination costs as, according to the decree of soil contamination, it was not the government's responsibility to indemnify the costs. Once the residents were officially discharged of the remediation costs, and once excavation was chosen as a decontamination strategy, these concerns lessened. Several residents perceived that the choice to excavate the soil was the best solution to destigmatize the site as it gave the highest assurance to grasp the dangers. The perceived need to grasp the dangers wasn't induced by high concerns about risks but by residents' aim to revalue their property. However, this technique, in comparison with decontamination strategies such as phytoremediation and immobilization, has a serious disadvantage too as it completely transforms residents' private property. Soil excavation as a decontamination method not only entailed the excavation of the soil but also demanded the replacement of mailboxes, fishponds, doghouses, drives, common walls, and so forth. Residents' awareness that it could take a long period to restore the view of the environment, and that the emotional value of several objects in their modified environment could not be counterbalanced by material or financial compensation, was stressful for several residents and for those of an advanced age in particular.

Besides the heterogeneous spread of the chemicals, Kouterwijk's soil was characterized by a unique physical structure. Foundations, basements, pipes, cables, debris of the factories, and so forth, were all located "somewhere" under people's houses and gardens. The primary stressors were not related to the chemicals' risks but to the impact of the excavation on the built and modified environment. Uncertainties about future conditions above the surface were more stressful than uncertainties about what was under the soil. One resident illustrated his anticipatory fears about what could go wrong during the excavation:

Marie They will excavate our soil, and I think it will be a catastrophe! Our house is built on one of the basements of the previous factories...and imagine it would rain for four days during the excavation.... Maybe our house will collapse, or...I also hope that those constructors can operate with those cranes. [warns] Those cowboys will have to be careful! [pause] And if something will go wrong, then who'll need to pay for it? The government? Imagine we need to take legal action against the government.... By then we're eighty years old and in any case if you need to compete with them [makes a sign of powerlessness].... [sighs] This is really nerve-racking.

Next to residents' perceived powerlessness to take legal action against the government if something went wrong during the excavation, most people felt their participation in major decisions on the evaluation of the risks (if decontamination is necessary), on the risk mitigation (choice of decontamination strategy), and the subsequent commencement and the course of the excavation, as nil. Residents' subordinate position under the almighty government and all-knowing experts induced for some residents, in addition to heightened levels of stress experience, feelings of resignation and demoralization. This is consistent with other cases as reported in the literature (see e.g.: Picou, Gill, Dyer, & Curry, 1992; Edelstein, 2004; Couch & Mercuri, 2007).

The configuration of residents' risk-disbelief

Supra it was stated that the Kouterwijk inhabitants' main concerns were nonphysical risks, and that they estimated the risks of the chemicals collectively as very low. But how can we explain that residents didn't believe that they were living on polluted soil that posed severe threats to their health and environment?

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Several main reasons can be situated in the history of the site (cf. Edelstein, 2004; Irwin et al., 1999). There were limited visible signals of contamination in the environment. In addition, people had been living in the community for more than twenty years and suddenly there was a problem, although they had never been sick.

Mark Over there, straight across from the sports center, there's some purple soil and there's no growth, nor thistles, weed, or grass...just nothing...but then you tend to take it for granted.

I Did no one talk about that before the announcement of the contamination?

Mark No, nobody.

Other residents told that they knew the industrial past of the site. However, although several people noted that they saw the factory remnants and some 'dirty stuff' during the allotment, they never thought they might be at risk. Moreover, when experts completed their risk assessments, many people still couldn't believe the seriousness of the situation. Many residents said that while they acknowledged the seriousness of the contamination in terms of the presence of chemicals, they reasoned that "to be at risk" there had to be exposure routes. As the only relevant exposure routes outlined by an independent, expert institution were "eating vegetables or soil particles," residents felt able to control the exposure routes and the resulting health risks despite recognizing the presence of 'dirty stuff'.

Further, residents mentioned that at the time they bought their terrain, prices were not cheaper than elsewhere, so residents considered, "Why would my soil be worse than somewhere else?" Also, several residents living in the community since the parcellation leveled up their terrain by 30 to 40 centimeters. What is more, as the Public Waste Agency has not undertaken any epidemiological research because of "methodological reasons," several residents annually allowed a blood test by their family doctor, with no anomalies found. As such, residents reasoned, "My doctor says I'm healthy, though the government says I'm at risk."

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I Let's assume that you would have the option to keep your parcel as it is now...that the government would say: "Well, if you don't want to decontaminate, it's up to you"?

Peter [resolute] We wouldn't decontaminate our garden. We act in defiance of it, and after all, I always listen to my house doctor. I told him how many years I lived in this community, I allowed my blood to be taken and asked him, "Am I abnormally sick?" After he took my blood, he said, "No, sir, you are healthy, and besides everybody looks healthy...and probably we're the healthiest of all"...and the doctor started laughing. So, what should I think about all this? [...] It's easy to frighten people — that's what I think.

Moreover, the fact that the announcement was made only months after the end of the 30-year liability of the local government to permit the allotment made residents feel trapped in some sort of impression management by the government. Such was illustrated when I tried to visit one resident: "You know what, sir: It's just like [the government] plays a game here, but it's not a comedy but a real tragedy! [slammed the door]." Thus, besides their experiences before the announcement of the contamination, many people interpreted the risks in the political context in which the contamination problem was constructed. According to several residents, other problems were more urgent than the decontamination of their environment. "Why should we be bothered by the government's whims? Couldn't they spend our taxes to fix real problems?" sounded the underlying factors that partially explained their risk perception.

Besides, several residents questioned the credibility of the risk assessments since more than half the parcels changed urgency class from the first to the second assessment. Besides, residents were skeptical toward the selection of the samples. Given the heterogeneous spread of the chemicals, how can one take a representative sample from a population that is unknown? Experts called it geostatistics, yet most of the residents called it "lucky shots." The next excerpt shows how one resident denounced the government's consulted scientists (e.g., toxicologists) and scientific consults (e.g., soil experts) as they didn't complete their assignments as he expected:

Sandra Look [points to another house in the same street]...over there lives a woman and based on the first risk assessment her parcel was not contaminated. Thus, she continues gardening and invests in flowers, plants, etcetera. Then, some months later,

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based on the second assessments, suddenly her parcel was contaminated and needs to be decontaminated. Now, explain that to me!

I Well, uh...

Sandra Then, of course, you start wondering: Are those professionals professional? I don't know. Probably those last experts were the super-professionals.

Some residents told me that when experts came to the community to take the soil samples, they didn't always use gloves. Yet, as the residents had been recommended at one of the first public meetings not to have contact with their soil, this small detail was perceived by the residents as a discordance between experts' risk assessments and risk behavior. The recommendation by the toxicologist "no contact with the soil!" seemed not to apply for the two soccer fields in the community, either — which were property of the local government:

Nathan In one of the public meetings by the Public Waste Agency we have been told that we could not have any contact with the soil. As such, we asked for a play area, which we got.

I Mhm.

Nathan But on the two soccer fields, some 75 meters from here, they keep on playing although the fields also need to be decontaminated. Something isn't right here.... Over there, little kids can play soccer, they can fall in to the mud, and that's not a problem. And we, we should wear gloves, and [mockingly] we should be careful even to touch the blades of grass. It's a big joke here!

Several residents understood the risks within a broader political context. In particular, residents blamed the former local government due to lack of regulation during the demolition of the factories and its permission to start the allotment. According to many residents, the support of the current local government — ruled by the same political party — equaled zero. Although, from the law's perspective, the current government was "innocent," people felt let down and said they received no social assistance. In addition, the long period between the announcement of the contamination and the start of the excavation

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- 6 years - threw further doubt on the urgency to decontaminate and the physical health risks:

I What is your experience with the current local government?

Robert They don't know a [bleep] about it. The local government is pathetic. They don't care at all! When there's a public meeting...they give one voucher for a free drink. Besides that, their support: zero! [makes a sign]

I What do you expect from them?

Robert That they represent the people. [...] For me it sounds obvious that the representatives represent the people.

I How do you think they could do this?

Robert By using their influence...not to talk but to act! The decontamination should have been finished for a long time now.

At the same time, residents acknowledged that the case was under authority of the Flemish government. Many residents mentioned that the current local government was a "victim" of political decisions on the supra-local level (Flemish district), or some stated more extremely that the local government also needed to cope with the whims of national politics because of the need to decontaminate its soccer fields, which was a heavy financial burden. These residents had an empathy with the local government within the frame of national politics, but a suspicious attitude toward it within the frame of the local government's predecessors. As official parties maintained silence on their definition of the situation, many residents were critical and stated that if there had been no hidden agenda between local and supra-local politicians before the announcement of the contamination, the local government had been very lucky that the announcement was only months after the end of the 30-year liability to permit the allotment. Not only the moment at which the risks were socially constructed was questioned, but also the ghostly amplifier, that is the mystery surrounding the press leak. This induced distrust against the political fabric that was difficult to recover by policy workers of the Public Waste Agency.

Objective risk assessments or experts' risk beliefs?

A main challenge was to assess the risks, which wasn't - as one expert told me - an exact science. The residents also acknowledged this, in particular because of the major differences between the first and second risk assessments. Later it became clear that these differences could be attributed to a different "soil-sampling methodology" between the first and second assessments. In the first, the soil samples were homogenized into one sample and sent to the laboratory. In the second, performed by another private company, first a distinction was made between the front and back garden. The different soil samples were separately analyzed, and the sample with the highest concentration was selected as representative for the front garden. The procedure for the back garden was the same. As the samples were not homogenized in this second assessment, more than half of the parcels with a low urgency class (or even no urgency) changed to moderate or high (or to low, from nothing), and parcels with a moderate urgency class altered to high. But why did the experts use mixed samples in the first assessment? In interviewing the experts, it became clear there was time pressure during the first risk assessment. Once the files of the first risk assessments from the department of "Soil Management" were taken over by another department within the Public Waste Agency (specializing in the realization of decontaminations), these experts started questioning the soil-sampling methodology, because based on these results they couldn't differentiate the risks between the front and back garden:

I What did you think when you received the files of the first risk assessment?

Erik Well, uhm...we wondered why the soil experts proposed to take mixed samples.... At the same time, I understood them, because in the early phase of risk evaluation there's a pressure to have results in the short run. Yet in the long term it creates delay. [...] Imagine for example that the front garden is clean and the back garden is highly contaminated. If you mix these samples, then it is possible that the concentration is halved. Then you only know the average concentration for the whole parcel. Then the question is posed [rhetorically], "Was it useful?" As such, in the future, we will not take mixed samples anymore, but separated samples.

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Besides the time pressure, homogenization of soil into one sample was much cheaper than analyzing eight or ten samples. Laboratories have a limited capacity, and the working hours are expensive as they employ higher educated people and require expensive technologies. In addition, experts had limited experience with these assessments as it was only the second community decontaminated in Belgium and the first with such a heterogeneous distribution of chemicals. An additional point of controversy surrounding the risk assessments was, "Why didn't the experts carry out an epidemiological research?" Given that there's such a big, seemingly unbridgeable, gap between experts' assessments and victims' perception, I wondered if a scientific study about the physical health effects could be a way to bridge these opposite risk estimations. Some experts involved told me that there were "methodological problems":

Suzy I don't think it would have been useful. I know other sites where there has been carried out an epidemiological research and people continued to minimize the risks. They just couldn't believe it because they were living over there for such a long time. I think this would have been the same in the Kouterwijk.

I Why didn't the experts carry out an epidemiological research?

Ludo I don't think it's possible for a community with 110 families... not enough cases. Besides, I don't trust that kind of designs. You can do anything you want with those researches.

I You told me before that an epidemiological research was not possible in the Kouterwijk...?

Toon Yes, besides the fact that there are not enough people living in the community, there were difficulties to control for lifestyle factors. I gave you the example of someone who allowed his blood to be taken...and the high concentration of heavy metals was caused by the fact that he was eating fish the day before, not because he was exposed to the heavy metals. So, I don't think it's a good idea.

Kris This is not the authority of the Ministry of Environment, but of the Ministry of Public Health. Besides, imagine that we would have found an effect, then you create needless anxiety for the people.

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However, other experts said quite the opposite:

I Do you think that an epidemiological research would have been useful?

Mark Yes, I think so. But yeah...that didn't happen indeed.

I Why not? Some argue there were methodological problems.

Mark No, I don't think so — 110 families should be enough.

I So, why then...

Mark [...] There could have been motives like politics, prestige.... But I can't talk...[seems to swallow his words]... I don't know.

In order to understand experts' judgments more deeply, I asked them if people were acting irrationally by accepting the risks:

I Are people acting irrationally by accepting the risks?

Suzy Yes. Today, the status of an expert and objective research is too often, though wrongfully, criticized. Many people distrust experts because constantly newspaper headlines say: this is risky, that is risky...finally people ponder, "What is not risky?" so they minimize it. There's a lack of knowledge on the side of non-experts.

Ludo [sighs]...People always have a reflex to push aside the things they can't cope with immediately. It's difficult for people to estimate these things, and automatically they maintain some distance to it. I think this is a natural reflex but to some extent irrational.

Yet, other experts who were involved told me:

Toon No! People are not acting irrationally. Certainly not. If I would be in their situation, I would act the same. [...] The second risk assessment was based on the worst-case scenario. The norms were too tight. The norm of benzo(a)pyrene for example, that parameter much talked of, was too tight. [...] Besides, the qualitative data in the risk model were too tight, too. They assumed a future scenario in which there would be a vegetable garden and that there would be children living, eating the soil. [...] I think it

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was better to say, "You can't cultivate vegetables, but you can keep your garden...." That would have been a better option than excavating. [...] Besides, as I told you before, I think that only 30% of the community really had to be decontaminated.

Kris I really understand the people. Besides, I think that the vision of the experts is not always univocal either. Between experts, there was a lot of discussion about the risk acceptability....

I About how safe, safe enough is...

Kris Yes, indeed. The parameters that are used in the risk evaluation...these are not only scientifically determined.... There are factors, political negotiations that influence the risk model.... I think that risk acceptability according to risk managers is always relative to a political context. The norms to decontaminate soil are different in almost every country. Why? Because politicians can't decontaminate everything, as their budget is limited. If there's no financial basis.... Look to the Netherlands...first the norms were very tight, but once the politicians realized it was not attainable in financial terms, they relaxed the norms.... That's politics.

Further, when we asked to the experts if the financial risks for the government influence the extent to which physical risks for citizens are regulated, the answer was unanimously 'yes'. Further, some experts noted that there is more political pressure to regulate those contaminated communities that receive relatively more media attention. One of the experts even told that in his view only one third of the neighbourhood had to be excavated. In other words, these data suggest that 'expert view' is not necessarily a coherent but rather a contested one.

Conclusion

In this article responses to chemical contamination in a neighbourhood were explored by means of in-depth interviews. In contrast to the prominent risk approaches (i.e. the psychometric paradigm, the risk society thesis, and cultural risk theory) we explored residents' risk perceptions in a manner which is sensitive to their lived experiences (Wynne, 1992; Irwin, Simmons, & Walker, 1999). Next to the people from the affected community, we explored experts' interpretations of risk and the symbolic dimensions of risk that shape those definitions.

Firstly the interviews revealed that residents' risk perceptions were not necessarily caused by heuristics (cf. the view of some behavioral economists on risk decisions, cf. Tversky & Kahneman, 1974) or a knowledge deficit (cf. the psychometric paradigm, cf. Slovic, Fischhoff, & Lichtenstein, 1977; Slovic, 1987). In addition, residents' risk perceptions cannot be understood as a product of reflexive modernization (cf. Giddens, 1990; Beck, 1992; Beck, Giddens & Lash, 1994). As several people perceived to control the exposure routes (i.e. eating soil particles or vegetables) a distinction was made between the presence of chemicals and physical health risks. Thus, in contrast to Beck's attention for the growth of a risk consciousness in a risk society, the results of this case study point to the presence of a hazard awareness in a contaminated community.

Further, in contrast to Douglas' emphasis on cultural bias and the social construction of risk (Douglas & Wildavsky, 1982; Douglas, 1985), the results suggest that people's risk acceptance did not result from internal rules or a desire to maintain the social cohesion in the neighbourhood. Although several residents acknowledged the presence of chemicals, their collective definition of the situation could be described as 'relatively safe'. The latter definition was a general belief rather than a perception driven by grid and group characteristics. This belief or conviction was embedded in the social contexts of everyday life (Irwin, Simmons, & Walker, 1999). In particular, people questioned the sudden amplification of the risks and referred to the changing political context. In addition, given the chronic and invisible nature of the threat, some experts told that people did not act irrationally by accepting the risks. In sum, it can be concluded that residents' view could be understood as 'social rational beliefs' rather than irrational perceptions or a consequence of cultural bias.

Further, the interviews with the experts have shown that other than scientific motives directly influence the risk assessments and the perceived need for decontamination, and this according to several experts involved with 'the Kouterwijk file'. The disagreements between experts induced a decline in difference to scientific knowledge and provided further support for residents' experience-based knowledge. In other words, the limits of expert-knowledge rather than the cognitive limitations of non-experts enhanced people's already persistent risk disbeliefs.

The results of this study draws the attention to the role of scientific uncertainty on the one hand, and to power-relations in terms of tensions

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between structure and agency on the other hand (i.e. between regulators and their consulted experts on the one hand, and people's physical health and their property on the other hand). Therefore, in the next chapters more attention will be paid to the limits of expert knowledge and the role of public participation (chapter 3 and 5). In addition, as people's primary concerns were not related to the chemicals' risks but to the impact of the excavation on their property and to their feeling of participation, we'll examine in more detail the stressful nature of risk-related *and* symbolic aspects of risk (chapter 4 and 5).

References

- Beck, U. (1992). *Risk society: Towards a new modernity*. London: Sage.
- Beck, U., Giddens, A., & Lash, S. (1994). *Reflexive modernization: Politics, tradition and aesthetics in the modern social order*. Stanford, CA: Stanford University Press.
- Boholm, A. (1996). Risk perception and social anthropology: Critique of cultural theory. *Ethnos*, 61(1-2), 64-84.
- Burch, W. (1976). The peregrine falcon and the urban poor: Some sociological interrelations, in: P. Richerson & J. McEvoy (Eds.), *Human ecology: an environmental approach*. North Scituate: Duxbury.
- Catton, W. & Dunlap, R. (1978). Environmental sociology. A new paradigm. *The American Sociologist*, 13(1), 41-49.
- Catton, W. & Dunlap, R. (1980). A new ecological paradigm for post-exuberant sociology. *American Behavioral Scientist*, 24(1), 15-47.
- Cohen, M. (1997). Risk society and ecological modernisation: alternative visions for post-industrial nations. *Futures*, 29(2), 105-119.
- Couch, S., & Mercuri, E. (2007). Toxic water and the anthill effect: The development of a subculture of distress in a once contaminated community. *Research in Social Problems and Public Policy*, 14, 117-137.
- Douglas, M., & Wildavsky, A. (1982). *Risk and culture*. Berkeley, CA: University of California Press.
- Douglas, M. (1985). *Risk acceptability according to the social sciences*. London: Routledge.
- Frank, D., Hironaka, A., & Schofer, E. (2000). The nation-state and the natural environment over the twentieth century. *American Sociological Review*, 65(1), 96-116.
- Freudenburg, W. (1993). Risk and recreancy: Weber, the division of labor, and the rationality of risk perceptions. *Social Forces*, 71(4), 909-932.
- Furedi, F. (1997). *Culture of fear: risk-taking and the morality of low expectation*. London: Cassell.
- Giddens, A. (1990). *The consequences of modernity*. Cambridge: Polity press.
- Gunter, V., Aronoff, M., & Joel, S. (1999). Toxic contamination and communities: Using an ecological-symbolic perspective to theorize response contingencies. *The Sociological Quarterly*, 40(4), 623-640.
- Hogenboom, J., Mol, A., & Spaargaren, G. (2000). Dealing with environmental risks in reflexive modernity, in: M. Cohen (Ed.), *Risk in the modern age: Social theory, science and environmental decision-making*. London: MacMillan.
- Irwin, A., & Wynne, B. (1996). *Misunderstanding science? The public reconstruction of science and technology*. Cambridge: Cambridge University Press.

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- Irwin, A., Dale, A., & Smith, D. (1996). Science and Hell's kitchen: the local understanding of hazard issues, in: A. Irwin & B. Wynne (Eds.), *Misunderstanding science? The public reconstruction of science and technology*, Cambridge: Cambridge University Press.
- Irwin, A., Simmons, P., & Walker, G. (1999). Faulty environments and risk reasoning: The local understanding of industrial hazards. *Environment and Planning A*, 31, 1311–1326.
- Kraus, N., Malmfors, T., & Slovic, P. (1992). Intuitive toxicology: Expert and lay judgements of chemical risks. *Risk Analysis*, 12(2), 215–232.
- Krimsky, S., & Golding, D. (1992). *Social theories of risk*. London: Praeger.
- Kroll-Smith, J. S., & Couch, S. R. (1991). What is a disaster? An ecological-symbolic approach to resolving the definitional debate. *International Journal of Mass Emergencies and Disasters*, 9(3), 355–366.
- Kroll-Smith, J. S., & Couch, S. R. (1993). Symbols, ecology, and contamination: Case studies in the ecological-symbolic approach to disaster. *Research in Social Problems and Public Policy*, 5, 47–73.
- Lash, S. (2000). Risk culture. In B. Adam, U. Beck, & J. Van Loon (Eds.), *The risk society and beyond: Critical issues for social theory* (pp. 47–62). London: Sage Publications.
- Latour, B. (2003). Is re-modernization occurring—and if so, how to prove it? *Theory, Culture & Society*, 20(2), 35–48.
- Lazo, J. K., Kinnell, J. C., & Fisher, A. (2000). Expert and layperson perceptions of ecosystem risk. *Risk Analysis*, 20(2), 179–193.
- Pidgeon, N., Simmons, P., & Henwood, K. (2006). Risk, environment, and technology, in: P. Taylor-Gooby & J. Zinn (Eds.), *Risk in social science*. Oxford: Oxford University Press.
- Rayner, S. (1992). Cultural theory and risk analysis, in: S. Krimsky & D. Golding (Eds.), *Social theories of risk*. London: Praeger.
- Renn, O. (1992). Concepts of risk: A classification, in: S. Krimsky & D. Golding (Eds.), *Social theories of risk*. London: Praeger.
- Rippl, S. (2002). Cultural theory and risk perception: a proposal for a better measurement. *Journal of Risk Research*, 5, 147-165.
- Scott, A. (2000). Risk society or angst society? Two views of risk, consciousness and community, in: B. Adam, U. Beck, & J. van Loon (Eds.), *The risk society and beyond: Critical issues for social theory*. London: Sage.
- Sjöberg, L. (1997). Explaining risk perception : An empirical evaluation of cultural theory. *Risk Decision and Policy*, 2(2), 113-130.
- Sjöberg, L. (2000). Factors in risk perception. *Risk Analysis*, 20(1), 1–11.
- Sjöberg, L., Peterson, M., Fromm, J., Boholm, A., & Hanson, S. (2005). Neglected and overemphasized risks: The opinion of risk professionals. *Journal of Risk Research*, 8(7-8), 599-616.
- Slovic, P., Fischhoff, B., & Lichtenstein, S. (1980). Facts and fears: Understanding perceived risks. In R. C. Schwing & W. A. Albers (Eds.), *Societal Risk Assessment* (pp. 181–214). New York: Plenum Press.

Chapter 2: Tumbling into the expert-lay gap

- Slovic, P. (1987). Perception of risk. *Science*, 236, 280–285.
- Spaargaren, G., & Mol, A. (1992). Sociology, environment, and modernity. Ecological modernization as a theory of social change. *Society & Natural Resources*, 5(4), 323-344.
- Taylor-Gooby, P., & Zinn, J. O. (2006). Current directions in risk research: New developments in psychology and sociology. *Risk Analysis*, 26(2), 397–411.
- Tulloch, J., & Lupton, D. (2003). *Risk and everyday life*. London: Sage Publications.
- Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: heuristics and biases. *Science*, 185, 1124-1131.
- Wilkinson, (2001). Social theories of risk perception: At once indispensable and insufficient. *Current Sociology*, 49(1), 1-22.
- Wynne, B. (1992). Misunderstood misunderstanding: Social identities and public uptake of science. *Public Understanding of Science*, 1, 281–304.
- Wynne, B. (1996). Misunderstood misunderstandings : Social identities and public uptake of science, in: A. Irwin & B. Wynne (Eds.), *Misunderstanding science? The public reconstruction of science and technology*, Cambridge: Cambridge University Press.
- Zavestoski, S., Mignano, F., & Agnello, K., et al. (2002). Toxicity and complicity: Explaining consensual community response to a chronic technological disaster. *Sociological Quarterly*, 43(3), 385-406.
- Zinn, J. (2008). *Social theories of risk and uncertainty*. Malden: Blackwell Pub.

CHAPTER 3: HAZARD PERCEPTION, RISK PERCEPTION AND THE NEED FOR DECONTAMINATION BY RESIDENTS EXPOSED TO SOIL POLLUTION*

Abstract: This case study examines the hazard and risk perception, and the need for decontamination according to people exposed to soil pollution. Using an ecological-symbolic approach (ESA), a multidisciplinary model is developed that draws upon psychological and sociological perspectives on risk perception and includes ecological variables by using data from experts' risk assessments. The results show that hazard perception is best predicted by objective knowledge, subjective knowledge, estimated knowledge of experts, and the assessed risks. However, experts' risk assessments induce an increase in hazard perception only when residents know the urgency of decontamination. Risk perception is best predicted by trust in the risk management. Additionally, need for decontamination relates to hazard perception, risk perception, estimated knowledge of experts, and thoughts about sustainability. In contrast to the knowledge deficit model, objective and subjective knowledge did not significantly relate to risk perception and need for decontamination. The results suggest that residents can make a distinction between hazards in terms of the seriousness of contamination on the one hand, and human health risks on the other hand. Moreover, next to the importance of social determinants of environmental risk perception, this study shows that the output of experts' risk assessments—or the objective risks—can create a hazard awareness rather than an alarming risk consciousness, despite residents' distrust of scientific knowledge.

Keywords: risk, hazard, soil pollution, ecological-symbolic approach

Introduction

This paper addresses how residents living on chemically polluted soil in a Belgian neighborhood interpret the hazards and risks and to what extent they accept the decision of the Public Waste Agency of Flanders to decontaminate the site. Policymakers and researchers have been studying risk perception and the extent to which laypeople and experts accept a broad spectrum of environmental hazards and technological dangers (Kraus, Malmfors, & Slovic, 1992; Lazo, Kinnell, & Fisher, 2000; Slimak & Dietz, 2006). As a result more interactive

* Vandermoere, F. (2008). Hazard perception, risk perception and the need for decontamination by residents exposed to soil pollution: The role of sustainability and the limits of expert knowledge. *Risk Analysis* (in press).

perspectives on risk communication have been provided and implemented in some local risk disputes (Fischhoff, 1995). Despite these significant efforts, however, a gap remains between decision makers and their regulatory scientists on the one hand, and academic social scientists and laypeople on the other hand (Jasanoff, 1993). In this study we propose that, although some factors needed to bridge this gap are beyond social science's scope - lack of political support, regulatory cultures (cf. Petts & Brooks, 2006) - certain factors do relate to the social-scientific approach to risk itself.

Whereas past research on the cognitive elements influencing variations in risk perception revealed some differences between lay and expert risk estimations, the focus on hypothetical situations does not necessarily generalize to people facing actual environmental dangers on a day-to-day basis (Baxter, Eyles, & Elliott, 1999; Tulloch & Lupton, 2003). In addition, despite the presence of a whole range of social scientific perspectives on risk (cf. Taylor-Gooby & Zinn, 2006), empirical research in which these risk theories are integrated in a real-world case study seems to be scarce. Furthermore, despite the sociological and cultural anthropological perspectives on risk (Wynne, 1992; Lidskog, 1996; Douglas & Wildavsky, 1982), which in our view correctly pointed to the contextual nature of knowledge forms, postmodern variants, which emphasize the constructedness of risk objects next to the social construction of risks (Fox, 1999), are inclined to deflect attention from the dialectical nature of the relations between complex hazards, the public, and experts' stock of knowledge. Therefore, in the next section a framework is developed which allows for the study of i) how people experience environmental risk and hazards in everyday life, ii) how a local environmental risk network consists of social as well as non-social factors, and iii) how these factors relate to each other.

Theoretical context

More than three decades of risk research has suggested several strategies for managing environmental dangers (Renn, 1998) that stem from different conceptual approaches to risk. Several authors, including Otway and Thomas (1982), and Bradbury (1986), identify at least two contrasting concepts of risks: i) the realist approach, which sees risk as a physical reality existing independently of our knowledge of it, and ii) risk as a social construct, with

emphasis on the contrasting definitions about the risks in social reality. The pure realist approach to risk is often characterized by what Sayer (2000) calls "foundationalism," whereby technical risk analysts claim unmediated access to the risk nucleus. Some policymakers have transformed this foundationalism into a knowledge deficit model, wherein the best way to bridge differences in risk definitions is by educating laypeople with the experts' hard facts. The policy implications of the social constructivist approach have been less univocal. On the one hand, post-modern versions (e.g., strong constructivism) that state that risks as well as hazards are socially constructed (Fox, 1999) seem to focus on the description of conflicting claims rather than on strategies for resolving conflict. Co-constructivist (Hannigan) as well as (critical) realist approaches to environmental risks (Murphy, 1997; Dickens, 2004), which presuppose a non-social world as well as the conditionality of all knowledge forms, argument that educating the public is useless or at least not sufficient, calling for alternatives and more dynamic combinations of social and scientific rationalities.

In contrast to heated meta-theoretical debates in the academic world between realist and constructivists, a more pragmatic stance is defended here in terms of looking for the significance of constructivist and realist perspectives in empirical reality. While this stance assumes a realist constructivism on the theoretical side, it adds the necessary differentiation that the importance of "eco-structures" and the social definitions of them on the one hand, and the resulting policy implications on the other hand, is dependent on the significance of the actants embedded in local risk networks (Tulloch & Lupton, 2003; Irwin, Simmons, & Walker, 1999; Latour, 2005).

Therefore, this article proposes an ecological-symbolic approach (ESA) to study how the nature of an event relates to the appraisals people make of that event (Kroll-Smith & Couch, 1991). Kroll-Smith and Couch (1991: 28) argue that "between the individual and the hazard there is a social process set in motion by the particular attributes of the aversive agent itself and symbolic capacities of human agents". The ESA recognizes the impact of material conditions and the biosphere on human cognition and actions, while recognizing the role of human agency as well (Gunter, Aronoff, & Joel, 1999). The ESA aims to resolve the overheated debate between realist and constructivist environmental sociologists by avoiding a relativistic view threatening strong constructivist or post-modern perspectives. It also avoids the deterministic view typical of pure realist

approaches. In addition, by paying attention to the perspectives and experiences of people with regard to changes in their environment, this approach underscores the importance of studying the diversity of public responses across a variety of man-made and environmental disruptions, and allows for a more in-depth analysis of responses within a specific case (Kroll-Smith & Couch, 1993).

Using the ESA to study environmental risk perception requires that we look to the nature of the environmental threat, risk, and hazard perceptions as well as to the cognitive and sociocultural aspects (e.g., cleanup of risks) set in motion after the announcement of contamination in a neighbourhood (Aronoff & Gunter, 1992). First we will examine the relation between the objective risks as assessed by soil experts, and residents' perceptions. Previous studies on the relation between real and perceived risks were analyzed by the challenge response model. It was hypothesized that people are concerned about environmental hazards because they need to cope with 'out there' yet objectively identifiable problems (Inglehart, 1995). The positive relationship between exposure and risk perception is reflected in theories of the *risk society* and in Ulrich Beck's research in particular (Beck, 1992, 1994). It is assumed here that, despite science's lack of social authority, laypeople's risk consciousness of manufactured uncertainties like chemical pollution is a direct outcome of the real nature of risks (Wilkinson, 2001). This is in accord with early studies of Slovic et al. (1980) which illustrate that personal exposure has a positive effect on risk perception and is part of the "dread-factor." While the challenge response model has been tested in hypothetical situations by comparing risks in psychometric studies, less attention has been given to the relations between risk perceptions in a local context and the variation within the risk assessments of the polluted place. We will therefore consider the soil experts' data that inform about the risks for each individual parcel.

Whereas some quantitative studies seem to suggest that non-experts do not discriminate between hazards and human health risks (Kraus, Malmfors, & Slovic), to our knowledge, there is little empirical evidence of this relation in a real-world case study. We will thus examine whether residents' hazards perception in terms of the seriousness of contamination relates to perceived health risk, as well as whether hazards and risk perception relate to need for decontamination. In a study on exposure to heavy metal soil pollution in a Swiss community, Grasmück and Scholz (2005) emphasize the need to study the role

of decontamination as it is linked more closely to inhabitants' willingness to act (Sjöberg, 1999). This is also relevant within the context of risk disputes where the government is the risk regulator rather than the companion of risk-producing industries.

Next, in order to operationalize the symbolic part of the approach, we will try to integrate some determinants which are linked to hypothesis from the psychometric, cultural, and reflexive modernization perspectives of risk perception. First, the psychometric approach assumes a knowledge deficit model because it considers differences between the real risks and lay perceptions to be a consequence of laypeople's lack of knowledge (the "familiarity" factor, see: Slovic, 1987), faulty memory, and an inability to consider the probability of an outcome (Jasanoff, 1998). Therefore, in addition to differences in exposure we'll examine if residents' knowledge about risk assessments induces higher scores on the risk variables. Since previous research has shown that not only objective knowledge but also subjective knowledge can be related to risk perception (Durant & Legge, 2005), we'll examine the impact of self-estimated knowledge.

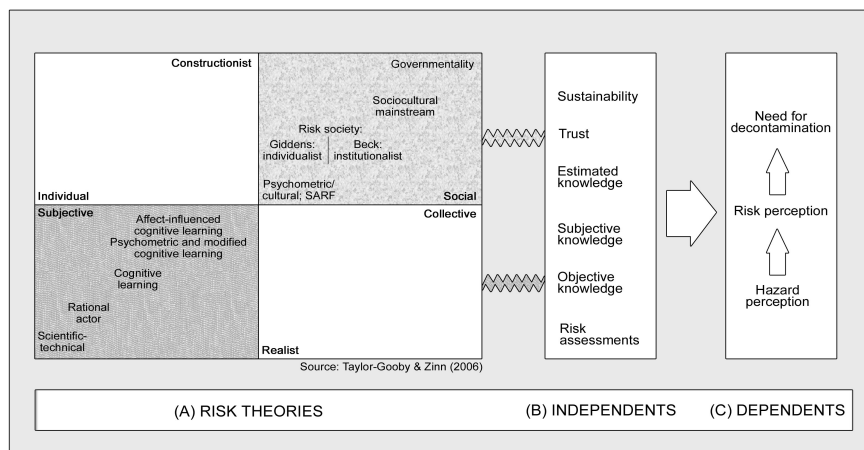
Next, by adding trust variables to the model we'll move from an individual to a more social theoretical level. In contrast to Ulrich Beck (1992), who states that people distrust scientists and experts, Anthony Giddens (1990) posits that trust in experts' systems is a mechanism to reduce complexity. In other words, when a layperson's knowledge is inadequate, according to Giddens, that person will retain his or her ontological security by trusting the experts. We will examine if trust functions as a coping mechanism. In addition, we will examine the role of residents' perception about scientists' and experts' stock of knowledge (Petts & Brooks, 2006; Sjöberg, 2001).

Finally, we introduced a cultural dimension. The cultural perspective on studying risk perception was initiated in the work of Mary Douglas (1985) and Douglas and Wildavsky (1982). In "Risk and Culture" they argue that perceptions of risk are induced by worldviews and myths of nature which can be linked to five ways of life, namely, individualists, egalitarians, hierarchists, fatalists, and hermits. Although this cultural theory holds a high position on theoretical grounds, its value on the empirical level is less promising (Sjöberg, 2000). This reservation is supported by other critiques (Wynne, 1992; Lash, 2000) which state that the cultural theory is too fixed to be useful because a) cultural bias is not unavoidable, b) people's identity consists of a personal identity as well as

several social identities, c) people can use values and beliefs from different forms of social organizations, and d) it is possible that, as time goes by, people can change their beliefs and values.

In response to these critiques, we will assume the cultural theory's less static alternative. Rayner (1992) proposes a more dynamic version that starts from the assumption that cultural theory should be limited to explaining risk perception and behaviour in a particular context. It will be argued here that, following the lead of Knight and Warland (2005), the coupling of a limited number of myths of nature to fixed forms of social organizations should also, perhaps, be set aside in favor of extending consideration to include ideological concepts such as political orientation, religion, and environmental values. As our research involves environmental risk perception, and as previous research has shown the importance of sustainability in cases of exposure to soil pollution (Weber et al., 2001; Grasmück & Scholz, 2005) we will focus on the impact of thoughts about sustainability on risk perception, hazard perception, and need for decontamination.

Figure 1. Risk theories (A) and analytical model (B & C)



To summarize the psychological and sociological approaches to risk, the multi-disciplinary model we used is visualized in Figure 1. It is build on a recent review of Taylor-Gooby and Zinn (2006) on current directions in risk research (see part A). The two axes represent two distinctions as discussed above, that is: the realist/constructivist distinction on the one hand, and the difference between individual and social approaches to risk on the other hand. By moving from the

3rd to the 1st quadrant the continuum goes from 'risks as real and to be studied at the individual level' to 'risks as constructed and to be studied at the group level' (Taylor-Gooby & Zinn, 2006). The model is adapted to the purpose of our case study (part B) by filtering key concepts and independent variables from the scientific-technical theories of risk (i.e. experts' risk assessments), the psychometric approach and the knowledge deficit model (e.g. objective knowledge), the theory of the risk society and reflexive modernization (e.g. trust in the risk management), and cultural theory (i.e. thoughts about sustainability). Finally, in part C, an overview is given of the dependent variables hazard perception, risk perception, and need for decontamination. These can also be positioned on the axis 'realism-constructivism' as they move from 'hazards as real' to the study of secondary problems (e.g., cleanup of risks and need for decontamination) caused by the social construction of risk (Aronoff & Gunter, 1992). In the next section we will give context for the study and describe the methodology.

Methods

The case and study design

The Kouterwijk is a middle-class community, located in the village of Sint-Amands aan-de-Schelde in the southwestern part of the province of Antwerp, Belgium. Since the 1970s, houses have been built on a dumpsite where a tanning and a fertilizer factory performed industrial activities in the preceding decennia. The dumping of waste materials (e.g., superphosphate, Na₂S) during the running of the factories caused soil contamination. During demolition the contamination increased through the spread of factory remnants across the community. This contaminated the soil with both heavy metals (e.g., cadmium, lead, arsenic) and polyaromatic hydrocarbons (e.g., BaP, naphthalene). The Kouterwijk was only the second community decontaminated in Belgium and was the first one with such a heterogeneous distribution of chemicals.

Although this article focuses on quantitative data, the study design of the research project was mixed method (Scholz & Tietje, 2002; Morgan, 1998). First, in order to explore the eco-history of the site we drew on local print media and newsletters, attended meetings for the inhabitants, and held unstructured

conversations with stakeholders. We collected further data from 19 in-depth interviews with the residents before the excavation started. These conversations were recorded, transcribed, and analysed using QSR Nvivo 1.2. Firstly, the interviews were coded on the basis of the main topics of the research project (i.e. risk perception, risk-communication, and site-specific concerns). In a second phase, each topic was coded in more detail on the basis of emergent subthemes (e.g. trust in the risk management). Next to the inclusion of variables relating to current sociological and psychological theories of risk (Taylor-Gooby & Zinn, 2006), the interviews were used as an input to the site-specific measures of the survey instrument.

The questionnaires were collected between September and December 2004. Questionnaires from 109 residents were collected, representing approximately 85% of the community at the household level. The average age was 51.88 (SD = 11.96) and the people in the sample were 42.2% male (see Table 1). 37.5% of the respondents are higher educated and 34.6% have children less than 18 years old. The average duration of residence is 18 years.

Table 1. Sample characteristics

Characteristics	Kouterwijk
% male	42.2
n	109
Mean Age (SD)	51.88 (11.96)
n	107
% Higher educated	37.5
n	104
Mean # years living in area (SD)	18.21 (10.28)
n	108
% households with children	34.6
n	107

The purpose of the research was explained to the residents on one of the public meetings and was communicated in a newsletter of the risk communicator. As the most important decisions (e.g. to decontaminate or not) had already been made at the moment of data collection, it was clarified that, although major problems were reported to the public waste agency, the information provided by the residents would mainly be used to support future decontaminations. For personal problems and specific concerns residents were contacting the risk

communicator and the representatives of the public waste agency. The anonymity of the residents and the confidentiality of the information were ensured.

The questionnaire

Using the software Vlier Humaan ("Vlaams Instrument voor de Evaluatie van Risico's") an independent, expert institution defined three urgency classes: low, moderate, and high (see Appendix for the questionnaire items). Vlier Humaan is accepted by the OVAM as a model for risk evaluation of soil contamination and is embedded in legislation. It is based on publications of the European Centre for Ecotoxicology and Toxicology of Chemicals (ECETOC) and is considered the standard model to assess the 'objective risks'. As we were mainly interested in the differences between the extreme urgency classes low and high, and as we aimed to reduce multicollinearity between the interaction-terms and the main effects, orthogonal contrast coding was used: Assessed risk D1 refers to "moderate urgency versus the average of low and high urgency," and Assessed risk D2 refers to "low versus high urgency."

Need for decontamination was measured by three items (e.g., "If I had the option I wouldn't decontaminate and would leave the parcel in the state as it is"). Scores ranged from 1 (*totally disagree*) to 5 (*totally agree*; $\alpha = 0.814$). Low scores indicated a low perceived need to decontaminate the site. These items related to perceived need for decontamination in general rather than to differences in preference about decontamination strategies (Weber et al., 2001). The use of these items was based on the meanings as derived from the qualitative study on the one hand, and previous, similar research on the risk perception of soil contamination on the other hand (Grasmück & Scholz, 2005).

Further, questioning residents' estimation of the danger for their health on the one hand and the seriousness of the contamination in their soil on the other hand helped measure risk perception and hazard perception. Hazard perception in this study is defined as the perception of the properties or composition, the presence, and the spread of the chemical substances in the soil. In contrast to the perception of these hazards, the perception of health risks could be considered as a hybrid variable as it assumes a pathway between the biophysical agents and the human body. Although these items do not cover the

multidimensionality of human risk perception (cf. Slovic, 1987) or hazard perception, from the in-depth interviews with the residents we learned that these overall holistic judgements were typical for the perception of personal health risks and the presence of hazards, in terms of the seriousness of the contamination as it is irrespective of decisions (Luhmann, 1993). As such, risk perception was measured by questioning "I think that the risk of the pollution in the soil for my health is...". Hazard perception on the other hand, was measured by questioning "I think that the seriousness of the contamination on my parcel is...". Both scores ranged from 1 (*very low*) to 6 (*very high*). The Pearson correlation coefficient between hazard and risk perception was rather low with $r = 0.272$ (see Table 2).

Self-estimated knowledge was measured by four items (e.g., "To what extent do you feel informed about the problem"). Scores ranged from 1 (*I have little knowledge*) to 5 (*I know a lot*). The score shows an adequate internal consistency ($\alpha = 0.797$). Objective knowledge was measured by questioning the decontamination urgency that had been communicated to all the residents. The responses were compared with experts' assessments and thus resulted in a dummy variable with possible answers *true* (1) or *false* (0). Although this clearly does not include all relevant risk information, this dummy variable represents the basic knowledge about the spread of the objective dangers on each resident's parcel as well as the risks these can pose to their health. Further, the estimated knowledge of scientists and experts was measured by asking, "To what extent do you think that scientists and experts already have the available knowledge to assess the risks of soil pollution?" Scores ranged from 1 (*they know very little*) to 6 (*they know a lot*).

Four items were used to measure thoughts about sustainability (e.g., "It is part of our responsibility to leave a clean soil for future generations"). Scores ranged from 1 (*totally disagree*) to 5 (*totally agree*; $\alpha = 0.572$). Finally, two items were used to measure trust in the risk management which correlated with $r = 0.690$ (e.g., "To what extent do you trust the Public Waste Agency"). Scores ranged from 1 (*not at all*) to 5 (*very much*).

In this study the sample size was limited. Other limitations of the present study concern the fact that some site-specific measures were short scales or single-item variables. Notwithstanding that the items of site-specific variables were based on the qualitative study and discussed with the residents' expert who

was in a privileged position in terms of local perspectives on risk and public concerns, and despite the fact that the items from the survey instrument were used in other research (Grasmück & Scholz, 2005) and clarified door-to-door by the researcher, the disadvantages of measuring the site-specific variables by one item or short scales should be acknowledged in terms of limited information on reliability and validity (Van der Pligt & De Vries, 1995). In addition, we should be cautious about a generalized interpretation of the results, as this was only the first social-scientific research assigned by the OVAM in order to understand social responses to living on polluted soil. Further, it is acknowledged that, in developing our multidisciplinary model, we did not include every social theory of risk (e.g. economic theory). Nevertheless, with the results presented here we believe we have obtained a better understanding of the Kouterwijk residents' perceptions of health risks and hazards, and we hope to raise some new issues in the rather unexplored sub-area of the objective and subjective risks of living on chemically polluted soil.

Analysis

After giving an overview of the descriptive statistics and the correlations, we will present the multiple linear regressions we used to examine the determinants of i) how residents perceive the hazards, ii) how they perceive the risks, and iii) how they accept the decision to decontaminate the site. The predictors were selected on the basis of past research and the results of the qualitative study (see Figure 1). As there was no clear decision that could be made about the order in which the variables should be entered, forced entry was chosen as the method of regression. The inclusion of interaction-terms (e.g. experts' risk assessments and residents' risk awareness) was based on theoretical relevance and when preceding analyses indicated their significance. In addition, as none of the socio-demographics had a significant relation with the dependent variables in the initial models, we excluded them in the final models which are presented in the following section. Given the potential relations between the dependent variables hazard and risk perception, the effect of the independent variables on risk perception was examined after it was controlled for hazard perception. Similarly when predicting need for decontamination, hazard and risk perception were included as control variables. Therefore, after entering the exogenous variables

in a first block (see part B, Figure 1), we entered the endogenous variables hazard and risk perception in separate blocks. Data were analysed using SPSS for windows (version 15.0, Chicago: SPSS Inc.).

Results

Descriptive statistics and correlations

When looking more closely at the descriptives and associations (see Table 2), we can see that risk and hazard perception positively correlate with the need for risk mitigation (with, respectively, $r = 0.535$, $p < 0.01$, and $r = 0.461$, $p < 0.01$). The correlation coefficient between risk perception and hazard perception is rather low ($r = 0.272$, $p < 0.01$). Considering the mean and standard deviation of risk and hazard perception, and knowing that the scales ranged from 1 to 6, it is clear that the overall perceptions were low ($M = 2.06$, $SD = 1.26$ for risk perception, and $M = 2.55$, $SD = 1.30$ for hazard perception). In Table 3 we can see that more than 67% of the residents estimated the risks to their health as low to very low; 25% reported that they perceived the risks to be moderate; and only 5.6% reported that they perceived the risks to be high. A similar distribution seems to hold for hazard perception with almost 50% of the residents estimating the seriousness of the pollution to be low or very low. Yet almost as many of the residents perceive the hazards to be moderate (42%). Considering these response percentages together with the moderate association between hazard and risk perception suggests that residents did make a distinction between the presence of chemicals and the risks to their health.

Despite the fact that many residents perceived the hazards and the risks in particular to be low, only 24.1% of the people strongly agreed that, given the option, they would not decontaminate their parcel (see Table 3). There is also a lot of variation in the responses on the other items of "need for decontamination." This underlies the importance of further examination of the indicators of residents' perceived need for decontamination as we are confronted with a situation in which, although several residents perceive the risks for one's health to be rather low to very low, the perceived need for decontamination seems to be highly polarized.

Chapter 3: Hazard perception, risk perception and risk mitigation

Table 2. Descriptive statistics and correlations between variables

	<i>M</i>	<i>SD</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>
1	8.82	3.12	1.00								
2	2.06	1.26	.535**	1.00							
3	2.55	1.30	.461**	.272**	1.00						
4	2.10	0.77	-.034	-.184	.120	1.00					
5	0.34	0.48	.217*	.072	.221*	-.111	1.00				
6	9.13	3.27	-.053	.026	-.115	-.049	.153	1.00			
7	6.39	2.78	.413**	.313**	.101	-.068	-.074	-.039	1.00		
8	3.69	1.49	.444**	.245*	.261*	.018	.015	.151	.440**	1.00	
9	13.83	2.88	.457**	.265**	.198	-.048	.082	.105	.262**	.202*	1.00

NOTE: N = 96. Spearman rho's for correlations with risk assessment; all other correlation measured by Pearson's r. 1 = need for decontamination; 2 = risk perception; 3 = hazard perception; 4 = risk assessment; 5 = objective knowledge; 6 = subjective knowledge; 7 = trust in the risk-management; 8 = estimated knowledge of scientists and experts; 9 = thoughts about sustainability. *p < .05. **p < .01

The extent of objective danger as suggested by the output of experts' risk assessments, did not vary significantly with hazard perception or with residents' need for decontamination or risk perception (see Table 2). Thus, in contrast to what could be expected by the challenge-response hypothesis there was no positive association between the risks assessed by soil experts and the way in which residents perceived the risks and hazards.

Table 3. Response percentages, means (M) and standard deviations (SD) on the items for risk perception, hazard perception and need for decontamination

Variable/Items (N)	M (SD)					
Need for decontamination						
The decontamination of the parcel is useless. (N = 107)						
Disagree strongly	Disagree somewhat	Neutral	Agree somewhat	Agree strongly		
8.4%	33.6%	29%	16.8%	12.1%		M = 2.91 (1.15)
If I had the option I wouldn't decontaminate and would leave the parcel in the state it is. (N = 108)						
Disagree strongly	Disagree somewhat	Neutral	Agree somewhat	Agree strongly		
13%	25%	16.7%	21.3%	24.1%		M = 3.19 (1.39)
The decontamination of my parcel is absolutely necessary. (N = 108)						
Disagree strongly	Disagree somewhat	Neutral	Agree somewhat	Agree strongly		
12%	20.4%	38.9%	22.2%	6.5%		M = 2.91 (1.08)
Risk perception						
I think that the risk of the pollution in the soil for my health is... (N = 108)						
Very low	Low	Moderate to low	Moderate to high	High	Very high	
46.3%	22.2%	18.5%	7.4%	3.7%	1.9%	M = 2.06 (1.26)
Hazard perception						
I think that the seriousness of the contamination on my parcel is... (N = 108)						
Very low	Low	Moderate to low	Moderate to high	High	Very high	
26.9%	22.2%	31.5%	11.1%	5.6%	2.8%	M = 2.55 (1.30)

Although the output of the final risk assessments, accompanied by a letter from the risk communicator, was communicated to the residents, only one third of the residents were aware of the assessed risks. Awareness of assessed risk is

positively associated with need for decontamination ($r = 0.217, p < 0.05$), as well as with hazard perception ($r = 0.221, p < 0.05$) but not with risk perception ($r = 0.072$). Considering residents' awareness of assessed risk as a proxy for actual knowledge, this suggests that an increase in objective knowledge by the residents induces higher perceived hazards and an acknowledgement of the need for decontamination, but does not influence variations in risk perceptions. Except for the latter result, these correlations are in line with the knowledge deficit model. However, the associations are reversed as actual knowledge is positively, rather than negatively, associated with hazard perception and need for decontamination.

In addition, trust in the risk management is positively correlated with the estimated knowledge of scientists and experts ($r = 0.440$), and thoughts about sustainability ($r = 0.262$). In contrast to Giddens' view on the role of trust as a coping mechanism, neither actual knowledge nor self-estimated knowledge was significantly associated with trust in the risk management. Finally, residents' need for decontamination is positively correlated at the 0.01 level with trust in the risk management ($r = 0.413$), with the estimated knowledge of scientists and experts ($r = 0.444$), and with thoughts about sustainability ($r = 0.457$). Similar results are found for hazard and risk perception.

Multivariate regression analysis

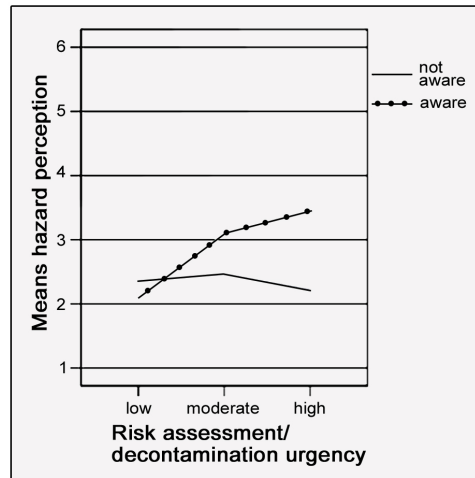
In Table 4 we can see that the assessed risks did not have a significant effect on hazard perception either (model 1). The extent to which the residents estimated the seriousness of the contamination was best predicted by objective knowledge ($\beta = 0.268, p < 0.01$), subjective knowledge ($\beta = -0.206, p < 0.05$), and estimated knowledge of scientists and experts ($\beta = 0.257, p < 0.05$). This means that awareness of assessed risk and a higher degree of self-estimated knowledge bring about higher scores on hazard perception. The latter correlation shows that the perception of experts' stock of knowledge as limited induced lower scores on hazard perception. Objective knowledge significantly interacted with the risk assessments of the experts ($\beta = 0.280, p < 0.05$). In Figure 2 it is shown that the positive association between assessed risk on hazard perception applied only when residents had knowledge about the risk assessment of their parcel. The final variability explained in hazard perception is 19.2%.

Table 4. Summary of multiple linear regression analysis for variables predicting hazard perception

Model	1	2
Predictors	β	β
Assessed risk D1	-0.136	-0.152
Assessed risk D2	0.172	-0.002
Objective knowledge	0.268**	0.259**
Subjective knowledge	-0.206*	-0.227*
Estimated knowledge	0.257*	0.279*
Trust	-0.014	-0.035
Sustainability	0.139	0.167
Objective knowledge - x assessed risk D1		0.077
Objective knowledge - x assessed risk D2		0.280*
F Change (sign.)	3.461(.003)	3.076 (.051)
Adjusted R ² (%)	15.4	19.2

NOTE: $N = 96$; * $p < 0.05$, ** $p < 0.01$

Risk perception is best predicted by the risk assessments ($\beta = -0.259$, $p < 0.01$), and the extent of trust in the risk management ($\beta = 0.248$, $p < 0.05$) (see Table 5, model 1). These associations remain significant when controlling for residents' hazard perception (see model 2). The first effect suggests a kind of unrealistic optimism as people living on a parcel with a high decontamination urgency have a lower average mean score on risk perception ($M = 1.61$; $SD = 0.97$) than residents living on a parcel with a decontamination urgency assessed as low ($M = 2.00$; $SD = 1.10$). Further, in contrast to what could be expected from the literature on reflexive modernization, a lack of trust correlates with low perceived personal health risks (rather than high). We can also see that the effect of hazard perception is rather moderate and borderline significant ($\beta = 0.195$, $p = 0.065$). Consistent with this finding, additional logistic regression analysis revealed that the probability of a moderate or high perceived personal health risks did not covary significantly with hazard perception ($B (SE) = 0.283 (0.229)$, $p = 0.216$). In other words, it can be concluded that if a relationship exists between hazard and risk perception, the effect size is rather weak. The final variability explained in risk perception is 19%.

Figure 2. Hazard perception as a function of assessed risk and objective knowledge

Some reasons can be postulated here in order to interpret the low scores on the perception of personal health risks. First, there were limited visible signals of contamination in the environment. In addition, people had been living in the community for more than twenty years and suddenly there was a problem, although they had never been sick. Some residents had been eating vegetables grown in contaminated soil and no anomalies were found. Indeed because of its chronic nature, the relations between the chemicals and people's physical health could not be substantiated by the experts. Furthermore, residents said that while they acknowledged the seriousness of the contamination in terms of the presence of chemicals, they reasoned that "to be at risk" there had to be exposure routes. As the only relevant exposure routes outlined by an independent, expert institution were "eating vegetables or soil particles," residents felt able to control the exposure routes and the resulting health risks despite recognizing the presence of hazards. In other words, many people's disbelief in the health risks was partially driven by the logic "risk = hazard + exposure." Moreover, several residents questioned the credibility of the final risk assessments since more than half the parcels changed urgency class from the first to the second assessment. As a result, in addition to residents' perceived control of the exposure routes, the differences between the risk assessments resulted in a distrust of the experts' stock of knowledge. In addition, as many residents felt able to control the pathways, they viewed the output of the risk assessments—as indicated by differences in urgency classes—as an indication of

differences in the presence of chemicals rather than differences in personal health risks (Luhmann, 1993).

Table 5. Summary of multiple linear regression analysis for variables predicting risk perception

Model	1	2
Predictors	β	β
Assessed risk D1	-0.259**	-0.233*
Assessed risk D2	-0.096	-0.130
Objective knowledge	0.095	0.042
Subjective knowledge	-0.037	0.004
Estimated knowledge	0.109	0.059
Trust	0.248*	0.251*
Sustainability	0.143	0.116
Hazard perception	-	0.195
F Change (sign.)	3.721(.001)	3.503 (.065)
Adjusted R ² (%)	16.7	19.0

NOTE: N = 96; * $p < 0.05$, ** $p < 0.01$

The risk assessments did not have a significant association with need for decontamination (see Table 6). Objective knowledge has a positive relation with need for decontamination ($\beta = 0.234$, $p < 0.01$) suggesting that an awareness of assessed risk induces a willingness to decontaminate the site. In contrast, subjective knowledge is negatively related to need for decontamination (see Table 6). However the effect of both knowledge-variables - objective and subjective - become non-significant once they are controlled for hazard perception (model 2). This suggests that objective knowledge can produce a hazard awareness rather than an alarming risk consciousness. Further, after it is controlled for hazard and risk perception (model 3), the variable "estimated knowledge of scientists and experts" has a positive correlation with need for decontamination ($\beta = 0.216$, $p < 0.05$) indicating that disavowing the need for decontamination relates to a judgement of experts' stock of knowledge as limited. Trust in the risk management has a positive association with need for decontamination ($\beta = 0.210$, $p < 0.05$) showing that a perceived need to

decontaminate relates to people's trust in the risk management and the decision of the Public Waste Agency to regulate the risks (model 1). However, after it is controlled for risk perception (model 3), the association between trust and need for decontamination becomes non-significant (with $\beta = 0.136$, $p = 0.114$).

Table 6. Summary of multiple linear regression analysis for variables predicting need for decontamination

Model	1	2	3
Predictors	β	β	β
Assessed risk D1	-0.087	-0.049	0.023
Assessed risk D2	-0.001	-0.048	-0.008
Objective knowledge	0.234**	0.160	0.147
Subjective knowledge	-0.167*	-0.111	-0.112
Estimated knowledge	0.305**	0.234*	0.216*
Trust	0.210*	0.214*	0.136
Sustainability	0.329**	0.291**	0.255**
Hazard perception	-	0.275**	0.214*
Risk perception	-	-	0.310**
F Change (sign.)	9,837 (.000)	10,285 (.002)	14,266 (.000)
Adjusted R ² (%)	39.4	45.2	52.5

NOTE: $N = 96$; * $p < 0.05$, ** $p < 0.01$

Thoughts about sustainability is positively related to the need for risk mitigation ($\beta = 0.255$, $p < 0.01$) indicating that residents' willingness to decontaminate the site is brought about by their thoughts on sustainability. Finally, we can see that hazard as well as risk perception correlate positively with residents' perceived need to decontaminate their parcel (with, respectively, $\beta = 0.214$, $p < 0.01$, and $\beta = 0.310$, $p < 0.01$). The VIF scores for hazard and risk perception were 1.327 and 1.348, respectively, (with tolerance scores of 0.754 and 0.742), indicating no problems with multicollinearity. The final variability explained for need for decontamination is 52.5%.

Conclusion and discussion

In this article an ecological-symbolic approach was introduced to study the determinants of hazard and risk perception and the need for risk mitigation by residents exposed to soil pollution. In contrast to theoretical debates on the concept of risk, this meant that attention was paid to how people experience environmental risk and hazards in everyday life, how a local environmental risk network consists of social as well as non-social factors, and how these factors relate to each other.

In contrast to the challenge-response hypothesis the analysis shows that the objective dangers did not relate to people's risk perception and need for decontamination. Only hazard perception was positively related to the risk assessments, provided that people knew the objective danger for their parcel. Hazard perception was only weakly related to risk perception, indicating that laypeople's risk perception developed irrespective of perceived or assessed dangers. In addition, the analysis shows that neither objective knowledge nor subjective knowledge about the risks induced changes in risk perception or need for risk mitigation. These results differ vastly from the knowledge deficit model, which assumes that the best strategy to bridge the expert-lay gap is to increase laypeople's knowledge about risks. Therefore, the use of instrumental rationality, typical for the prevailing knowledge deficit model in decision-making processes⁶, was not enough in the Kouterwijk as an increase in objective knowledge brought about changes in the perception of the seriousness of the contamination, but not in the perception of risk or in residents' demand for risk mitigation.

The results also differ from the literature on reflexive modernization (Giddens, 1992; Beck, 1990). An increase in objective knowledge induced a higher hazard perception, yet, while people seemed to make a distinction between hazards and risks, objective knowledge did not necessarily induce concerns about the risk to their health. In other words, scientific knowledge (i.e. the output of experts' risk assessments) produced a hazard awareness rather than an alarming risk consciousness as suggested by Ulrich Beck. In addition, whereas trust in the risk management was related to risk perception, it seemed to occur apart from residents' knowledge about the risks. In addition, trust and risk perception were positively associated rather than negatively as could be expected by Anthony Giddens' description of trust as a mechanism to reduce

complexity. According to Sjöberg (2001: 189) "the reason for the surprisingly minor importance of trust is that people believe that there are clear limits to how much science and experts know". It could be argued then, that distrusting science, rather trusting experts' systems, operated as a coping mechanism. However, the skewed distribution of risk perception suggested the presence of a 'collective risk-disbelief' (Borhek & Curtis, 1975; Kroll-Smith & Couch, 1991, 1993). According to the residents, there were no fears that needed to be reduced as long as scientists and experts did not have sufficient knowledge to substantiate the health risks rather than the presence of chemicals. We therefore suggest that future research examine not only whether trust operates as a coping mechanism when actual or self-estimated knowledge is low (Giddens, 1990), but also whether distrusting science can result from people's agency in terms of the danger/risk distinction on the one hand, and from a self-serving attitude in terms of a perceived imbalance between the benefits and the costs of the government's decision to regulate environmental risks on the other hand.

Finally, although most of the residents perceived the risks to their health as low, their perceived need for decontamination seemed to be highly polarized. Attitude toward risk mitigation was positively related to hazard and risk perception, which is in accord with other studies, for example, Grasmück and Scholz (2005). Moreover, in line with the mobile version of cultural theory, the need for risk mitigation was positively related to thoughts about sustainability and to the estimated knowledge of scientists. Given the persistent nature of residents' risk perception, the impact of these social variables and the symbolic aspects of risk come to the fore. Moreover, as need for decontamination, in comparison to risk perception or hazard perception, is linked more closely to residents' willingness to act (Grasmück & Scholz, 2005) we suggest that the still prevalent knowledge deficit model in environmental decision making and its efforts to retrain the lay public should be replaced by more deliberative methods that can cope with the principles of sustainability and the limits of expert knowledge.

APPENDIX

Questionnaire items

Variable/Question	Type
Assessed risk	
1. Output of soil experts' risk assessments (low/moderate/high)	categorical
Objective knowledge	
1. Are residents aware of the assessed risk? (no/yes)	categorical
Subjective knowledge	
1. To what extent do you feel informed about the problem of soil pollution? (not at all/very much)	5-point scale
2. To what extent do you feel informed about the problem in comparison with other residents? (less informed/better informed)	5-point scale
3. To what extent do you feel informed about the previous industrial activities on the site? (not at all/very much)	5-point scale
4. To what extent do you feel informed about the previous industrial activities on the site in comparison with other residents? (less informed/better informed)	5-point scale
Estimated knowledge of scientists and experts	
1. To what extent do you think that scientists and experts already have the available knowledge to assess the risks of soil pollution? (they know very little/they know a lot)	6-point scale
Trust in the risk management	
1. To what extent do you trust the Public Waste Agency? (not at all/very much)	5-point scale
2. To what extent do you trust institution X, responsible for communicating about the risk mitigation?	5-point scale
Thoughts about sustainability	
1. It is part of our responsibility to leave a clean soil for future generations. (strongly agree/strongly disagree)	5-point scale
2. I feel concerned about the future when I think about environmental problems.	5-point scale
3. My contribution to the mitigation of environmental pollution doesn't make a difference.	5-point scale
4. All that talking about environmental problems makes people to worry needlessly.	5-point scale
Risk measures	
1. I think that the seriousness of the contamination on my parcel is... (very low/very high)	6-point scale
2. I think that the risk of the pollution in the soil for my health is... (very low/very high)	6-point scale
Need for decontamination	
1. The decontamination of the parcel is useless.	5-point scale
2. If I had the option I wouldn't decontaminate and would leave the parcel in the state as it is.	5-point scale
3. The decontamination of my parcel is absolutely necessary.	5-point scale

References

- Aronoff, M., & Gunter, V. (1992). Defining disaster: Local constructions for recovery in the aftermath of chemical contamination. *Social Problems, 39*(4), 345–365.
- Baxter, J., Eyles, J., & Elliott, S. (1999). Something happened: The relevance of the risk society for describing the siting process for a municipal landfill. *Geografiska Annaler, 81*, 91–109.
- Beck, U. (1992). *Risk society: Towards a new modernity*. London: Sage.
- Beck, U. (1994). The reinvention of politics: Towards a theory of reflexive modernization. In U. Beck, A. Giddens, & S. Lash (Eds.), *Reflexive modernization: Politics, tradition and aesthetics in the modern social order*. Stanford, CA: Stanford University Press.
- Borhek, J. T., & Curtis, R. F. (1975). *A sociology of belief*. New York: John Wiley and Sons.
- Bradbury, J. A. (1989). The policy implications of differing concepts of risk. *Science, Technology, & Human Values, 14*(4), 380–399.
- Dickens, P. (2004). *Society & nature. Changing our environment, changing ourselves*. Cambridge, UK: Polity Press.
- Durant, R. F., & Legge, J. S. (2005). Public opinion, risk perceptions, and genetically modified food regulatory policy. *European Union Politics, 6*(2), 181–200.
- Douglas, M., & Wildavsky, A. (1982). *Risk and culture*. Berkeley, CA: University of California Press.
- Douglas, M. (1985). *Risk acceptability according to the social sciences*. London: Routledge & Kegan Paul.
- Fischhoff, B. (1995). Risk perception and communication unplugged: Twenty years of process. *Risk Analysis, 15*(15), 137–145.
- Fox, N. (1999). Postmodern reflections of risk, hazards and life choices. In D. Lupton (Ed.), *Risk and sociocultural theory. New directions and perspectives* (pp.12–33). Cambridge: Cambridge University Press.
- Giddens, A. (1990). *The consequences of modernity*. Cambridge: Polity.
- Grasmück, D., & Scholz, R. W. (2005). Risk perception of heavy metal soil contamination by high-exposed and low-exposed inhabitants: The role of knowledge and emotional concerns. *Risk Analysis, 25*(3), 611–622.
- Gunter, V. J., Aronoff, M., & Joel, S. (1999). Toxic contamination and communities: Using an ecological-symbolic perspective to theorize response contingencies. *The Sociological Quarterly, 40*(4), 623–640.
- Hannigan, J. (2006). *Environmental sociology* (2nd ed.). London: Routledge.
- Inglehart, R. (1995). Public support for environmental protection: Objective problems and subjective values in 43 societies. *Political Science and Politics, 28*(1), 57–72.
- Irwin, A., Simmons, P., & Walker, G. (1999). Faulty environments and risk reasoning: The local understanding of industrial hazards. *Environment and Planning A, 31*, 1311–1326.

Chapter 3: Hazard perception, risk perception and risk mitigation

- Jasanoff, S. (1993). Bridging the two cultures of risk analysis [Guest editorial]. *Risk Analysis*, 13(2), 123–129.
- Jasanoff, S. (1998). The political science of risk perception. *Reliability Engineering and System Safety*, 59, 91–99.
- Knight, A. J., & Warland, R. (2005). Determinants of food safety risks: A multi-disciplinary approach. *Rural Sociology*, 70(2), 253–275.
- Kraus, N., Malmfors, T., & Slovic, P. (1992). Intuitive toxicology: Expert and lay judgements of chemical risks. *Risk Analysis*, 12(2), 215–232.
- Kroll-Smith, J. S., & Couch, S. R. (1991). What is a disaster? An ecological-symbolic approach to resolving the definitional debate. *International Journal of Mass Emergencies and Disasters*, 9(3), 355–366.
- Kroll-Smith, J. S., & Couch, S. R. (1993). Symbols, ecology, and contamination: Case studies in the ecological-symbolic approach to disaster. *Research in Social Problems and Public Policy*, 5, 47–73.
- Lash, S. (2000). Risk culture. In B. Adam, U. Beck, & J. Van Loon (Eds.), *The risk society and beyond: Critical issues for social theory* (pp. 47–62). London: Sage Publications.
- Latour, B. (2005). *Reassembling the social. An introduction to actor-network theory*. Oxford: Oxford University Press.
- Lazo, J. K., Kinnell, J. C., & Fisher, A. (2000). Expert and layperson perceptions of ecosystem risk. *Risk Analysis*, 20(2), 179–193.
- Lidskog, R. (1996). In science we trust? On the relation between scientific knowledge, risk consciousness and public trust. *Acta Sociologica*, 39, 31–56.
- Luhmann, N. (1993). *Risk: A sociological theory*. Berlin, New York: Walter de Gruyter.
- Morgan, D. L. (1998). Practical strategies for combining qualitative and quantitative methods: Applications to health research. *Qualitative Health Research*, 8(3), 362–376.
- Murphy, R. (1997). *Sociology and nature. Social action in context*. Oxford: West View Press.
- Otway, H. J., & Thomas, K. (1982). Reflections on risk perception and policy. *Risk Analysis*, 2, 69–82.
- Petts, J., & Brooks, C. (2006). Expert conceptualisations of the role of lay knowledge in environmental decision-making: Challenges for deliberative democracy. *Environment and Planning A*, 38, 1045–1059.
- Rayner, S. (1992). Cultural theory and risk analysis. In S. Krimsky & D. Golding (Eds.), *Social theories of risk* (pp. 275–297). London: Praeger.
- Renn, O. (1998). Three decades of risk research: Accomplishments and new challenges. *Journal of Risk Research*, 1(1), 49–71.
- Sayer, A. (2000). *Realism and social science*. London: Sage Publications.
- Scholz, R. W., & Tietje, O. (2002). *Embedded case study methods. Integrating quantitative and qualitative knowledge*. London: Sage Publications Ltd.

Chapter 3: Hazard perception, risk perception and risk mitigation

- Sjöberg, L. (1999). Consequences of perceived risk: Demand for mitigation. *Journal of Risk Research*, 2 (2), 129–149.
- Sjöberg, L. (2000). Factors in risk perception. *Risk Analysis*, 20(1), 1–11.
- Sjöberg, L. (2001). The limits of knowledge and the limited importance of trust. *Risk Analysis*, 21(1), 189–198.
- Slimak, M. W., & Dietz, T. (2006). Personal values, beliefs, and ecological risk perception. *Risk Analysis*, 26(6), 1689–1705.
- Slovic, P., Fischhoff, B., & Lichtenstein, S. (1980). Facts and fears: Understanding perceived risks. In R. C. Schwing & W. A. Albers (Eds.), *Societal Risk Assessment* (pp. 181–214). New York: Plenum Press.
- Slovic, P. (1987). Perception of risk. *Science*, 236, 280–285.
- Tulloch, J., & Lupton, D. (2003). *Risk and everyday life* (pg. 141). London: Sage Publications.
- Taylor-Gooby, P., & Zinn, J. O. (2006). Current directions in risk research: New developments in psychology and sociology. *Risk Analysis*, 26(2), 397–411.
- Van der Pligt, J., & De Vries, N. K. (1995). *Opinies en attitudes. Meting, modellen en theorie*. Amsterdam: Boom.
- Weber, O., Scholz, R.W., Bühlmann, R., & Grasmück, D., (2001). Risk perception of heavy metal soil contamination and attitudes toward decontamination strategies. *Risk Analysis*, 21(5), 967–976.
- Wilkinson, I. (2001). *Anxiety in a risk society*. London: Routledge.
- Wynne, B. (1992). Misunderstood misunderstanding: Social identities and public uptake of science. *Public Understanding of Science*, 1, 281–304.

CHAPTER 4: THE PROCESS OF SOIL EXCAVATION IN A COMMUNITY: SITE-SPECIFIC DETERMINANTS OF STRESS PERCEPTION*

Abstract: This study examines the psychosocial impact of the process of soil excavation in a Belgian community after the initial responses to the announcement of the contamination. Qualitative and quantitative data are connected to predict the stress experience of the residents. Halfway through the excavation of the community, structured questionnaires were collected ($N = 98$) that included questions about stressors related to the risks of the physical environment as well as to the process of soil excavation. The results show that neither risk assessments nor risk perceptions about the contaminated sources significantly contribute to the explanation of variance. The stress perception is best predicted by the need for additional information about the risks, the decontamination stage, and the extent of site-specific concerns. However, concerns related to the process of soil excavation seemed to have an effect on the experience of stress only if inhabitants had started with the recovery of the excavation.

Keywords: soil pollution, excavation, stress perception, subjective and objective aspects of risk

Introduction

Humans increasingly confront the noxious consequences of the chemical revolution of the 20th century, manifested by new technological and environmental dangers (e.g., air, soil, and groundwater contamination). Beyond research on the physical impact of exposure to contamination (e.g., Poels & Veerkamp, 1992; Pukkala & Pönka, 2001; Vrijheid, 2000; Rushton, 2003; Jarup et al., 2002), research on the psychosocial impact of contamination incidents has identified that these relatively new socioenvironmental problems generate changes in individual and community well-being (see Edelstein, 1988; McGee, 1999).

A number of case studies have revealed the stressful nature of chronic technological disasters (CTDs), such as living on polluted soil or close to a toxic waste site, as stress results from ambiguities about the often invisible physical agents (e.g., the concentration, diversity, and distribution of chemicals in the soil) as well as proposed solutions to mitigate the noxious consequences of these

* Vandermoere, F. (2006). The process of soil excavation in a community: Site-specific determinants of stress perception. *Environment and Behavior*, 38(5), 715-739.

black boxes (e.g., phyto-remediation, soil excavation) (Edelstein, 1988; Vyner, 1988; Preston, Taylor & Hodge, 1983). Concrete policy actions to manage these modern risks depend increasingly on the knowledge, technologies, and models that engineers, scientists, and other experts use (see also Beck, 1992; Douglas & Wildavsky, 1983; Giddens, 1990; Pollack, 2005). Even once the agents are assessed or, better, estimated as accurately as possible, further problems with transformation of the natural and built environment, risk communication, governmental interventions, judicial decisions about community matters, and so forth can add stress reactions (see also Aronoff & Gunter, 1992; Edelstein & Wandersman, 1987; Markovitz & Gutterman, 1985).

The sneaking accumulation of microstressors related to the hazardous event and the physical agents (also stress-e, Quarantelli, as cited in Hartsough, 1985), as well as to the social responses they can provoke (stress-r), defines Vyner's (1988) metaphor that "adapting to an invisible exposure is a toxic process" (p.195). While most of the research has identified the psychosocial effects of contamination incidents by addressing general determinants of objective stress (e.g., general health status predicting somatic complaints or anxiety) through comparing a contaminated community with an uncontaminated area as a control group, relatively few studies have addressed the effects of site-specific determinants of subjective stress. This results in a lack of site-specific strategies to temper psychosocial effects (see also Wakefield & Elliot, 2000; Becker, 1997), leading to questions about the practicability of current social-scientific models and results for concrete policy actions.

Using a victim-focused approach, this paper aims to assess the stressors related to soil excavation in the Kouterwijk, a contaminated community in Belgium, as well as to the environment's physical risks. Therefore, in addition to identifying the potential effect of actual and perceived contamination on subjective stress, this study focuses on the effects of site-related concerns and the decontamination stage on the experience of stress and assesses the impact on psychological distress from the perceived lack of information about the chemicals' risks. Before detailing the current research on the modeling and understanding of psychosocial impacts of contamination incidents, an overview will give context for the study.

The eco-history of the Kouterwijk

The Kouterwijk is a middle-class community of about 100 households spread over 10 streets, located in the village of Sint-Amands aan-de-Schelde in the southwestern part of the province of Antwerp, Belgium. This small village is among other things known for its restful natural setting, conveniently situated to bicycle rides and promenades along the river de Schelde, its natural boundary. Within or close to the community are one supermarket, a post office, a sports center with two soccer fields, and one tavern. The allotment started during the 1970s, built on a dump site where two factories performed industrial activities in the preceding decennia. At the end of the 19th century, permission was given to run a tannery. Fifty years later, the first complaints were registered regarding the draining of wastewater consisting of NaS and calcareous salts emanating from the depilatory processing of pelts, and the draining of rinse and wastewater from the paintbrush department. In 1956-1966, the tannery quit these activities. A second factory opened in 1907. Permission was given to produce superphosphate and sulfuric acid, the latter being estimated at 20,000 tons a year. The first complaints were noted during the 1930s. Subsequent complaints resulted in the council of mayor and aldermen issuing an unfavorable recommendation during the 1960s. The company was sold to a demolition firm, followed shortly by the start of the allotment.

Although to some extent disputable and uncertain, the causes of the contamination are generally assumed to be twofold (see the descriptive soil research report by Gerling Consulting Group Europe nv, 1999). In addition to the negligent dumping of waste materials during the running of the two factories, the contamination of the soil increased through the spread of debris, installations, and other factory remnants all over the community during demolition. This transformed the soil into an "invisible chemical cocktail" consisting of both heavy metals (e.g., cadmium, lead, arsenic) and polyaromatic hydrocarbons (e.g., benzo(a)pyrene [BaP], naphthalene).

The rise of a socioenvironmental problem

Thirty years after the parcellation started, in September 1998, the radio, the local government, and the Public Waste Agency of Flanders (OVAM) informed the

inhabitants about the contamination of the soil in their residential area (see Figure 1 for a chronology of the major events). Local and national newspaper coverage followed shortly. The sudden amplification of these environmental risks was caused by a soil analysis performed on request by a local inhabitant working on the conveyance of a house, as laid down in the decrees of 1995 and 1998 concerning soil contamination. Consequently, the OVAM organized a first meeting to give a global overview of the potential physical health risks of the contaminated soil and to give some recommendations: Every contact with the soil needed to be avoided, and inhabitants were advised to stop eating vegetables from their gardens.

Figure 1. Chronology of the major events

<p><u>1900s-1965</u>: Industrial activities.</p> <p><u>1970s</u>: Demolition of the plants followed by the start of the allotment.</p> <p><u>1995</u>: The Flemish government ratifies a decree concerning soil remediation. This decree contains some key issues that reveal new ways to handle the issue. It explains the differences between historical and new soil pollution, and between obligation and liability for remediation. Also outlined are the register of polluted soil and the necessity of a soil certificate in case of conveyance of land property.</p> <p><u>1998</u>: According to the decree, a private person orders a soil analysis. These results, which indicate pollution of the soil, reach the Public Waste Agency of Flanders (OVAM).</p> <p><u>Late 1998</u>: The local government and the OVAM inform inhabitants about the situation. The OVAM organizes a first meeting to give a global overview of the potential health risks as well as some recommendations.</p> <p><u>1999 February</u>: The inhabitants hear the results of a first risk assessment. To give an exclusion about the precise spread of the contamination, a second assessment is assigned.</p> <p><u>1999 December</u>: The inhabitants hear the results of the second assessment.</p> <p><u>2000 June</u>: The inhabitants are officially discharged of the remediation costs.</p> <p><u>2000 August</u>: Additional experts are appointed. A first expert must outline the plan for the remediation, and a second independent expert is responsible for the communication between the inhabitants and the OVAM.</p> <p><u>2001</u>: Incidental difficulties are detected concerning the proposed decontamination strategy. Finally, excavation is chosen.</p> <p><u>2002</u>: Additional assignments focus on the detection of subterranean structures, and the value of several properties are estimated.</p> <p><u>2003</u>: The results of the extra assessments are provided. The community will be excavated in two parts. One part will be excavated in 2004, the second in 2005.</p>
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In February 1999, inhabitants received the results of the first risk assessments. From the 150 parcels investigated, 127 posed a strong indication of a serious threat. A second assessment presented an exclusion boundary for the precise spread of the contamination. At the end of 1999, the inhabitants received these results. A letter exempting the inhabitants from the duty to decontaminate and the financial consequences involved included the juridical obligations and a personal fiche with the results of the risk assessments for each individual parcel.

In June 2000, the inhabitants were officially discharged of the remediation costs. Next, several experts were assigned. A first expert outlined the plan for the remediation, and a second independent expert was responsible for communicating between the inhabitants and the OVAM. Additional borings in the following two years assessed the severity of the chemicals, and supplementary assignments detected subterranean structures. Excavation was chosen as the decontamination strategy, and the value of several properties was estimated (e.g., trees, plants, flowers, garden houses). Another meeting for the inhabitants took place in 2003, where they learned the results of the extra assessments. Ghent University was appointed to carry out the sociological research, and representatives explained to the inhabitants at this meeting the purpose of the research. The OVAM announced that the community would be excavated in two parts, one part in 2004, the second part in 2005.

Modelling & understanding the psychosocial impact of contamination incidents in a community context

While initial interest about contamination incidents focused on physical health effects (e.g., cancer, asthma, birth defects), over the past several years social scientists—mainly environmental psychologists and sociologists—have noted psychological distress (see e.g., Baum, Fleming, & Singer, 1983; Havenaar et al., 1996, 1997; Kovalchick et al., 2002; Lima, 2004). The next paragraphs summarize the current literature on the modeling and understanding of the psychosocial impact of living on polluted soil or close to toxic waste.

Living on polluted soil

In comparison with studies on the stress effects of technological disasters like nuclear and gas-release accidents, the subarea of research on the psychosocial

impact of living on polluted soil and the decontamination process is rather bare (see also Matthies, Höger, & Guski, 2000). In addition to their explorative status, most of these studies are North American-centered as they refer predominantly to Love Canal, a chemically contaminated community in New York. Stone and Levine (1985) noted that residents indicated mental well-being, in addition to physical effects, as a concern, as well as property damage and financial loss. Levine (1982) and Gibbs (1983) noted the stress of the situation, induced among other things by uncertainties about the distribution and potential health impacts of the chemicals.

On the subject of uncertainties, Weterings and Van Eijndhoven (1989) compared the communication of risk information in three contaminated communities in the Netherlands. Following Wynne (1987, 1992a,b), they emphasized communicating the different interpretations of residents, experts, and authorities and showed how the public's definition of "safe" and "risk" related to the institutional context and background of the stakeholders.

Matthies, Höger, and Guski (2000) studied stress reactions from housing built on soil contaminated by a coking plant in Dortmund-Dorstfeld, Germany. People on polluted soil reported significantly more stress than a control group in an uncontaminated area. The investigation suggested the chronic nature of the stress, as the data were collected 9 years after discovery of the contaminants, when decontamination had just occurred. These results reflect Kroll-Smith and Couch's (1991) ecological-symbolic approach, that is, the need to investigate both the nature of an event and the appraisals people make of that event. This study assumes that approach by assessing the effect on stress of both the risk assessment of the chemicals by soil experts and the residents' risk perceptions.

Living close to a waste site or a toxic waste-producing facility

Research on the psychosocial impacts in communities near waste facilities often draws on psychological theories—cognitive stress models in general, or environmental stress theory in particular. Following Lazarus's ideas on social stress (1966), Baum et al. (1985) defined environmental stress as "a process by which environmental events threaten ... an organism's existence ... and by which an organism responds to this threat" (p. 186). These responses on the one hand, and the contaminated sources, individual, social network, and wider community

on the other hand, can influence each other, resulting in psychological distress (see Taylor et al., 1991). Taylor et al. initiated using this theory to model the psychosocial effects of toxic exposure. Elliot et al. (1997) defined negative psychosocial impacts of environmental contamination as "as a consequence of actual *or perceived* environmental contamination" (p.230). The italics of "or perceived" emphasize that the impacts of perceived contamination are as "real" as the impacts of actual contamination (Elliot, 1993).

Besides descriptive studies (e.g., Barnes et al., 2002; Baxter, Eyles, & Willms, 1992; McGee, 1999; Wakefield & Elliot, 2000), linear models helped launch the idea (e.g., Crighton et al., 2003; Dunn et al., 1994; Elliot et al., 1993), but the literature reveals ambiguities. Without questioning studies' benefits, we want to deal with methodological problems.

First, the impacts of contamination on stress are, in most cases, assessed by comparing a contaminated with uncontaminated area. The ecological variables also lack data. This excludes the potential variation within the risk assessments of the polluted place. Further, due to the limited sample size of most case studies, statistically assessing the impact of the wider community system and the social network is difficult. Consequently, most of these studies underscore the role of the cognitive representation of the situation without accounting for the institutional background within which individuals define the situation.

Next, most models differ on the a priori assumptions of the social scientist to consider the dependent variable as a situational (e.g., site-specific concerns, site-related actions) or as a dispositional (e.g., subjective changes in general physical and subjective health) construct. Models with site-specific independent variables are rare, and although Elliot et al. (1993) argued for general health status as a mediator of site-specific effects, they acknowledged the possibility that, inversely, site-specific effects could mediate general health status.

Another methodological ambiguity concerns the relation between measures of perceived changes in objective stress (e.g., self-reported stress symptoms) and subjective stress (e.g., global stress). The latter, by logical deduction, is usually considered an antecedent of the first. However, little is known about the indicators that influence the experience of stress. Moreover, considering the dependent variable as a situational measure, this results in (a) a lack of understanding of site-related concerns' effect on subjective stress and (b)

a deficiency of site-specific strategies to temper psychosocial effects (see also Elliot et al., 1993; Becker, 1997).

A tentative conclusion, parallel to the problems engineers and policy workers face in assessing and communicating characteristics of biophysical agents and physical health effects, is there seems an empirical ambiguity at least as much concerning the complexity of psychosocial impacts these 'new species of trouble' (see Erikson, 1991, for this term) generate for social scientists. This study contributes to an understanding of this complexity by measuring the major site-specific determinants of stress perception.

Besides the dependent measure stress perception, the model consists of three sets of variables: (a) control (sex, age, socioeconomic status [SES]); (b) physical properties of contaminants, subdivided by experts' assessments and the public's perceptions; and (c) those related to soil decontamination. These include stressors from a lack of information about contamination risk as well as site-specific hassles due to excavation. We also considered stress caused by redevelopment, specific to soil contamination (see Matthies et al., 2000). To summarize, this paper seeks to measure the effects on the experience of global stress of the (a) characteristics of contaminated sources, (b) risk perception of chemicals, (c) site-related concerns, (d) decontamination stage, and (e) perceived lack of risk information.

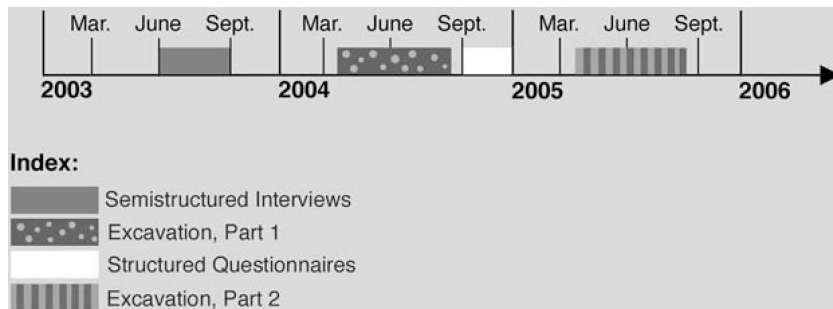
Methodology

Study design and participants

A cross-sectional design fit the study's victim-focused approach. Comparable to the study of Michael Edelstein on groundwater contamination in Legler (1988), we paid attention to the diversity of site-specific experiences of the affected population, rather than looking for differences from an uncontaminated community as a control group. We collected data from different sources—both qualitative and quantitative—at different points in time. To explore the eco-history of the site, we drew upon local print media and newsletters, attended meetings for the inhabitants, and held unstructured conversations with stakeholders (engineers, local politicians, constructors, and social workers). We

collected further data from 19 semistructured interviews with the residents before the excavation started (see Figure 2).

Figure 2. Decontamination phases and moments of data collection



Subsequently, we collected structured questionnaires from 98 residents, representing approximately 75% of the community at the household level. To address the impact of the decontamination phase, we collected the questionnaires halfway through the excavation of the community. One part of the soil in the community had undergone excavation (postimpact), and the second part would be decontaminated the following year (preimpact; see also Figure 2). Inhabitants in the preimpact phase did not have significantly more men or women and had no significantly higher educated people, but did have fewer older-aged inhabitants than did residents from the postimpact phase (see Table 1). As it is very plausible that these sociodemographic characteristics influence the experience of stress, we used hierarchical regression. We considered the variables age, sex, and SES as explanatory variables, as well as control variables for the other independent measures described below.

Table 1. Description of sample by pre- and post-decontamination phase

Variable	Category	Pre (<i>N</i> =43)	Post (<i>N</i> =55)	Difference
Sex	Male	41.9%	45.5%	$\chi^2(1) = 0.127; p = 0.722$
Age	<i>M</i>	47.77	52.89	$t(2.208); p = 0.030^*$
	<i>SD</i>	11.31	11.47	
Education	<i>M</i>	8.21	6.96	$t(-1.809); p = 0.074$
	<i>SD</i>	2.83	3.76	

* $p < 0.05$

Measures

Dependent variable. We assessed stress perception using the 12 items of the perceived stress scale (PSS) (Cohen, Kamarck, & Mermelstein, 1983). The PSS is a subjective measure of stress. According to Cohen et al., this means that, as opposed to objective measures, it acknowledges that people interact with their environment and can appraise potential stressful situations. The PSS can be used as an outcome variable and has been recommended for community surveys (Cohen & Williamson, 1988). It includes items such as, "In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?" Answers were given in a 5-point Likert scale (1 = never, 5 = very often). The sample's internal consistency was very acceptable ($\alpha = 0.921$).

Independent variables. To analyze the role of sociodemographic characteristics, we first measured SES by education level ranging from 1 (*elementary education*) to 12 (*academic education*). The mean was 7.51 (see also Table 3). We assessed age by a continuous variable ranging from 22 to 79 years old. The average age was 51. We analyzed sex by a dummy variable with 0 referring to *female* and 1 to *male*. The people in the sample were 44% male.

Soil experts produced *risk assessments* by measuring the critical values of the contaminants (e.g., cadmium, arsenic, lead, BaP), taking into account the potential exposure routes for each pollutant (e.g., the use of vegetables, ingesting of soil particles). We did not include information about potential health effects because no specific data regarding health risks for the affected population were collected. With the collected data on the characteristics of the contaminated sources and their exposure routes as input, and with the software Vlier Humaan as a tool, soil experts defined three urgency classes: low, moderate, and high. These categories were analyzed using contrast coding: D1 refers to "high versus low urgency," and D2 refers to "low versus moderate urgency."

We assessed *risk perception* by using a compound measure of four items: estimated danger for physical health and for the fertility of the soil, in each case subdivided by the estimated danger for oneself and for others in the community (e.g., "I think that the danger of the pollutants in the soil on my health is..."). Answers ranged from 1 (*very low*) to 6 (*very high*). The score shows an adequate internal consistency ($\alpha = 0.830$).

Perceived lack of information about the risks was measured by questioning, "To what extent do you need more information about the risks of the contaminated sources?" Scores ranged from 1 (*not at all*) to 6 (*much more*).

Decontamination phase is an independent measure and was assessed by using a dummy variable with 0 referring to inhabitants from the postimpact phase, that is, where the parcels were already excavated, and 1 referring to the residents from the preimpact phase, that is, where the parcels still needed to be decontaminated.

Site-specific concerns were based on the discomforts registered by the semistructured interviews of the qualitative study. Based on 19 semistructured interviews with the inhabitants, nine major site-specific stressors were registered, including such items as violation of privacy, reliability of the excavation, and financial responsibility in the long term.

Next, a structured questionnaire measured the extent to which inhabitants were concerned about these stressors, with answers ranging from 1 (*never*) to 5 (*very often*). To assess the potential underlying dimensions, we performed an exploratory factor analysis using varimax as a rotation method. A scree test suggested retaining two factors. Following Kaiser's criterion (1960), we retained only factors with eigenvalues greater than 1. The eigenvalues and percentage of variance explained for the two factors were 4.972 (55.25%) and 1.229 (13.65%) (see Table 2).

The first factor referred to concerns over the short-term impact of the soil excavation on the natural and built environment ($\alpha = 0.874$). These discomforts included items such as *violation of privacy* and *the changing view of the environment*. Soil excavation as a decontamination method in the Kouterwijk not only entailed the excavation of the soil but also required the replacement of plants and flowers, garden houses, common walls, footpaths, drives, and so forth. This process therefore brought forth a serious and abrupt transformation of the environment, and the first factor dealt with the concerns about these stressors.

The second factor referred to stressors situated in the long term like *financial responsibility*, such as: Who is liable for cracks in walls or elements of damage to the houses or gardens that appear in the future but could be attributed to the excavation? Another example is *conveyance of the parcels*, that is, potential uncertainties about the future juridical state of the parcels—as, for

example, the inhabitants must carry out a new soil analysis to transfer ownership ($\alpha = 0.853$). These items were rather “hard” in comparison with the first factor, where the items referred more to the esthetical characteristics of the environment.

Table 2. Site-specific concerns: items and subscale factor loadings

	Factor loading	
	1	2
Changing view of the environment	0.635	0.305
Violation of privacy	0.670	0.239
Uniformity of the parcels	0.595	0.337
Time for the recovery of the excavation	0.790	0.278
Time to restore the view of the environment	0.891	0.226
Financial responsibility in the long term	0.368	0.603
Conveyance of the parcels	0.136	0.805
Reliability of the soil excavation	0.324	0.759
Groundwater contamination	0.411	0.671

Note. Principal axis factoring, varimax with Kaiser normalization; factor 1: recovery/soft, factor 2: long-term/hard

The factor scores of concerns about site discomforts were based on time as well. Site-specific concerns from the preimpact phase dealt with an anticipated effect, contrary to postimpact, when concerns about the subscale “recovery” were a present danger as inhabitants faced a real transformation of the environment. We worked out the possibility that the relation between site-specific concerns and the experience of stress depended on the decontamination phase by addressing the interaction terms.

Analysis

After giving an overview of the descriptive statistics and the correlations, we will present the hierarchical regression we used to predict the amount of perceived stress, entering first the independent variables sex, age, and SES and subsequently adding the site-specific predictors. Given the relatively small sample size, and to meet the requirement to have approximately 15 cases per predictor, we entered these new independent variables in a stepwise manner. As such, we excluded nonsignificant variables from the model.

Results

Descriptive statistics and correlations

The perception of stress varied significantly with sex ($r = 0.301, p < 0.01$), showing that women reported higher stress levels than men reported (see Table 3). Neither the SES nor the age of the respondents was significantly associated with stress perception. The decontamination phase correlated highly with the experience of global stress ($r = -0.343, p < 0.001$), indicating that inhabitants where the parcels were already excavated experienced more stress than people from the preimpact phase did. The positive correlations between decontamination phase and site-specific concerns suggested that people from the preimpact phase were more concerned about site-specific discomforts than were residents from the postimpact phase. The need for additional information about the risks of the contaminated sources correlated positively with perceived stress ($r = 0.287, p < 0.01$), age ($r = -0.228, p < 0.05$), and risk perception ($r = 0.252, p < 0.01$). Risk assessments, the risk perceptions about the chemicals, and site-specific concerns, however, were not significantly associated with the experience of global stress. Considering the mean and standard deviation of risk perception, and knowing that the scale ranged from 4 to 24, it is clear that the overall perception was low ($M = 8.88, SD = 3.96$). Risk perception correlated positively with education ($r = 0.198$), which was significant at the $p < 0.05$ level. Living on polluted soil characterized by a relatively higher urgency did not seem to associate significantly with higher risk perception.

Multivariate regression analysis

From the control variables, only sex had a significant effect on the dependent variable (step 1). Women reported higher stress levels than men did ($\beta = -0.293, p < 0.01$) (see Table 4). After controlling for the background variables sex, age, and SES, we saw that the experience of stress was best predicted by the decontamination phase ($\beta = -0.384, p < 0.001$), the need for additional information about the risks ($\beta = 0.338, p < 0.001$), and concerns related to the recovery ($\beta = 0.237, p < 0.01$). The first effect indicated that inhabitants from the postimpact phase reported higher stress levels than people from the

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Table 3. Descriptive statistics and correlation matrix (N = 98)

	<i>M</i>	<i>SD</i>	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1.	13.22	7.81	1,00	-	-	-	-	-	-	-	-	-	-
2.	0.44	0.50	-.301**	1,00	-	-	-	-	-	-	-	-	-
3.	50.64	11.62	.088	.077	1,00	-	-	-	-	-	-	-	-
4.	7.51	3.42	-.099	.194*	-.260**	1,00	-	-	-	-	-	-	-
5.	8.88	3.96	.051	-.009	-.137	.198*	1,00	-	-	-	-	-	-
6.	-0.07	1.44	-.003	.015	.021	.030	.128	1,00	-	-	-	-	-
7.	-0.17	0.79	-.015	-.038	.258**	-.162	-.159	-.165	1,00	-	-	-	-
8.	3.43	1.64	.287**	-.056	-.228*	.003	.252**	.026	-.062	1,00	-	-	-
9.	0.02	0.90	.135	-.072	-.001	.015	-.147	-.234*	.088	-.117	1,00	-	-
10.	0.02	0.89	.045	-.032	.025	-.062	-.285**	-.034	.085	.050	.048	1,00	-
11.	0.44	0.50	-.343***	-.036	-.220*	.182*	-.072	-.071	.091	.045	.117	.291**	1,00

* $p < 0,05$, ** $p < 0,01$, *** $p < 0,001$; 1 = Perceived stress (PSS); 2 = Sex (MAN); 3 = Age (AGE); 4 = Education (EDUC); 5 = Risk perception; 6 = Risk assessment D1; 7 = Risk assessment D2; 8 = Need for additional information about risks; 9 = Site-specific concerns: recovery/soft; 10 = Site-specific concerns: long term/hard; 11 = Decontamination stage: pre vs. post

preimpact phase did. The latter two effects showed that higher levels of site-specific concerns about discomforts related to the recovery, as well as higher levels of perceived need about risk information of the contaminants, had a significant effect on the experience of global stress. Need for additional risk information and site-specific concerns about discomforts related to the recovery accounted for an additional 8.8% (step 3) and 3.1% (step 4) respectively in the variance of stress perception. The risk perceptions, the risk assessments of soil experts, and long-term concerns about private property and financial loss did not have any significant effect in one of the steps. The final model (step 5) showed that site-specific concerns about discomforts related to the recovery significantly interacted with the decontamination stage of the residents ($\beta = -0.239, p < 0.01$). This indicated that the positive effect of these concerns on stress perception applied only to residents from the postimpact phase ($\beta = 0.237$, with $\beta = -0.147$ for residents from the preimpact phase). By introducing the interaction term, the explained variance in the dependent variable increased by 4.1%. The final variability explained in stress perception is 35.1%.

Table 4. Results of regression analysis, dependent variable: perceived stress ($N = 98$)

Model / step	1		2		3		4		5	
Predictors	B	β	B	β	B	β	B	β	B	β
(Constant)	11.834		13.208		5.204		4.733		5.248	
Sex	-	-	-	-0.324**	-	-0.316**	-	-0.301**	-	-0.293**
	4.806	0.307**	5.082		4.952		4.716		4.589	
Age	0.073	0.109	0.031	0.046	0.081	0.121	0.081	0.120	0.057	0.064
SES	-	-0.012	0.090	0.039	0.129	0.056	0.125	0.055	0.234	0.103
	0.026									
Pre-post	-	-	-	-	-	-	-	-	-	-
			2.748	0.352***	2.750	0.352***	2.932	0.375***	3.003	0.384***
Lack of info on risks	-	-	-	-	1.487	0.313**	1.603	0.337***	1.609	0.338***
Concerns soft / short-term	-	-	-	-	-	-	1.690	0.195*	2.052	0.237**
Concerns soft * pre-post	-	-	-	-	-	-	-	-	-	-0.239**
									2.043	
Fchange (sign.), R^2	3.594 (0.016), Adj $R^2 = 7.4\%$		13.721 (0.000), Adj $R^2 = 18.5\%$		12.314 (0.001), Adj $R^2 = 27.3\%$		5.142 (0.026), Adj $R^2 = 30.4\%$		7.598 (0.007), Adj $R^2 = 35.1\%$	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Discussion and conclusions

Several studies on CTDs that were outlined by the environmental stress theory have revealed the role of the perception of contaminants as a mediating factor between the objective dangers of pollution and the subsequent influence on mental well-being. The findings of this study accord only to a limited extent with this assumption. Inhabitants on polluted soil characterized by a higher decontamination urgency did not report higher stress levels than residents living on soil with a lower risk assessment. Although risk assessments were not associated with risk perceptions, the latter did not seem to have an effect on the experience of stress, either. The important site-specific variables predicting the stress levels of the residents living in the Kouterwijk related to concerns about environmental hassles caused by the process of soil decontamination as well as the perceived lack of risk information, rather than to experts' or laypersons' appraisals of the contaminants.

The presence of stress-r and the non-appearance of stress-e in this case study underscore the importance of the symbolic component of the ecological-symbolic approach as it shows how controversies and social responses can be significant and can be even the most important stressors (Kroll-Smith & Couch, 1991a, 1991b, 1993a, 1993b; see also, e.g., Baum, Singer, & Baum, 1981, Edelstein, 1991; Picou et. al, 1992; Freudenburg, 1997; McGee, 1999).

The results of the regression analysis indicate that the experience of global stress of Kouterwijk's inhabitants significantly relates to site-specific concerns about the recovery of the excavation and, related to this, the decontamination phase. The first effect refers to the relation between concerns about the short-term impact of the soil excavation on the natural and built environment and higher stress. The second effect shows the postimpact phase caused higher stress levels than the preimpact phase. One possibility is that people where parcels still awaited excavation were in a period of habituation. Although this could provoke chronic environmental annoyance, this did not result in higher stress.

However, prudence is wise, as we assessed the role of the decontaminated stage in the model by using an independent measure. Further, notwithstanding that we controlled for age, sex, and SES, there could be a spurious relation between these variables, as stress perception could be

attributed to stressful life events other than the decontamination process. Because of this problem of internal validity—typical for cross-sectional designs—it is hard to verify if this effect is caused by the real impact of the transformation of the environment due to soil excavation. Nevertheless, the impact of the perception about this transformation on subjective stress could be assessed with less ambiguity by considering the interaction term between decontamination stage and site-specific concerns related to the recovery. Although residents from the preimpact phase were significantly more concerned about the discomforts related to the excavation, these site-specific concerns substantially influenced the stress perception only when the recovery process began. This refers to the distinction as outlined by Lazarus and Coyne (as cited in Baum, Singer, & Baum, 1981; see also Edelstein, 2004) between the appraisals of a present and subsequent danger, with inhabitants of the preimpact phase experiencing a subsequent danger, contrary to the inhabitants of the postimpact phase where the discomforts reflected a present state.

This is in accordance with previous research indicating that stressors related to the cleanup of an environmental danger and the subsequent recovery can be more stressful than the threat of the contamination itself (see Couch & Mercuri, 2006; Picou et. al, 1992; Edelstein, 2004). Soil excavation as a decontamination method not only entailed the excavation of the soil but also demanded the replacement of mailboxes, fishponds, doghouses, drives, and so forth. Although most residents from the postimpact phase were rather positive about the course of the excavation and were satisfied with the indemnification of the decontamination costs by the Public Waste Agency, residents' awareness that it could take a relatively long period to restore the view of the environment induced higher stress levels. In addition, although several objects like garden houses were replaced by new ones and although the expenses to redesign the gardens were valued by experts and repaid by the government, several residents reported that the way in which they were experiencing and valuing some aspects of their environment in everyday life before the decontamination could not be counterbalanced for by material or financial compensation of whatever kind. As the excavation of the soil also required the replacement of common walls, several residents complained about inconveniences induced by the violation of their privacy. One of the residents remarked that he had never had privacy problems until then because his house had been surrounded by high shrubs and

several trees. "But look now," he said, "the neighbors can see into our kitchen! There's no privacy anymore...and that is really annoying me!"

Furthermore, the perceived lack of information about the risks of the chemicals had an effect on stress perception. Residents complained about how the risk information was communicated to them, criticizing the scientific jargon they received. The positive association between risk-perception and the need for risk-information could suggest that part of the stress resulted indirectly from the uncertainties about the chemicals risks. However, what is worth mentioning here, is that this study analyzed the role of risk perception by using a compound measure of four items, because when using the single item *estimated danger of the contamination for one's health*, there was not enough variation, as more than 85% of the inhabitants estimated the danger for one's health as low to very low. The semi-structured interviews revealed that several residents questioned the credibility of the risk assessments as more than half the parcels changed urgency class from the first to the second assessment. The contradictory results of these borings brought into question the nonconditionality of expert knowledge (see Wynne, 1992b). The relatively long period between the announcement of the contamination and the start of the excavation (6 years), mainly as a result of juridical obligations for the paper mill and the time taken for technical assessments induced by the ignorance and uncertainties the soil experts confronted in quantifying and categorizing the properties of chronic contaminants, threw further doubt on the urgency to decontaminate. In addition to authorities' delayed actions to decontaminate the site and the inconsistent results of the risk assessments, this general low risk perception is attributed to the absence of clear physical health effects as well as to the limited visible signals of contamination in the environment (see Vyner, 1988).

Following Wynne's hypothesis (1992b) that "zero risk" demands could be interpreted as "zero trust" demands (p. 281), the semi-structured interviews revealed that the residents' risk perceptions and their need for risk information should also be understood in relation to the institutional and political background of the problem (Wynne, 1987, 1992b). For example, some official parties maintained silence on their definition of the situation. More specifically, the residents questioned the timing of the announcement of the contamination, as this was only months after the end of the 30-year liability of the local government to permit the allotment. Consequently, some residents raised the

question of a possible conspiracy between national and local politicians to ensure financial safety for the latter, and they blamed local politicians for lack of social support.

We suggest future research could examine not only how risk perception mediates the impact of an objective danger on the experiences of stress, but also—and maybe this especially—to what extent psychosocial impacts resulting from the conflict between the risk-beliefs of the victims (see Kroll-Smith & Couch, 1987, 1993a; Vyner, 1988; McGee, 1999) and the technical risk assessments of scientists and other experts, could be tempered by means of public participation in the process of risk-evaluation.

The findings of this case study show the stressful nature of the transformation of private property produced by the process of soil excavation as well as by residents' need for risk information as it arose from the controversies surrounding the risk status of the chemicals. Neither risk perception nor the objective danger of soil pollution related to the stress experience of Kouterwijk's residents. This has methodological as well as theoretical consequences. Methodologically, we believe that in assessing the impact of site-specific measures on subjective and objective stress to make concrete policy actions, methodologically pluralistic designs are indispensable. Theoretically, we believe further research should pay attention to the extent to which the concept of environmental stress requires a deconstruction in order to construct site-specific measures as well as to gain an insight into stressors related to the institutional and sociopolitical dimensions of society's risks.

APPENDIX**Regression Analysis: Excluded Variables (β In & Sig.)**

Model / step	1		2		3		4		5	
Predictors	β In	Sig.	β In	Sig.	β In	Sig.	β In	Sig.	β In	Sig.
Risk assessment D1	.000	.997	-.025	.785	-.036	.683	.008	.925	.019	.827
Risk assessment D2	-.036	.723	.026	.788	.029	.754	.013	.884	.012	.893
Risk perception	.068	.499	.022	.815	-.058	.533	-.034	.709	-.004	.965
Concerns hard / long-term	.032	.744	.155	.111	.137	.134	.133	.137	.085	.339
Concerns hard * pre-post	-.129	.194	-.103	.273	-.175	.051	-.138	.128	-.142	.105
Concerns soft * pre-post	-.194	.056	-.200	.035	-.195	.030	-.239	.007	-	-
Concerns soft / short-term	.114	.249	.155	.095	.195	.026	-	-	-	-
Lack of info on risks	.312	.002	.313	.001	-	-	-	-	-	-
Pre-post	-.352	.000	-	-	-	-	-	-	-	-

References

- Aronoff, M., & Gunter, V. (1992). Defining disaster: Local constructions for recovery in the aftermath of chemical contamination. *Social Problems, 39*(4), 345-365.
- Barnes, G., Baxter, J., Litva, A., & Staples, B. (2002). The social and psychological impact of the chemical contamination incident in Weston Village, UK: A qualitative analysis. *Social Science and Medicine, 55*, 2227-2241.
- Baum, A., Fleming, R., & Singer, J. E. (1983). Coping with victimization by technological disaster. *Journal of Social Issues, 39*(2), 117-138.
- Baum, A., Fleming, R., & Singer, J. E. (1985). Understanding environmental stress: Strategies for conceptual and methodological integration. In A. Baum & J. E. Singer (Eds.), *Advances in environmental psychology* (Vol. 5, pp.185-207), Hillsdale, NJ: Erlbaum Associates.
- Baum, A., Singer, J. E., & Baum, C., S. (1981). Stress and the environment. *Journal of Social Issues, 37*(1), 4-35.
- Baxter, J., Eyles, J., & Willms, D. (1992). The Hagersville tire fire: Interpreting risk through a qualitative research design. *Qualitative Health Research, 2*(2), 208-237.
- Beck, U. (1992). *Risk society: towards a new modernity*. London: Sage.
- Becker, S., M. (1997), Psychosocial assistance after environmental accidents: a policy perspective, *Environmental Health Perspectives, 105*(suppl.6), 1557-1563.
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*, 385-396.
- Cohen, S. & Williamson, G. (1988). Perceived stress in a probability sample of the United States. In S. Spacapan & S. Oskamp (Eds.), *The social psychology of health: Claremont symposium on applied social psychology* (pp. 31-67), Newbury Park, CA: Sage.
- Crighton, E. J., Elliot, S. J., van der Meer, J., Small, I., & Upshur, R. (2003). Impacts of an environmental disaster on psychosocial health and well-being in Karakalpakstan. *Social Science and Medicine, 56*, 551-567.
- Davidson, L. M., Baum, A., & Collins, D. L. (1982). Stress and control-related problems at Three Mile Island. *Journal of Applied Social Psychology, 12*, 349-359.
- Douglas, M., & Wildavsky, A. (1982). *Risk and culture*. Berkeley, CA: University of California Press.
- Dunn, J. R., Taylor, S. M., Elliot, S. J., & Walter, S. D. (1994). Psychosocial effects of PCB contamination and remediation: The case of Smithville, Ontario. *Social Science and Medicine, 39*(8), 1093-1104.
- Edelstein, M. R. (1988). *Contaminated communities: The social and psychological impacts of residential toxic exposure*. Boulder, CO: Westview Press.
- Edelstein, M. R., & Wandersman, A. (1987). Community dynamics in coping with toxic contaminants. In I. Altman and & A. Wandersman (Eds.), *Neighborhood and community environments* (pp. 69-112). New York: Plenum Press.

Chapter 4: Psychosocial health and soil excavation

Elliot, S. J., Taylor, S. M., Hampson, C., Dunn, J., Eyles, J., Walter, S., et al. (1997). "It's not because you like it any better...": residents' reappraisal of a landfill site. *Journal of Environmental Psychology*, *17*, 229-241.

Elliot, S. J., Taylor, S. M., Walter, S., Stieb, D., Frank, J., & Eyles, J. (1993), Modelling psychosocial effects of exposure to solid waste facilities. *Social Science and Medicine*, *37*(6), 791-804.

Erikson, K. T. (1991). A new species of trouble. In S. R. Couch & J. S. Kroll-Smith (Eds.), *Communities at risk: Collective responses to technological hazards* (pp. 11-29). New York: Peter Lang.

Evans, G. W. (1982). *Environmental stress*. Cambridge, England: Cambridge University Press.

Evans, G. W., & Cohen, S. (1987). Environmental Stress. In D. Stokols & I. Altman (Eds.), *Handbook of environmental psychology* (Vol. 2, pp. 571-610). New York: Wiley and Sons.

Gerling Consulting Group Europe nv (1999). *Beschrijvend bodemonderzoek op de site "Kouterwijk" te Sint-Amands*, CO990301, in opdracht van: Openbare Afvalstoffenmaatschappij voor het Vlaamse Gewest (OVAM).

Gibbs, L. M. (1983). Community response to an emerging situation: Psychological destruction and the Love Canal. *American Journal of Community Psychology*, *11*, 116-125.

Giddens, A. (1990). *The consequences of modernity*. Cambridge, England: Polity Press.

Hartsough, D. M. (1985). Measurement of psychological effects of disaster. In J. Lambe & S. A. Murphy (Eds.), *Perspectives on disaster recovery* (pp. 22-61). Norwalk, CT: Appleton Century Crafts.

Havenaar, J. M., & van den Brink, W. (1997). Psychological factors affecting health after toxicological disasters. *Clinical Psychology Review*, *17*(4), 359-374.

Havenaar, J. M., van den Brink, W., Kasyanenko, A. P., van den Bout, J., Iljina, L., Poelijoe, N. W., et al. (1996). Mental health problems in the Gomel region (Belarus): An analysis of risk factors in an area affected by the Chernobyl disaster. *Psychological Medicine*, *26*, 845-855.

Jarup, L., Briggs, D., de Hoogh, C., Morris, S., Hurt, S., Lewin, A., et al. (2002). Cancer risks in populations living near landfill sites in Great Britain. *British Journal of Cancer*, *86*(11), 1732-1736.

Kaiser, H. F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement*, *20*, 141-151.

Kovalchick, D. F., Burgess, J. L., Kyes, K. B., Lymp, J. F., Russo, J. E., Roy-Byrne, P. P., et al. (2002). Psychological effects of hazardous materials exposures. *Psychosomatic Medicine*, *64*, 841-846.

Kroll-Smith, J. S., & Couch, S. R. (1987). A chronic technical disaster and the irrelevance of religious meaning: The case of Centralia, Pennsylvania. *Journal of the Scientific Study of Religion*, *26*, 25-37.

Kroll-Smith, J. S., & Couch, S. R. (1991). What is a disaster? An ecological-symbolic approach to resolving the definitional debate. *International Journal of Mass Emergencies and Disasters*, *9*, 355-366.

Chapter 4: Psychosocial health and soil excavation

Kroll-Smith, J. S., & Couch, S. R. (1993). Technological hazards: Social responses as traumatic stressors. In J. P. Wilson & B. Raphael (Eds.), *The international handbook of traumatic stress syndromes* (pp. 79-91). New York: Plenum Press.

Latour, B. (1987). *Science in Action. How to Follow Scientists and Engineers Through Society*. Milton Keynes: Open University Press.

Lazarus, R., S. (1966). *Psychological stress and the coping process*. New York: McGraw-Hill

Levine, A. (1982). *Love Canal: Science, politics, and people*. Lexington, MA: Lexington Books.

Lima, M. L. (2004). On the influence of risk perception on mental health: Living near an incinerator. *Journal of Environmental Psychology, 24*, 71-84.

Markowitz, J. S., & Gutterman, E. M. (1985). Predictors of psychological distress in the community following two toxic chemical incidents. In A. Baum & J. E. Singer (Eds.), *Advances in Environmental Psychology* (Vol. 5, pp.89-107). Hillsdale, NJ: Erlbaum Associates.

Matthies, E., Höger, R., & Guski, R. (2000). Living on polluted soil: Determinants of stress symptoms. *Environment and Behavior, 32*(2), 270-286.

McGee, T. K. (1999). Private responses and individual action: Community responses to chronic environmental lead contamination. *Environment and Behavior, 31*(1), 66-83.

Poels, C. L., & Veerkamp, W. (1992). Hazard assessment of chemical contaminants in soil. *Toxicology Letters, 503*, 64-65.

Pollack, H. N. (2005). *Uncertain science...uncertain world*. Cambridge: Cambridge University Press.

Preston, V., Taylor, S. M., & Hodge, D. C. (1983). Adjustment to natural and technological hazards: A study of an urban residential community. *Environment and Behavior, 15*(2), 143-164.

Pukkala, E., & Pönkä, A. (2001). Increased incidence of cancer and asthma in houses built on a former dump area. *Environmental Health Perspectives, 109*(11), 1121-1125.

Rushton, L. (2003). Health hazards and waste management. *British Medical Bulletin, 68*, 183-197.

Stone, R. A., & Levine, A. G. (1985). Reactions to collective stress: Correlates of active citizen participation at Love Canal. *Prevention in Human Services, 4*, 153-177.

Taylor, S. M., Elliot, S., Eyles, J., Frank, J., Haight, M., Streiner, D., et al. (1991). Psychosocial impacts in populations exposed to solid waste facilities. *Social Science and Medicine, 33*(4), 441-447.

Vrijheid, M. (2000). Health effects of residence near hazardous waste landfill sites: A review of epidemiologic literature. *Environmental Health Perspectives, 108*(Suppl. 1), 101-112.

Vyner, H. M. (1988). *Invisible trauma*. Lexington, MA: Lexington Books.

Chapter 4: Psychosocial health and soil excavation

Wakefield, S., & Elliot, S. J. (2000). Environmental risk perception and well-being: Effects of the landfill siting process in two southern Ontario communities. *Social Science and Medicine*, *50*, 1139-1154.

Weterings, A. P. M., & Van Eijndhoven, J. C. M. (1989). Informing the public about uncertain risks. *Risk Analysis*, *9*(4), 473-482.

Wynne, B. (1987). *Risk management and hazardous waste: Implementation and the dialectics of credibility*. New York: Springer-Verlag.

Wynne, B. (1992a). Misunderstood misunderstanding: social identities and public uptake of science. *Public Understanding of Science*, *1*, 281-304

Wynne, B. (1992b). Risk and social learning: reification to engagement. In S. Krimsky & D. Golding (Eds.), *Social Theories of Risk* (pp.275-297), London: Praeger Publishers

CHAPTER 5: PSYCHOSOCIAL HEALTH OF RESIDENTS EXPOSED TO SOIL POLLUTION IN A FLEMISH NEIGHBOURHOOD*

Abstract: The objective of this study is to examine several major covariates of mental health among residents living on polluted soil. In the Kouterwijk community (Belgium), contaminated by heavy metals and polyaromatic hydrocarbons, 109 residents were compared with a quasi-control group (N = 161). The mental health of the exposed residents was much worse than in the matched group (OR = 2.52, 95% CI = 1.44–4.39). To examine the residents' mental health in detail, site-specific variables were added in a binary logistic regression. The probability of distress did not covary with independently assessed or perceived danger of the contaminants, but with residents' sense of participation in consultation over the contamination problem (OR = 1.72, 95% CI = 0.99–2.94), and with interaction of the latter with a perceived need for decontamination (OR = 2.56, 95% CI = 1.31–5.00). This suggests that a disbelief in the necessity of risk mitigation, along with a perceived lack of participation, can be more stressful than actual and perceived contamination.

Keywords: Soil pollution; mental health; risk; public participation

Introduction

Past research has demonstrated the potential physical health effects of exposure to several chemical contaminants (Pukkala & Pönkä, 2001; Vrijheid, 2000). Problems with one's environmental health induced by exposure to chemical dangers, however, can also relate to mental well being. Although a number of case studies have revealed the stress reactions of people coping with environmental pollution, research on the psychosocial impact of living on polluted soil is rather scarce (Matthies, Höger, & Guski, 2000). Within a Belgian context this is not surprising, since the problem only became a part of the political agenda in 1995 when the first soil contamination decree became effective. Since then, the Flemish government has started tackling the problem of soil pollution in neighbourhoods. The results presented here are from an assignment from the Public Waste Agency of Flanders (OVAM) to explore the mental burden of the

* Vandermoere, F. (2008). Psychosocial health of residents exposed to soil pollution in a Flemish neighbourhood. *Social Science & Medicine*, 66(7), 1646-1657.

process of soil decontamination in Kouterwijk, a community contaminated by chemicals from previous industrial activities.

The psychosocial effects of exposure to human-made hazards have frequently been quantitatively assessed by comparing a contaminated community with a non-exposed area as a control group (Havenaar, de Wilde, van den Bout, Drottz-Sjöberg, & van den Brink, 2003; Dunn, Taylor, Elliot, & Walter, 1994). In screening the literature on contamination incidents, however, it is notable that little attention has been given to the relations between the mental health condition of the affected people and the variation within the risk assessments of the polluted place (Elliot, Taylor, Walter, Stieb, Frank, & Eyles, 1993). Kouterwijk was characterized by a very heterogeneous distribution of chemicals. Consequently, the soil experts' data containing information about the risks for each individual parcel will be used. Thus, in addition to the study of differences in psychosocial health between residents of the affected community and a matched group, we will examine the relation between the mental health condition of the affected people and differences in independently assessed risk within the endangered place.

Next to the stress reaction of exposure to environmental risks, previous research has shown that the psychosocial impacts of perceived contamination can be as real or even more real as the impacts of actual contamination (Elliot, Taylor, Hampson, Dunn, Eyles, Walter et al., 1997; Lima, 2004). Related to this, some studies have shown that secondary stressors (e.g. the decontamination of the site) can be more stressful than the threat itself (Kroll-Smith & Couch, 1991; Picou, Gill, Dyer, & Curry, 1992; Barnes, Baxter, Litva, & Staples, 2002; Edelstein, 2004). Furthermore, research on the siting of landfills has shown that psychosocial effects can be caused by unilateral decisions embedded in the process of siting, rather than by actual and perceived exposure (Wakefield & Elliot, 2000). Therefore, in addition to the study of mental health and risk exposure, we will examine the psychosocial effects from perceived contamination, residents' perceived need to decontaminate the site, as well as to what extent a lack of participation in major decisions during the soil decontamination process functions as an additional stressor.

The framework for this study draws on theories that refer to relations between environmental distress and independently assessed risks (i.e. risk society framework), to the stress reaction of perceived contamination (i.e.

environmental stress theory), and to the psychosocial effects of process-related stressors (i.e. empowerment theory). By using a variety of theories this study aims to come to a better understanding of the multidimensionality of the psychosocial impacts of chemical contamination in Kousterwijk. In addition, by examining site-specific stressors of chemical contamination in a local context, this case study has broader implications for the management and understanding of environmental risks in terms of the need to examine stressors related to risk characteristics and the wider socio-political context in general, and also for the role of deliberative strategies to temper psychosocial impacts of exposure to environmental hazards in particular.

Theoretical context

Research on the relations between objective risks and environmental distress can be traced back to what Kroll-Smith and Couch (1991) termed the event-quality perspective. Based on a realist epistemology, this perspective emphasizes how biophysical entities influence human actions and experiences independent of human actors' definitions of these entities. This perspective was applied in early disaster research where it was assumed that natural disasters "follow a consistent sequence of events and impacts a community's social structure at identifiable levels" (Gill & Picou, 1998, p. 795). The mental health impacts of natural disasters are further distinguished from man-made and chronic technical disasters such as toxic contamination (Baum, Fleming, & Davidson, 1983; Couch & Kroll-Smith, 1985). In contrast to natural disasters where the causes of the event are considered "acts of god," man-made risks often induce conflicting claims about the dangers to one's health and the environment. The uncertainties surrounding the health effects of exposure to chronic and invisible contaminants can induce victims' distrust of policymakers, and intra-community conflicts (Wandersman & Hallman, 1993). Additionally, living in a contaminated community can result in the development of an environmental stigma, financial uncertainty about property values, and tensions within the family (Edelstein, 2004). Therefore, it is likely that chronic rather than acute distress is developed (Baum et al., 1983).

For example, Matthies et al. (2000) studied stress reactions from housing built on soil contaminated by a coking plant. People living on polluted soil

reported significantly more stress than did a control group in an uncontaminated area. The investigation suggested the chronic nature of the stress, as the data were collected 9 years after discovery of the contaminants. In another study by Baum et al. (1992) flood victims were compared with people living near a leaking, hazardous toxic waste dump. The latter reported more symptoms of chronic stress, including higher levels of anxiety, depression and alienation, than the flood victims and control subjects.

The attention to the distinguishing characteristics of the mental health effects of these "new species of trouble" (Erikson, 1991) relative to natural disasters, reminds us of the theories of the risk society on manufactured uncertainties (Giddens, 1990) and Ulrich Beck's version of reflexive modernization in particular (Beck, 1994). According to Beck (1992) in a *Risk Society* risks are no longer limited to natural disasters but are often unintended consequences of human interference with nature. The pervasiveness of these modern risks challenges the societal order by a process called "reflexive modernization." The latter, as Beck understands it, "signifies not an increase of mastery and consciousness, but only a heightened awareness that mastery is impossible" (Latour, 2003, p.36). This in turn can breach our ontological security (Giddens, 1990), which can have serious implications for the experience of environmental stress such as increased anxiety levels (Beck, 1992). Although Beck (1992) emphasized the role of agency when expressing hope for more direct citizen involvement by means of subpolitics, his thesis suggests that the perceived pervasiveness of risks, along with science's lack of social authority, causes inevitable psychosocial consequences, at least for a person who is not yet a "subpolitician."

Even though the event-quality perspective on natural versus man-made disasters and Beck's thesis of the risk society differ in their level of analysis (meso/local-level risks versus high consequence/global-level risks, respectively: see Mol & Spaargaren, 1993; Baxter, Eyles, & Elliot, 1999) their view on the psychosocial impact of these new risks seems to be very similar. Specifically, they both assume that because of these manufactured uncertainties and non-experts' increased awareness of the limits of expert knowledge, a risk consciousness is created that in turn induces psychosocial reactions. In addition, it is assumed that people are risk-averse by definition (Tulloch & Lupton, 2003; Lidskog, 1993). While these assumptions seem to be tenable in situations where non-experts

view the risks as high as opposed to experts' assurances that risks are low, other authors argue for "an open-mindedness about which risks appear relevant in specific settings and whether risks are an issue at all" (Irwin, et al., 1999, p. 1312). Furthermore, Wilkinson (2001, p. 105) noted that risk consciousness can be interpreted "not so much as a sign of existential doubt and a disposition to question the meaning of the world but, rather, as an attempt to articulate and defend a preferred point of view on reality." In addition to the possibility of risk perception as a coping strategy rather than an inevitable stressor, past research also reveals social factors as pressure to ignore environmental risks despite experts' recommendations to avoid them. For example, in order to retain their ontological security people can downplay environmental risks by developing a positive community identity that offers protection against outsiders' stigmatisation of the polluted site (Aronoff & Gunter, 1992; Lidskog, 1996). These studies show that, in addition to studying the relation between independently assessed risk and environmental distress, social scientists should also look for the role of agency as well as the social and cultural system as a secondary stressor.

Research on the psychosocial impacts in communities near waste facilities often draws on environmental stress theory (Lazarus & Folkman, 1984; Baum, Fleming, & Singer, 1985). An iterative process involving two stages is proposed: primary appraisal, where the environmental threat is appraised as a positive or negative risk; and secondary appraisal involving problem-focused (e.g. community action toward the threat) and emotion-focused coping strategies (e.g. threat-denial). These appraisals can alter through changes in the risk-characteristics and the wider context (Taylor et al., 1991; Luginaah et al., 2002). Some studies outlined by environmental stress theory have shown that the psychosocial impacts of perceived contamination can be as real or even more real as the impacts of actual contamination (see e.g. Elliot et al., 1997). Therefore, next to the data of soil experts on the independently assessed risks, we will examine the relation between mental health and residents' risk perceptions.

Additionally, the study of secondary problems (e.g., cleanup of risks) caused by the social construction of risk (Aronoff & Gunter, 1992) is called for in view of the possibility of risks being ignored once they have been placed on the political agenda and require potentially severe changes in everyday life. In

studying responses by residents exposed to soil pollution, Grasmück and Scholz (2005) found that in addition to the positive relation between risk perception and need for decontamination, the need for decontamination was determined by variables from the wider cultural context (e.g., commitment to sustainability). Furthermore, it has been shown that problems related to the cleanup of an environmental danger, rather than the health risks posed by contamination, can be the major causes of community action (Aronoff & Gunter, 1992) and environmental distress (Picou, Gill, Dyer, & Curry, 1992). Consequently, next to the role of actual and perceived contamination, we will examine to what extent need for decontamination relates to the psychosocial effects of exposure to contamination.

Finally, in cases where the government initiates demands for risk regulation, research might consider whether or not a feeling of diminished personal efficacy in affecting governmental decisions can result in psychosocial effects. Within the discipline of community psychology in general and empowerment theory in particular, an extensive amount of research documents the link between mental health and the larger socio-political context (see e.g.: Levine & Perkins, 1987; Zimmerman, 1995; Rappaport & Seidman, 2000). Empowerment refers to processes such as citizen participation by which people aim to gain control over the affairs that affect them, as well as to the resulting levels of being empowered (Perkins & Zimmerman, 1995). Given the high levels of uncertainty in cases of serious soil contamination (Van der Pligt & De Boer, 1991), a decline in deference to scientific knowledge and related increases in demand for citizen participation become more prominent (Hadden, 1991). Moreover, in cases where people feel to take no part in decision making about the affairs that affect them, the relation between disempowerment and mental distress can be even more important than the impact of objective or subjective risk measures (Kroll-Smith & Couch, 1991). Research has suggested the role of citizens' involvement as a problem-focused strategy to cope with environmental hazards (Giddens, 1990; Luginaah, Taylor, Elliot, & Eyles, 2002), yet with few exceptions (Rich et al., 1995; Edelstein, 2004) less attention has been paid to what extent a perceived lack of effectiveness in public participation can act as an additional stressor. Moreover, the psychosocial effect of a perceived lack of participation in consultation over the contamination problem definitely seems to be plausible within the context of the reflexive regulation of contaminated

communities, as prospects for actual participation can be limited (Rich et al., 1995; Elliot et. al, 1997; Gunter, Aronoff, & Joel, 1999; Petts, 2004).

To summarize, this study examines the psychosocial health among residents living on polluted soil and how this varies in relation to: i) independently assessed risk, ii) resident's risk perception, iii) need for decontamination, and iv) sense of inclusion in consultation over the contamination problem. Because of the attention our study pays to the local culture in which risks are constructed and experienced, the next section provides an overview to give community context for the study.

Community context

Kouterwijk is a middle-class community of about 100 households located in the village of Sint-Amands aan-de-Schelde in Belgium. It was only the second community decontaminated in Belgium and was the first with such a heterogeneous distribution of chemicals. Some of the most important pollutants were benzo(a)pyrene (BaP) and arsenic, which according to an independent, expert institution exceeded the decontamination norms by a factor of 81 and 121 at maximum, respectively. There are two notable periods in which many of the present residents moved into the community; between 1977–1979 and 1989–1992, 22.3% and 30.4%, respectively, of the current population took possession. Almost all the residents are homeowners (approximately 95%).

The allotment started during the 1970s, built on a dumpsite where two factories had performed industrial activities in the preceding decennia (see Table 1 for a chronology of major events). At the end of the 19th century, permission had been given to run a tannery. Fifty years later, the first complaints were registered regarding the draining of wastewater containing sodium sulphide (Na₂S) and calcareous salts from the depilatory processing of pelts, and the draining of rinse water from the paintbrush department. In 1965–1966, the tannery ceased these activities. A second factory opened in 1907, with permission given to produce superphosphate and sulphuric acid. The first complaints were noted during the 1930s. Subsequent complaints resulted in the local council issuing an unfavourable judgment during the 1960s. The company was sold to a demolition firm; the start of the allotment followed shortly.

In September 1998, the radio, the local government, and the Public Waste Agency of Flanders (OVAM) informed inhabitants about the soil contamination. The sudden amplification of these environmental concerns occurred when a soil analysis was performed on request, according to the 1995 and 1998 decrees concerning soil contamination, for a local inhabitant working on the conveyance of a house. OVAM organized an initial meeting to give a global overview of the potential physical health risks of the contaminated soil and to give some recommendations: All contact with the soil needed to be avoided and inhabitants were advised to stop eating vegetables from their gardens.

Table 1. Chronology of major events

Date	Event
1900s–1965	Industrial activities.
1970s	Demolition of the plants followed by the start of the allotment.
1995	The Flemish government ratifies a decree concerning soil remediation. This decree contains some key issues that reveal new ways to handle the issue. It explains the differences between historical and new soil pollution, and between obligation and liability for remediation. Also outlined are the register of polluted soil and the necessity of a soil certificate in case of conveyance of land property.
1998	According to the decree, a private person orders a soil analysis. These results, which indicate pollution of the soil, reach the Public Waste Agency of Flanders (OVAM).
Late 1998	The local government and OVAM inform inhabitants about the situation. OVAM organizes a first meeting to give a global overview of the potential health risks as well as some recommendations. Shortly after the announcement an action group is formed.
1999 February	The inhabitants hear the results of a first evaluation of the presence of hazards. To give an exclusion about the precise spread of the contamination and the adverse effects for human health and the environment, a risk assessment is assigned.
1999 December	The inhabitants hear the results of the risk assessment.
2000 June	The inhabitants are officially discharged of the remediation costs. The commitment to the action group decreases.
2000 August:	Additional experts are appointed. A first expert must outline the plan for the remediation, and a second independent expert is responsible for the communication between the inhabitants and OVAM.
2001:	Excavation is chosen as the decontamination strategy.
2002:	Additional assignments focus on the detection of subterranean structures, and the value of several properties are estimated.
2003:	The results of the extra assessments are provided. The community will be excavated in two parts. One part will be excavated in 2004, the second in 2005.

Shortly after the announcement of the contamination, some people who lived on the same street came together and formed an action group. The action group

quickly expanded to about three fourths of community residents. In this way, most people received support from each other and looked to collectively define the unexpected situation. The leaders of the action group researched websites and articles on the physical health effects of heavy metal and PAHs, and worked to put people's minds at rest. In addition, the group started proceedings to receive "the status of innocent owner" (i.e. to prove that the pollution was not caused by the inhabitants).

In February 1999, inhabitants received the results of an initial evaluation regarding the presence of hazards. Furthermore, a more profound risk assessment was assigned to give an exclusion boundary for the precise spread of the contamination and its adverse effects on human health and the environment. An independent, expert institution stated that the causes of contamination were twofold (Gerling Consulting Group Europe, 1999). In addition to the negligent dumping of waste materials during the running of both factories, soil contamination increased through the spread of debris, installations, and other factory remnants during demolition. This transformed the soil into an "invisible chemical cocktail" consisting of both heavy metals (e.g., cadmium, lead, arsenic) and polyaromatic hydrocarbons (e.g., benzo(a)pyrene, naphthalene).

In June 2000, the inhabitants were officially discharged from remediation costs. Many residents were grateful to the action group's efforts toward receiving the status of innocent owner. Yet, after the initial relief over the decontamination costs, commitment to the action group eventually decreased from about three fourths to one third of residents. Moreover, an independent risk-communicator group was formed. The leaders of the action group distrusted the organization as a mediator and felt discounted by it. Yet some residents preferred to address themselves to this official authority and others started questioning the leadership style of the founders of the action group. A tacit conflict developed between some non-members and ex-members of the action group on the one hand, and the remaining (for the most part founding) members on the other hand. In addition to public meetings, the independent risk-communicator group started newsletters and home visits by the 'residents' expert', an independent risk communicator with a role as a flexible interface between the residents and OVAM. However, the decision to decontaminate was already made by then. As a result, despite several information channels and sources, many people still felt powerless regarding major decisions.

Subsequently, another independent, expert institution outlined the plan for remediation. Excavation was chosen as the decontamination strategy and the value of certain properties was estimated (e.g., trees, plants, flowers, garden houses). Another meeting for the inhabitants took place in 2003, where they learned the results of the additional assessments. OVAM announced that the community would be excavated in two parts, one in 2004, the second in 2005.

Methods

Study design

To compare the mental health condition of Kouterwijk's residents with a non-exposed group, a stratified sample was taken from the Belgian Health Survey (1997). The variables on which the stratification was based were sex, age, and socio-economic status measured by education level (see Table 2). The use of a quasi-control group in the form of a stratified sample from a national health survey, instead of using data from a similar neighbourhood without contamination, came about because research on risks of soil contamination is still in its early stages. Although OVAM, one of the first organisations in Europe with an inventory of industrial and dumping sites, was started during the nineties, little is still known about the adverse effects of contamination on human health and the environment. Given the fact that these risks have not yet been accurately assessed at the population level, the number of people from our stratified sample that could have known the risks is limited, as is their contribution to the sample mean.

The data from the residents in the affected community were collected by means of structured questionnaires between September and December 2004. These were collected halfway through the decontamination. One part of the neighbourhood had undergone excavation and the second part would be decontaminated the following year. To assess the probability of the mental burden within the affected community, decontamination phase was considered as an additional indicator of exposure (see below). Structured questionnaires from 109 residents were collected, representing approximately 85% of the community at the household level. As will be detailed in the next section, these included

standardized scales related to general mental well being as well as some single-item measures or short scales specific to the local context.

Measures

In addition to questions about socio-demographic characteristics including sex, age, and education level, mental health condition was assessed by using the Dutch 12-item version of the General Health Questionnaire. Following Goldberg (1998) subjects with a score of 3 or more were defined as having symptoms of distress. Additional measures of psychosocial health included 3 subscales of the Symptom Check List (SCL) (Derogatis, Lipman, & Covi, 1973), that is, somatic complaints (SCL-SOM), anxiety (SCL-ANX), and sleeping disorders (SCL-SLP, Dutch version) (see Arrindell & Ettema, 1986).

Using the software *Vlier Humaan* (Vlaams Instrument voor de Evaluatie van Risico's) an independent, expert institution defined three urgency classes: low, moderate, and high. *Vlier Humaan* is accepted by OVAM as a model for risk evaluation of soil contamination and is embedded in legislation. It is based on publications of the European Centre for Ecotoxicology and Toxicology of Chemicals (ECETOC) and is considered the standard model for assessing the 'objective risks'. The urgency categories were analysed using dummy coding: D1 refers to "low versus moderate urgency," and D2 refers to "low versus high urgency." Since data were collected halfway through the excavation of the site, we used decontamination phase as an additional indicator of exposure. Decontamination phase was assessed by using a dummy variable, with 0 referring to inhabitants from the post-impact phase, that is, where the parcels were already excavated, and 1 referring to the residents from the pre-impact phase, that is, where the parcels still needed to be decontaminated.

We assessed risk perception with two items related to personal risks ($\alpha = 0.677$). A first item referred to the perceived human health risk ("I think that the risk of the pollution in the soil for my health is...") and a second item referred to the perception of ecological risk ("I think that the risk of the pollution for the fertility of the soil on my parcel is..."). Answers ranged from 1 (*very low*) to 6 (*very high*). Although these items do not cover the multidimensionality of human risk perception (Slovic, 1987) and ecological risk perception (McDaniels, Axelrod,

& Slovic, 1995), these overall holistic judgements were typical for the perceptions about personal risks.

The question "To what extent do you feel that your comments are taken into account?" measured feeling of participation. Scores ranged from 1 (*not at all*) to 6 (*very much*). As stated previously, the inclusion of feeling of participation in the survey instrument derives from the observation that in spite of several information channels and sources, many people felt powerless in major decisions.

Need for decontamination was measured by three items related to residents' attitude about decontamination of the site (e.g., "If I had the option I wouldn't decontaminate and would leave the parcel in the state it is", "The decontamination of the parcel is useless", and "The decontamination of my parcel is absolutely necessary"). Scores ranged from 1 (*totally disagree*) to 5 (*totally agree*; $\alpha = 0.814$). These items related to perceived need of decontamination in general (Grasmück & Scholz, 2005) rather than to differences in preference for decontamination strategies (Weber, Scholz, Bühlmann, & Grasmück, 2001).

Although the items of site-specific variables were discussed with the residents' expert, who was in a privileged position in terms of local understandings of risk and public concerns, and although the items from the survey were clarified door-to-door by the researcher, the disadvantages of measuring the site-specific variables by one-item or short scales should be acknowledged in terms of limited information on reliability and validity (Van der Pligt & De Vries, 1995). In addition, we should be cautious about a generalized interpretation of the results. This was the first social-scientific research exploring the psychosocial health impacts of living on polluted soil in a Flemish neighbourhood. Therefore this article should only be seen as presenting the first results of a pilot study to obtain a better understanding of the mental health effects of soil contamination in Kouterwijk.

Analysis

The first part of the analysis examines differences in psychosocial health status *between* residents of the affected community and a matched group. As none of these dependent variables meet the parametric assumptions, we will use the Mann-Whitney U test as a non-parametric alternative for the independent *t* test.

In the second part of the analysis, in order to examine the relation between mental health and the differences in risk-related measures *within* the affected community in more detail, we will use binary logistic regression.

Results

Table 2 shows that the socio-demographic characteristics of the people living in Kousterwijk are very similar to those from the matched group. The samples do not differ on mean scores for age ($p = 0.959$), sex ($p = 0.717$), and education ($p = 0.467$). However, residents in the affected area reported significantly more somatic complaints and sleeping disorders ($p = 0.020$ and $p = 0.002$, respectively).

Table 2. Characteristics of Kousterwijk's residents versus subjects of the matched comparison group

	Residential area		(test statistic) p value
	Kousterwijk's residents (exposed)	Matched comparison group (non-exposed)	
Mean age (SD)	50.88 (11.96)	50.95 (10.77)	(t = 0.051) 0.959
<i>n</i>	107	161	
Female sex (%)	57.4	59.6	$(\chi^2 = 0.131)$ 0.717
<i>n</i>	108	161	
Higher educated SES (%)	37.5	33.1	$(\chi^2 = 0.528)$ 0.467
<i>n</i>	104	157	
GHQ			
Mean rank	148.85	114.12	(U = 5792.50) <0.001
<i>n</i>	106	150	
High score of GHQ (%)	42.5	22.7	$(\chi^2 = 11.396)$ <0.001
OR for high GHQ	2.52 (95% CI: 1.46–4.33)	Reference	
SCL-Somatic complaints			
Mean rank	141.61	119.81	(U = 6516.50) 0.020
<i>n</i>	102	154	
SCL-Sleeping disorders			
Mean rank	147.54	118.77	(U = 6355.50) 0.002
<i>n</i>	106	154	
SCL-Anxiety			
Mean rank	136.70	121.23	(U = 6829.00) 0.087
<i>n</i>	103	151	

Residents living in Kousterwijk also had higher scores on the anxiety subscale of the Symptom Check List (SCL) than residents who were not exposed or aware of their exposure to soil pollution, yet this was significant only at the 0.1 level ($p = 0.087$). In addition, the proportion of the inhabitants with a score on the General Health Questionnaire (GHQ) of 3 or more in the contaminated community (42.5%) was significantly higher than for those in the quasi-control group (22.7%; $p < 0.001$). The OR for high score of GHQ was also significantly higher in Kousterwijk than in the matched group (OR = 2.52, 95% CI = 1.46–4.33).

In Table 3 the results of the logistic regression analysis are given with the site-specific measures of the mental health burden in Kousterwijk as predictors. Our analysis shows that women seem to be more likely to report distress than men, yet none of the socio-demographic variables significantly predicts the probability of distress in any one of the steps. Although the Kousterwijk sample showed worse health than the 'control' sample from another area, within Kousterwijk there were no differences associated with local differences in independently assessed risks or in residents' perceptions of local risk.

A number of explanations can be postulated here. First, there were limited visible signs of contamination in the environment. Additionally, some people who had been living in the community for more than 20 years were suddenly told there was a problem, although they had never experienced physical health problems that could be attributed to the chemical contamination. Moreover, some residents said that while they acknowledged the seriousness of the contamination in terms of the presence of chemicals, they reasoned that "to be at risk" there had to be exposure routes. As the only relevant exposure routes outlined by an independent, expert institution were "eating vegetables or soil particles," residents felt able to control the exposure routes and the resulting risks despite recognizing the presence of hazards. Moreover, several residents questioned the credibility of the final risk assessments since more than half the parcels changed urgency class from the first to the second assessment. As a result, in addition to residents' perceived control of the exposure routes, the differences between the risk assessments resulted in distrusting the experts' stock of knowledge. In addition, as many residents felt able to control the pathways, they viewed the output of the risk assessments—as indicated by

differences in urgency classes—as an indication of differences in the presence of hazards rather than differences in objective risks.

Table 3. Logistic regression (GHQ as dependent variable)

	Model 1			Model 2			Model 3		
	B (SE)	Exp B	95% CI	B (SE)	Exp B	95% CI	B (SE)	Exp B	95% CI
Included									
Sex	0.62 (0.45)	1.85	0.78- 4.43	0.76 (0.53)	2.14	0.76- 6.02	0.61 (0.56)	1.84	0.62- 5.46
Age	0.03 (0.02)	1.03	0.99- 1.07	0.02 (0.02)	1.01	0.97- 1.07	-0.01 (0.03)	1.00	0.95- 1.05
SES	-0.18 (0.46)	0.98	0.40- 2.43	-0.51 (0.55)	0.60	0.20- 1.77	-0.40 (0.58)	0.96	0.31- 3.01
Pre- vs. post- impact				2.54** (0.61)	12.71	3.88- 41.56	2.82** (0.65)	16.70	4.67- 59.73
Risk assess. (D1)				-0.77 (0.69)	0.46	0.12- 1.79	-0.91 (0.73)	0.40	0.10- 1.69
Risk assess. (D2)				-0.13 (0.69)	0.88	0.23- 3.38	-0.18 (0.74)	0.83	0.19- 3.58
Risk perception				0.35 (0.32)	1.42	0.76- 2.66	0.13 (0.33)	1.13	0.59- 2.18
Need for decontamination				-0.13 (0.27)	0.88	0.51- 1.50	0.03 (0.35)	1.03	0.52- 2.07
Feeling of participation				-0.54 (0.28)	0.58	0.34- 1.01	-0.52 (0.32)	0.60	0.32- 1.11
Need for decontamination * feeling of participation							0.94* (0.34)	2.56	1.31- 5.00
R ² (Nagelkerke)	0.05			0.36			0.46		

*p < 0.01, **p < 0.001

Further, need for decontamination is not a direct determinant of the probability of distress. The general mental health state is best predicted by decontamination phase (OR = 12.71, 95% CI = 3.88–41.56, p < 0.001) and feeling of participation in the decision to decontaminate the land (OR = 1.72, 95% CI = 0.99–2.94) but the probability value for this association is significant only at the 0.6 level (p = 0.055). The association with feeling of participation shows that the

odds of reporting mental distress increases as the level of feeling of participation decreases. The association with the decontamination phase shows that after controlling for the socio-demographic characteristics, people from the post-impact phase reported significantly more distress than residents who were still exposed to the risks associated with the pollution of their parcel. This is consistent with previous research that indicated that stressors related to the recovery from an environmental threat can be more stressful than the threat itself (see Picou, Gill, Dyer, & Curry, 1992). In Kouterwijk the top part of the contaminated soil was excavated and replaced with new, clean soil. While soil excavation has the benefit of grasping the dangers in an effective manner, it requires severe changes in residents' environment (e.g. the replacement of garden houses and common walls) and this was stressful for several residents.

Finally, in a third step it is shown that the relation between a sense of participation and psychological distress is dependent on perceived need for decontamination (OR = 2.56, 95% CI = 1.31–5.00). In other words, the odds of mental distress increases when the feeling of participation decreases, especially when the perceived need to decontaminate the site is low. The public meetings had information value for several residents. However, the interviews and conversations with the residents revealed that the process of risk assessment and the communication by experts was too complex and technical. In addition, their influence on the decision to decontaminate was minimized to responding to proposals after they were formulated. Given the long period between the discovery of the contamination and the start of the decontamination of the site, residents criticised the repetitive nature of the content of the public meetings. In addition, the information shared on public meetings was rather general and people aimed to have more news on their personal property. To fulfil this need, the policymakers of the OVAM appointed the residents' expert to have direct contacts (i.e. home visits) with the inhabitants to register their uncertainties and concerns and to loop these back to the OVAM. However, the independent risk communicator was appointed only after the risk assessments were done. This showed that the decision to decontaminate and the decision to excavate were made in advance of public consultation. This lack of participation may have induced a senses of disempowerment and was associated with heightened levels of mental distress. This was certainly the case for people who made a distinction

between the dangers and risks (see Luhmann, 1993), and for those residents who disavowed the decision to decontaminate their property.

Discussion and conclusion

Previous research on the psychosocial impact of chemical contamination has emphasized the relation between objective risk and environmental distress on the one hand (Beck, 1992, 1994), and the role of the perception of contaminants in addition to the impact of risk-exposure on mental well being, on the other hand (Lazarus & Folkman, 1984; Baum et al., 1985). The findings of this study differ from those findings. This study suggests that the psychosocial effects of exposure to soil pollution are associated with a lack of citizens' involvement in the decisions embedded in the process of risk regulation, rather than with actual and perceived exposure.

Although the first part of the analysis showed that Kouterwijk's residents reported a significantly lower general mental well-being, with more sleeping disorders and somatic complaints, than subjects from a matched comparison group, the second part of the analysis showed that the mental burden was not produced by the chemicals' objective or perceived dangers. Inhabitants who had a higher risk perception or lived on polluted soil characterized by a higher decontamination urgency did not report higher distress levels than residents who had a lower risk perception or lived on soil with a lower risk assessment.

The absence of any relationship between risk perception and distress was explained by the observation that residents made a distinction between risks and hazards because they felt able to control the exposures routes. As a result, scientific knowledge (i.e. the output of experts' risk assessments) created a hazard awareness rather than an alarming, anxiety surrounded, risk consciousness as suggested by Ulrich Beck. Further, the absence of any association between risk perception and distress is also in contrast with the environmental stress theory (Lazarus & Folkman, 1984; Baum et al., 1985). Whereas the latter theory assumes that the primary stressor relates to the environmental threat, the findings of this study show that the major stressor may relate to problems caused by the social construction of the risk (i.e. the decontamination of the site).

The irrelevance of the risk measures was supported by the finding that residents living on parcels that were already decontaminated reported significantly higher mental health problems than residents who were still exposed to the polluted soil (pre-impact phase). This relates to the results of previous research that indicate that stressors related to the cleanup of an environmental danger and the subsequent recovery can be more stressful than the threat of the contamination itself (Picou, Gill, Dyer, & Curry, 1992). Therefore future research will examine in more detail the stressors related to the process of soil remediation.

The results of the binary logistic regression analysis further indicated that the mental health burden of being exposed to environmental contamination could be induced by a lack of feeling of participation. This seemed to depend on the extent to which residents accept the decision to decontaminate. Thus, a lack of perceived participation induces psychosocial distress, especially when a government's decision to decontaminate is not accepted. In other words, a lack of belief in the necessity of risk mitigation coupled with a lack of citizen participation can be more stressful than the impact of actual and perceived contamination.

These conclusions indicate that, in addition to the examination of risk perception and experts' risk assessments, more attention should be paid to variables associated with demand for risk mitigation (Sjöberg, 1999; Grasmück & Scholz, 2005). Moreover, the finding that one of the primary stressors in this case study was associated with a lack of empowerment through any meaningful participation in the decision to decontaminate rather than to objective or subjective risk measures, points to the significance of including hypotheses from empowerment theory in the study of the psychosocial impacts of toxic contamination. Rich et al. (1995) propose two broad factors to shape empowerment in the case of local environmental hazards. A first factor relates to the community's capacity for responding to the problem (e.g. the presence of community organizations), and a second factor concerns the capacity of formal institutions for involving people in decision making. In this study the action group was a source of social support and an important information channel to many residents. However, the commitment to the action group decreased since people were officially discharged from remediation costs. The lack of institutional basis in the period between this indemnification and the start of the decontamination (four to five years) may have induced a sense of disempowerment. Further, in

Kouterwijk a residents' expert was assigned in order to minimize the stress experience of the residents. Several newsletters were sent and door-to-door visits were organized in order to reduce stressors related to the decontamination of the site. However, what can be learned from this case study is that stressors cannot relate only to the risks or decontamination as such, but must also relate to a sense of exclusion from decisions about the criteria that legitimate risk regulation. In other words, we think future research is needed to examine the possibilities and limits of deliberative interventions in the pre-impact phase.

In this study demographic characteristics and education level were similar in Kouterwijk and the non-exposed group and so could not account for differences in mental health status. However, income level and presence of children could also be examined in future research. Other limitations of the present study concern the role of physical health status and specific life-style variables (e.g., drinking, smoking) as relevant matching variables in addition to socio-demographic factors. Furthermore, it should be noted that the sample size of this study is small and that some site-specific measures were short scales or single-item variables. In order to generalize our interpretations it would be useful to compare these findings with other case studies. Nevertheless, with the results presented here we believe we have obtained a better understanding of the psychosocial impacts amongst Kouterwijk's residents, and we hope to have raised some new issues in the rather unexplored sub-area of the mental health effects of living on chemically polluted soil.

References

- Aronoff, M., & Gunter, V. (1992). Defining disaster: Local constructions for recovery in the aftermath of chemical contamination. *Social Problems, 39*(4), 345–365.
- Arrindell, W. A., & Ettema, J. H. M. (1986). *SCL-90: Handleiding bij een multidimensionele psychopathologie-indicator*. Lisse: Swets, Test Publishers.
- Baum, A., Fleming, R., & Davidson, L. M. (1983). Natural disaster and technological catastrophe. *Environment and Behavior, 15*(3), 333–354.
- Baum, A., Fleming, R., & Singer, J. E. (1985). Understanding environmental stress: Strategies for conceptual and methodological integration. In A. Baum & J. E. Singer (Eds.), *Advances in environmental psychology* (Vol. 5, pp.185–207), Hillsdale, NJ: Erlbaum Associates.
- Baum, A., Fleming, I., Israel, A., & O’Keeffe, M., K. (1992). Symptoms of chronic stress following a natural disaster and discovery of a human-made hazard. *Environment and Behavior, 24*(3), 347–365.
- Baxter, J., Eyles, J., & Elliot, S. (1999). ‘Something happened’: The relevance of the risk society for describing the siting process for a municipal landfill. *Geografiska Annaler, 81 B*(2), 91–109.
- Beck, U. (1992). *Risk society: Towards a new modernity*. London: Sage.
- Beck, U. (1994). The reinvention of politics: Towards a theory of reflexive modernization. In U. Beck, A. Giddens, & S. Lash (Eds.), *Reflexive modernization: Politics, tradition and aesthetics in the modern social order*. Stanford, CA: Stanford University Press.
- Buziarsist, J., Demarest, S., Gisle, L., Tafforeau, J., Van der Heyden, J., & Van Oyen, H. (2005). *Health interview survey Belgium, database 1997–2001*. Scientific Institute of Public Health, Unit of Epidemiology.
- Couch, S. R., & Kroll-Smith, J. S. (1985). The chronic technical disaster: Toward a social scientific perspective. *Social Science Quarterly, 66*, 564–575.
- Derogatis, L. R., Lipman, R. S., & Covi, L. (1973). SCL-90: An outpatient psychiatric rating scale—preliminary report. *Psychopharmacology Bulletin, 9*, 13–27.
- Dunn, J. R., Taylor, S. M., Elliot, S. J., & Walter, S. D. (1994). Psychosocial effects of PCB contamination and remediation: The case of Smithville, Ontario. *Social Science and Medicine, 39*, 1093–1104.
- Edelstein, M. R. (2004). *Contaminated communities: The social and psychological impacts of residential toxic exposure* (2nd ed.). Boulder, CO: Westview.
- Elliot, S. J., Taylor, S. M., Hampson, C., Dunn, J., Eyles, J., Walter, S., et al. (1997). It’s not because you like it any better . . . : Residents’ reappraisal of a landfill site. *Journal of Environmental Psychology, 17*, 229–241.
- Elliot, S. J., Taylor, S. M., Walter, S., Stieb, D., Frank, J., & Eyles, J. (1993). Modelling psychosocial effects of exposure to solid waste facilities. *Social Science and Medicine, 37*(6), 791–804.

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- Erikson, K. T. 1991. A New Species of Trouble. In S. R. Couch & J. S. Kroll-Smith (Eds.), *Communities at risk: Collective responses to technological hazards* (pp. 11–29). New York: Peter Lang.
- Gerling Consulting Group Europe (1999). Descriptive soil research in the Kouterwijk, Sint Amands, under the authority of The Public Waste Agency of Flanders (OVAM). Antwerp, Belgium.
- Giddens, A. (1990). *The Consequences of Modernity*. Cambridge: Polity.
- Gill, D. A., & Picou, J. S. (1998). Technological disaster and chronic community stress. *Society and Natural Resources*, 11, 795–815.
- Goldberg, D. P., Oldehinkel, T., & Ormel, J. (1998). Why GHQ threshold varies from one place to another. *Psychological Medicine*, 28, 915–921.
- Grasmück, D. & Scholz, R., W. (2005). Risk Perception of Heavy Metal Soil Contamination by High-Exposed and Low-Exposed Inhabitants: The Role of Knowledge and Emotional Concerns. *Risk Analysis* 25, 3, 611–622.
- Gunter, V. J., Aronoff, M., & Joel, S. (1999). Toxic contamination and communities: Using an ecological-symbolic perspective to theorize response contingencies. *The Sociological Quarterly*, 40(4). 623–640.
- Hadden, S. J. (1991). Public perception of hazardous waste. *Risk Analysis* 11, 47–57.
- Havenaar, J. M., de Wilde, E. J., van den Bout, J., Drottz-Sjöberg, B. M., & van den Brink, W. (2003). Perception of risk and subjective health among victims of the Chernobyl disaster. *Social Science & Medicine*, 56, 569–572.
- Irwin, A., Dale, A., & Smith, D. (1996). Science and Hell's kitchen: the local understanding of hazard issues. In A. Irwin & B. Wynne (Eds.), *Misunderstanding science? The public reconstruction of science and technology*, Cambridge, UK: Cambridge University Press.
- Irwin, A., Simmons, P., & Walker, G. (1999). Faulty environments and risk reasoning: The local understanding of industrial hazards. *Environment and Planning A*, 31, 1311–1326.
- Kroll-Smith, J. S. & S. R. Couch. (1991). "What is a disaster? An ecological-symbolic approach to resolving the definitional Debate." *International Journal of Mass Emergencies and Disasters*, 9(3), 355–366.
- Latour, B. (2003). Is re-modernization occurring—and if so, how to prove it? *Theory, Culture & Society*, 20(2), 35–48.
- Lazarus, R. S., & Folkman, S. (1984). *Stress, Appraisal, and Coping*. New York: Springer.
- Levine, M., & Perkins, D. (1987). *Principles of Community Psychology: Perspectives and Applications*. New York: Oxford University Press.
- Lidskog, R. (1993). A review of Ulrich Beck's 'The risk society. Towards a new modernity'. *Acta Sociologica*, 36, 400–403.
- Lidskog, R. (1996). In science we trust? On the relation between scientific knowledge, risk consciousness and public trust. *Acta Sociologica*, 39, 31–56.

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- Lima, M. L. (2004). On the influence of risk perception on mental health: Living near an incinerator. *Journal of Environmental Psychology, 24*, 71–84.
- Luginaah, I., Taylor, M., Elliot, S., & Eyles, J. (2002). Community responses and coping strategies in the vicinity of a petroleum refinery in Oakville, Ontario. *Health & Place, 8*, 177-190.
- Luhmann, N. (1993). *Risk: A sociological theory*. Berlin, New York: Walter de Gruyter.
- Matthies, E., Höger, R., & Guski, R. (2000). Living on polluted soil: Determinants of stress symptoms. *Environment and Behavior, 32*, 270–286.
- McDaniels, T., Axelrod, L., & Slovic, P. (1995). Characterizing perception of ecological risk. *Risk Analysis, 15*(5), 575–588.
- Mol, A., & Spaargaren, G. (1993). Environment, modernity and the risk-society: the apocalyptic horizon of environmental reform. *International Sociology, 8*(4), 431–459.
- Morgan, D. L. (1998). Practical strategies for combining qualitative and quantitative methods: Applications to health research. *Qualitative Health Research, 8*(3), 362–376.
- Perkins, D., D., & Zimmerman, M, A. (1995). Empowerment theory, research, and application. *American Journal of Community Psychology, 23*(5), 569-579.
- Picou, J. S., Gill, D. A., Dyer, C. L., & Curry, E. W. (1992). Disruption and stress in an Alaskan fishing community: Initial and continuing impacts of the Exxon Valdez oil spill. *Industrial Crisis Quarterly, 6*, 235–257.
- Pukkala, E., & Pönkä, A. (2001). Increased incidence of cancer and asthma in houses built on a former dump area. *Environmental Health Perspectives, 109*, 1121–1125.
- Rappaport, J., & Seidman, E. (Eds.) (2000). *Handbook of Community Psychology*. New York: Kluwer Academic/Plenum Publishers.
- Rayner, S., & Cantor, R. (1987). How fair is safe enough? The cultural approach to societal technology choice. *Risk Analysis, 7*, 3-13.
- Rich, R., C., Edelstein, M., Hallman, W., K., & Wandersman, A., H. (1995). Citizen participation and empowerment: The case of local environmental hazards. *American Journal of Community Psychology, 23*(5), 657-676.
- Scholz, R., & W., Tietje, O. (2002). *Embedded case study methods. Integrating quantitative and qualitative knowledge*. London: Sage Publications Ltd.
- Sjöberg, L. (1999). Consequences of perceived risk: demand for mitigation. *Journal of Risk Research, 2*(2), 129–149.
- Slovic, P. (1987). Perception of Risk. *Science, 236*, 280–285.
- Tulloch, J., & Lupton, D. (2003). *Risk and everyday life*. London: Sage Publications Ltd.
- Tyler, T. R. (1994). Psychological models of the justice motive: antecedents of distributive and procedural justice. *Journal of Personality and Social Psychology, 67*, 850–863.

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Van der Pligt, & De Boer, J. (1991). Contaminated soil: Public reactions, policy decisions, and risk communication. In R. E. Kasperson (Ed.), *Communicating risks to the public. Technology, risk, and society*. Dordrecht: Kluwer Academic Publishers.

Van der Pligt, J., & De Vries, N. K. (1995). *Opinies en attitudes. Meting, modellen en theorie*. Amsterdam: Boom.

Vrijheid, M. (2000). Health effects of residence near hazardous waste landfill sites: A review of epidemiologic literature. *Environmental Health Perspectives*, 108(1 Suppl), 101–112.

Wakefield, S., & Elliot, S. J. (2000). Environmental risk perception and well-being: Effects of the landfill siting process in two southern Ontario communities. *Social Science and Medicine*, 50, 1139–1154.

Wandersman, A. H., & Hallman, W. K. (1993). Are people acting irrationally? Understanding public concerns about environmental threats. *American Psychologist*, 48(6), 681–686.

Weber, O., Scholz, R. W., Bühlmann, R., & Grasmück, D. (2001). Risk perception of heavy metal soil contamination and attitudes toward decontamination strategies. *Risk Analysis*, 21(5), 967–976.

Wilkinson, I. (2001). *Anxiety in a Risk Society*. London and New York: Routledge.

Wynne, B. (1992). Misunderstood misunderstanding: Social identities and public uptake of science. *Public Understanding of Science*, 1, 281–304.

Zimmerman, M., A. (1995). Psychological empowerment: issues and illustrations. *American Journal of Community Psychology*, 23(5), 581-599.

CHAPTER 6: CONCLUSION AND DISCUSSION

« Throughout history, critical voices have spoken out to condemn human being's powerlessness and alienation. They recognized that the only effect of the cult of suffering is to reconcile people to their existence. Otherwise suffering has no intrinsic meaning. Indeed, humanity has advanced not through suffering but by struggling: in many cases, by struggling against the conditions where people were forced to suffer. Today, such critical voices are overwhelmed by those who seem to want to revel in their alienation; since society reminds us that it is our powerlessness that we have in common, suffering seems to be the main inspiration for the sense of community. It is a collective sense but the collective sense of resignation (Furedi, 1997: 175). »

Sociology and nature: the general context of this dissertation

This dissertation started with a discussion about the location of society outside nature's boundaries by mainstream sociology. To breach the taken for granted concerning the establishment of a 'sociology as if nature does not matter' attention was paid to the intellectual and historical climate in which sociology developed as a discipline. Firstly, we pointed to the potential role of religious beliefs wherein people are viewed as separate from and superior to the rest of nature (cf. White, 1967). In addition, it was shown that thoughts about endless social progress and indifferent attitudes toward nature were sustained during the age of exuberance and the age of reason. During the industrial and post-industrial era, advances in production process, science, and technology further enhanced people's feeling of immunity to ecological conditions (Catton & Dunlap, 1978, 1980). Further, some factors distinctive to the sociological discipline were discussed. These related to the dominant sociological traditions that excluded the sociological study of societal-environmental interactions. Firstly, although the Durkheimian tradition and its social-facts thesis created a niche for sociology, sociologists' conclusion that social actions should not be explained by non-social facts induced the development of a purely social sociology (Catton & Dunlap, 1978). Secondly, as the adherents of the Weberian tradition focussed on the social definitions and perceptions about social and non-social phenomena, attention was deflected from materiality and the hybrid side of life.

Although sociology's inattention for the natural was functional to enter upon the struggles with other scientific disciplines during the days of its founding fathers, today, it was argued, sociologists' human exceptionalism paradigm

should be abandoned. Sociological inquiry that cannot find a place for ecological parameters, is a sociology that is incapable to cope with some of the most important dimensions of our contemporary world (Lockie, 2004). Only too often, sociologists identify with a certain compartment of the sociological enterprise while they are unaware of or indifferent to the program that holds these compartments together. Although we agree that sociologists should proceed with the study of those aspects that differentiates sociology from other disciplines (i.e. in our view: the social construction, the use, and the impact of social forces), and although we acknowledge that interdisciplinarity presupposes disciplines (cf. Abbott, 2001), it was argued that the best way to be exempted from methodological individualism and social determinism is to accept interdisciplinary research to address those problems that transcend disciplinary boundaries.

From the 1970s onwards, some sociologists followed the interdisciplinary path as they increasingly confronted 'new species of trouble' such as social-ecological problems. However, when environmental sociology developed as a subdiscipline, the real subject matter was under dispute. Dissension arose between sociologists of environmental issues and real environmental sociologists. The former searched for the social correlates of environmental actions and concerns and the 'real environmental sociologists' examined the role of ecological constraints. Although efforts were made to abandon the distinction between both types of environmental sociology (cf. Buttel, 1987), the relative importance of the symbolic and non-symbolic effects of environmental conditions is still discussed between environmental constructivists and realists. Constructivist environmental sociologists are influenced by the Weberian tradition (i.e. the exploration of contrasting definition of natural phenomena or 'natures'), and realist environmental sociologists translate the Durkheimian tradition in some sort of ecological structuralism by explaining the social by 'the pure and objectively measurable natural'. Next to an intra-subdisciplinary polarisation in the epistemological sphere, the Durkheimian-Weberian distinction seemed to recur in the theoretical and methodological approach of environmental sociologists. In particular, although we acknowledged an overlap between European and US environmental sociology, we noted with others (Mol, 2006; Dunlap, 2002) a division of labour between the empirical and quantitative tradition in N-American environmental sociology, and the more theoretical and qualitative approach in Europe.

The conclusion that intra disciplinary debates end up recapitulating old lines of dispute, was linked to Abbott's notions of fractal distinctions (e.g. realism versus constructivism, quantitative versus qualitative research, etc.) and the idea of 'microcosm', i.e.: the idea that a subset of a larger unit contains scaled-down versions of structures and processes in the larger unit. However, rather than concluding that science is not cumulative and that social scientific reasoning is destined to be cyclical, new directions were postulated in the epistemological/theoretical field on the one hand, and in the methodological/empirical field on the other hand. In particular, an ecological-symbolic approach (Kroll-Smith & Couch, 1991, 1993) was introduced to study the importance of social and ecological parameters in empirical reality. In addition, a methodological pluralist stance was defended. Next to the importance to include social and ecological data, it was argued that mixed-method designs could be a valuable alternative for the one-sided use of qualitative or quantitative research methods. This program was specified by conducting an intensive research about social-environmental interactions relating to the problem of soil contamination in a Flemish neighbourhood.

In what follows, the empirical results of the study will be summarized. In addition, the limitations of this study and the methodological implications will be considered. Subsequently, based on the empirical results, attention is paid to the policy implications. Finally, niches for future research are explored and the theoretical implications will be discussed.

Summary of the empirical results

This dissertation was build on two main research objectives, i.e.: i) to investigate social and ecological correlates of residents' risk judgements and to compare residents' meanings of risk with experts' risk assessments, and ii) to examine the association between residents' psychosocial health and risk-related variables, the process of soil decontamination, and public participation. These research objectives were examined in four empirical papers:

In the article 'Tumbling into the expert-lay gap: Understanding risk disbelief in a contaminated neighbourhood' we firstly discussed the dominant social theories of

risk, i.e.: the psychometric paradigm, the theory of the risk society, and cultural risk theory. After we explored their basic assumptions and specific critiques, we focussed on a limitation underlying all of them, i.e.: the a-contextual nature of these theories. Further, concerning empirical risk research we noted that, despite environmental risks have been studied thoroughly by social scientists, these empirical studies were largely based on large-scale surveys that rarely consider the importance of context-dependency. In addition, studies that explore experts' definitions of the situation and their relations to residents' risk evaluations seemed to be scarce. Further, based on our literature review we concluded that little is known about risk perceptions of chemicals when it is placed on the agenda by public authorities and when non-experts rather than experts tolerate these risks. In response to the a-contextual nature of the dominant theoretical and empirical studies about environmental risks, we build on interpretative risk research to understand residents' low concerns about the physical health risks of the chemicals in the Kousterwijk's soil. By examining residents' and experts' interpretations of not only the hazard, but the social dimensions of risk that shape those interpretations, several in-depth explanations for residents' risk disbelief were discussed. In a first part of the analysis, attention was paid to the context in which the risks were socially constructed. The residents questioned the timing of the announcement of the contamination. They had been living in the Kousterwijk for several years and suddenly they were 'at risk'. The residents questioned this sudden change and felt suspicious about regulators' claims. Although several people admitted that they knew the ecological history of their neighbourhood, when residents moved into the community during the 1970s and 1980s, environmental issues and soil contamination in particular was not a main political issue. People's astonishment was strengthened when some of the residents realized that the amplification of the risks was only months after the end of the liability of the local government to permit the allotment. Next to factors that relate to the political context, residents' disbelief about the chemical's risks for their physical health and the environment was explained by their perceived controllability of the exposure routes. Moreover, conflicting risk definitions and disagreements between experts about the need to decontaminate induced a decline in difference to scientific knowledge and provided further support for residents' experience-based knowledge. As a result, it was concluded

that limits of expert-knowledge rather than the cognitive limitations of non-experts enhanced people's risk disbeliefs.

In the article 'Hazard perception, risk perception and the need for decontamination by residents exposed to soil pollution: The role of sustainability and the limits of expert knowledge' quantitative data were used to examine people's hazard perception, risk perception and their perceived need for decontamination. The previous qualitative study aimed at giving a thick description of the responses of the residents. The data from the survey provided more detailed information on the distribution and the relative importance of the potential determinants of residents' risk judgements. In chapter 2 it was shown that several people perceived to control the exposure routes. As such, a distinction was made between physical health risks on the one hand, and the seriousness of the contamination as it is irrespective of risk decisions on the other hand. Further, given the potential gap between cognitions and actions, and the importance to study policy-related variables next to risk perceptions (i.e. variables that relate to people's actions or their willingness to act), we examined people's demand for risk mitigation. Although the inclusion of the variables was partially based on the results of the qualitative study (cf. the importance of the limits of expert knowledge), this article was more explicitly driven by theory than the qualitative study. However, in contrast to what one might think intuitively, 'theory-driven research' did not refer to 'purely deductive research'. Quite the contrary, in this paper a multidisciplinary model was developed (cf. Taylor-Gooby & Zinn, 2006) to explore the extent to which a diverse range of social theories of risk were applicable in a particular context. Key concepts and independent variables were filtered from the scientific-technical theories of risk (i.e. experts' risk assessments), the psychometric approach and the knowledge deficit model (e.g. objective knowledge), the theory of the risk society and reflexive modernization (e.g. trust in the risk management), and cultural risk theory (i.e. thoughts about sustainability). The analyses showed that the public ignorance model (i.e.: the assumption that the best way to bridge differences in risk definitions is by educating laypeople with the experts' hard facts) does not apply to the Kouterwijk case. Only hazard perception was positively related to independently assessed risk if people knew the assessed risk for their property. An increase in so-called 'objective knowledge' brought about changes in the

perception of the seriousness of the contamination but not in the perception of risk or in residents' demand for risk mitigation. Further, the conclusion that residents made a distinction between hazards and physical health risks indicated the presence of a hazard awareness rather than an alarming and action-initiating risk consciousness (cf. Beck, 1992). In addition, it was shown that trust did not operate as a coping mechanism when people's actual or self-estimated knowledge is low (cf. Giddens, 1990). Furthermore, although most people estimated the risks to be low, several residents demanded for risk mitigation. Perceived need for decontamination was positively related to thoughts about sustainability and to the estimated knowledge of scientists, even after it was controlled for hazard and risk perception. Given the persistent nature of residents' risk perception, the impact of the symbolic aspects of risk was emphasized.

In the article 'The process of soil excavation in a community: site-specific determinants of stress perception' the stressful nature of the decontamination of the soil in the Kouterwijk was examined. Based on interview-data with the residents, several site-specific stressors were explored (cf. Vandermoere & Vincke, 2004). Subsequently, structured questionnaires were used to address the extent to which people were concerned about these stressors. As the quantitative data were collected halfway through the excavation of the neighbourhood, decontamination-phase indicated if the residents were still 'exposed to' the chemical risks in their soil. By considering the interaction-terms between decontamination-phase and site-specific concerns related to the recovery, we were able to focus on the stressful nature of the changes in people's natural and built environment as caused by the excavation of the site. The analysis showed that concerns that related to the process of soil excavation associated with the experience of stress only if inhabitants had started with the recovery. The sudden and real transformation of people's environment, rather than the anticipatory fears about these changes, induced higher stress levels. Before the decontamination of the site there were limited visible signals of the contamination. With the exception of a little purple soil in a vacant part of the community, the trees were growing and the flowers were blooming. In addition, although some residents doubted whether to maintain their garden before the decontamination, most of the residents maintained their well-kept gardens or at

least the barest essentials. However, the excavation required the replacement of not only the lawns, plants and flowers, but also the garden houses, drives, mailboxes, and so forth. As a result, the soil excavation drastically changed people's natural and built environment and translated in feelings of inner void. Further, although the expenses to recover the neighbourhood were repaid by the government, the emotional value of some aspects of people's environment could not be counterbalanced by material or financial compensations. In addition, as the excavation of the soil also required the replacement of common walls, several residents complained about inconveniences induced by the violation of their privacy. Next to the decontamination of the neighbourhood the major stressors related to the need for risk-information. However, the conclusion that most residents perceived the risks to be low, suggested that part of the stress did not necessarily result from the uncertainties about the physical health impact of the chemicals. As people's demand for risk-information could relate to people's perception about their agency, rather than to the influence of eco-structures, in a final empirical paper specific attention was paid to people's feeling of participation.

In the article 'Psychosocial health of residents exposed to soil pollution in a Flemish neighbourhood' it was shown that people living on polluted soil in the Kouterwijk, reported a significant lower general mental well being with more sleeping disorders and somatic complaints than subjects from a matched comparison group. In the second part of the analysis, the relations between mental health and the differences in risk-related measures within the affected community were examined in more detail. These analyses indicated that the psychosocial impacts were not related to actual or perceived contamination but to a lack of empowerment through any meaningful participation in the decision by the OVAM to decontaminate the neighbourhood. The irrelevance of the risk measures was in accordance with the findings of the third empirical paper (chapter 4) and was further supported by the finding that residents living on parcels that were already decontaminated reported significantly higher mental health problems than residents who were still 'exposed to' the polluted soil. The results of the qualitative study further helped to interpret the statistical results. In particular, interviews with the residents had shown that, although the action group provided social support to many residents, the commitment to the action

group decreased since people were officially discharged from remediation costs. Initially OVAM informed the residents by newsletters and public meetings. While these had an important information value for several residents, the interviews and several conversations with the residents revealed that the disadvantage of both sometimes overshadowed their benefit as — according to many residents — they excluded real public participation. As people aimed to have more news on their personal property, some residents started characterizing these public meetings as 'control methods' to legitimize some policy (the authority of the source) rather than methods to really empower the people (cf. Irwin, Dale & Smith, 1996). Thus, despite several information channels and sources many people felt powerless in major decisions. To fulfill this need, the policymakers of the OVAM pointed the residents' experts to have more direct contacts with the inhabitants to register the uncertainties and concerns of the residents and subsequently to loop these back to the Public Waste Agency. However, although the residents' expert tried to increase people's participation with regard to the soil decontamination process by home visits, the independent risk communicator was appointed only after the hazards and risks were assessed. As a result, major decisions about the risk assessments and the criteria of risk acceptability were made in advance of public consultation. This lack of participation induced a sense of disempowerment and related to heightened levels of mental distress. In sum, the results in this article indicated that a lack of belief in the necessity of risk mitigation coupled with a lack of citizen participation can be more stressful than the impact of actual and perceived contamination.

Limitations of the study and methodological implications

No research is spared from critique. A first limitation of this study relates to the moments of data collection. Our department was appointed to carry out a sociological research almost five years after the announcement of the contamination. As such, several phases of the decontamination process were completed. The hazards were identified, the risks were assessed, and the decontamination strategy was chosen. In addition, the risk communicator was appointed and several public meetings were organized. Furthermore, as the neighbourhood was built on a dump site and as the former owners were no longer alive, we were not able to address the representatives of the factories

who caused the contamination. To address some of the problems associated with this time lag we drew upon local print media, newsletters, newspaper articles, pictures, and books from the local library. In addition, in the qualitative study some residents were selected by theoretical sampling (e.g., a resident who had been working in one of the factories and knew much about the eco-history of the site, residents who knew the political past of the community, etc.). Further, we included several retrospective questions. Attention was paid to residents' knowledge of the previous industrial activities and their experiences since the allotment of the site. However, given the long period between the moment when most of the residents moved into the neighbourhood and the announcement of the contamination, and between the latter and the moment of data collection, some rich data might still be missing as a result of oblivion or the use of availability heuristics. In addition, the potential role of positive reinterpretations is acknowledged. Although this problem should not be exaggerated, and although we bear in mind the Thomas theorem (i.e. "if men define situations as real, they are real in their consequences"), it is worth mentioning that some people might have underemphasized the presence of chemicals and debris during the allotment and that some of them overemphasized their efforts to level up their terrain with clean soil. Further, during the semi-structured interviews it became clear that residents' risk perceptions did not change in course of time. From the beginning most residents felt suspicious about regulators' claims on the risky situation (cf. chapter 2). However, the stress-experience since the announcement of the contamination was difficult to assess by qualitative data. In the qualitative study we concluded that some of the major stressors related to the risk mitigation rather than the risks as such. As such, the quantitative data were collected when the excavation of the site was halfway. By considering the interaction-terms between decontamination stage and site-specific concerns related to the recovery, we were able to address the stressful nature of the transformation of the neighbourhood as caused by the excavation. Nevertheless, it is acknowledged that the cross-sectional design restricted the study of the potential fluctuations of the psychosocial consequences on the one hand, and the causal relation between variables on the other hand. To address these problems, it is proposed that future research could use longitudinal data.

A second subject of debate concerns the measures as used in the quantitative study. Next to the inclusion of variables relating to current theories of risk, empowerment, and environmental distress, the interviews were used as an input to the site-specific measures of the survey instrument. These context specific measures were often short scales or single-item variables. Although the items of these site-specific variables were based on the qualitative study and discussed with the residents' expert, and despite the items from the survey were clarified door-to-door by the researcher, the disadvantages of measuring the site-specific variables by one-item or short scales was acknowledged in terms of limited information on reliability and validity (cf. Van der Pligt & De Vries, 1995). Further, with respect to the psychosocial measures, there might be discussion about the direction of the relations between context-sensitive and standardized scales which measure more general phenomena. In this case study the dependent variable was considered a general construct (i.e. subjective changes in subjective health) and included site-specific measures (e.g. site-specific concerns) as independents. This choice was motivated by our conclusion that there is a lack of understanding about the effects of site-related concerns on general mental well-being and that there is deficiency of site-specific strategies to temper psychosocial effects. However, it might be argued that general mental well-being can also mediate site-specific concerns. Another ambiguity threatening the stress literature concerns the mind-body distinction (Abbott, 2001). In particular, one possibility is that chemicals influence people's physical health and then induce changes in people's mental health. However, the relation between mental and physical health might also run in the opposite direction. For example, secondary stressors like problems that relate to the process of soil excavation (i.e. the transformation of the environment, lack of participation, etc.) can induce increased stress-levels which in turn could produce physical complaints. Therefore, we propose that future research might consider using non-recursive path-analysis to study the potential presence of reciprocal determinism (i.e. between general mental well being and site-specific concerns, and between mental well-being and physical health status). In addition, new research methods might be applied to understand (rather than statistically explain) the psychosocial impacts. For example, given the severe changes in people built and natural environment as caused by the excavation of the soil, photo-elicitation techniques (e.g. the use of disposable cameras) might be a relevant research tool to

visualize local environmental distress. Further, concerning the use of ecological variables, we did use the urgency classes as defined by an independent expert institution. The use of categorical data resulted from the heterogeneous distribution of chemicals in the Kouterwijk and the conclusion that it was difficult to select one specific ecological parameter from this complex chemical cocktail. Nevertheless, it is acknowledged that future research on social-environmental interactions could benefit from using continuous ecological variables.

Further, we should be cautious about a generalized interpretation of the results. This project was the first social-scientific research exploring the psychosocial health impacts of living on polluted soil in a Flemish neighbourhood. Given the context in which this research developed in general (i.e. research for the Public Waste Agency of Flanders), and the explorative nature of the problem under study in particular, this study aimed to provide more concrete explanations that are less generalizable rather than less concrete explanations that are more generalizable. Nevertheless, some results could apply to other neighbourhoods where people are exposed to chemical contamination. For example, in those cases where people perceive to control the exposure routes (e.g. eating vegetables) and when the risk mitigation strategies require severe changes in people's everyday life (e.g. soil excavation), it is hypothesized that social rather than risk-related variables, and that secondary problems (e.g. clean-up of risks) rather than primary problems (e.g. risk exposure), could be the major causes of environmental distress and community action (cf. Picou et al., 1992; Couch & Mercuri, 2007; Aronoff & Gunter, 1992). In addition, within the context of the reflexive regulation of contaminated communities, the psychosocial effect of a perceived lack of participation in consultation over the contamination problem seems to be plausible when prospects for public participation are limited (Rich et al., 1995; Elliot et. al, 1997; Gunter, Aronoff, & Joel, 1999; Petts, 2004). Further, the conclusion that the knowledge deficit model was not sufficient in the Kouterwijk and that experience-based knowledge can provide a valuable supplement to scientific rationality is consistent with previous case studies as reported in the literature (cf. e.g.: Wynne, 1992; Irwin, Simmons & Walker, 1999). Further, the conclusion that people were not concerned about physical health risks might relate to the more general hypothesis that risk deniers rather than risk alerters could be a silent majority among the public (Sjöberg, 2006).

However, most researchers select those cases whereby experts are the risk-deniers and non-experts the risk alerters. To address the potential presence of this selection effect, it is argued that future research should examine responses to chemical contamination when it is placed on the agenda by public authorities and when citizens are less concerned than the government officials and their consulted experts. On the other hand, it is acknowledged that, next to the detection of socio-ecological laws, we should pay attention to those characteristics peculiar to the dynamics of a community and to differences in the local and national policies in which specific responses are embedded. For example, it could be hypothesized that the danger-risk distinction at the individual or community-level is dependent on the extent to which the problem of chemical contamination in neighbourhoods is placed on the political agenda, i.e.: perceived controllability of the exposure routes might be less important when the problem of soil contamination is relatively more amplified in a particular region, state or country. As the social construction of risk at the community level might relate to the social construction of risk at higher levels (e.g. the national level), future research might use multi-level analyses on the one hand, and comparative methods to explain differences within a particular set of cases on the other hand (cf. Ragin, 1987; Rueschemeyer et al., 1992).

Policy implications: living in a sustainable society?

This dissertation resulted from a research project for the Public Waste Agency of Flanders (OVAM). As noted previously, OVAM wanted to assess "the sociological impact and consequences of the process of soil decontamination, - and the procedures that are being used in particular - on the residents of a neighborhood" (Germonprez, 2001: 10). Although this initial proposal was elaborated more fundamentally by the development of a meta-theoretical frame and the use of several middle-range and grand theoretical perspectives, we agree with others that sociologists should reassume their moral task (Mills, 1959). Moreover, given the increased discovery of new species of trouble posing severe threats for human health and the environment (cf. Erikson, 1991), it seems obvious that this task can be no longer restricted to the search for solutions for social problems but also for social-environmental problems like contaminated communities (cf. Edelstein, 2004).

In a recent article Buttel (2003) points to four mechanisms of environmental reform or improvement: environmental activism and movements, state environmental regulation, ecological modernization (cf. chapter 1), and international environmental governance. Although we could intuitively agree with Buttel when he stated that environmental movements are the most fundamental pillars of environmental reform, the focus of this study does not permit to make general conclusions about the preferred mechanisms for environmental improvement. In particular, rather than looking for the social causes or solutions for the environmental crisis, this study examined the social consequences of a particular social-environmental problem in a specific context (i.e. process evaluation), and how the efficiency of future soil decontaminations in Flemish neighborhoods could be optimized (i.e. plan-evaluation, cf.: Swanborn, 1999). Consequently, the policy implications resulting from this study are empirical grounded and bottom-up rather than theoretical or top-down in nature.

Firstly, this research has shown that the costs of our industrial past not only relate to the risks for our physical health and the environment, but that the post-hoc actions these provoke (e.g., soil excavation) can also have a negative impact on the mental health of people 'exposed to' these environmental dangers. While these results give an additional reason to prevent these environmental dangers from occurring in the first place, we also need to consider the potential social impacts of historical pollution. In a first empirical paper, it was shown that one of the major site-specific stressors related to the transformation of the people's environment (cf. chapter 4). As a result, it is recommended to pay more attention to the follow-up phase (i.e.: psychosocial assistance after the decontamination). Further, as it was shown that people's need for risk information was more stressful than actual and perceived contamination, it is advised to make the process of risk-evaluation more transparent for non-experts. Related to this, risk-regulators and their consulted expert institutions should perform univocal risk-assessments, accelerate the time taken to assess the risks, and are advised to look for ways to communicate about the scientific principles of risk-assessments, about scientific uncertainties, and ignorance. Further, considering the disempowering and stressful consequences of a lack of public

participation (cf. chapter 5), it is recommended to create a platform where people's concerns are effectively accounted for in major decisions.

The latter recommendation is supported by the findings relating to the comparison of residents' meanings of risk with experts' risk assessments (chapters 2), and to the social and ecological correlates of residents' risk judgements (chapter 3). In particular, it was shown that people could make a distinction between physical health risks and the seriousness of the contamination as it is irrespective of risk decisions, that people did not necessarily act irrational by ignoring or tolerating the risks, and that some experts' risk perceptions were closer to people's risk disbelief than to the output of their risk-assessments. The use of instrumental rationality, typical for the prevailing knowledge deficit model in decision-making processes, was not sufficient as an increase in objective knowledge brought about changes in the perception of hazards but not in the perception of physical health risk or in residents' demand for risk mitigation. Consequently, it can be concluded that the knowledge deficit model is ineffective to transcend the expert-lay gap.

The ineffectiveness of the knowledge deficit or public ignorance model confirms with other studies that have shown that science and experimental methods are problematic as a basis for environmental policy-making (Blowers, 1993; Jasanoff, 1993). In reply, there is a growing body of opinion that we need a greener science that is based on the precautionary principle (cf. e.g.: Wynne & Mayer, 1993). The latter principle states that "where an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically" (Wingspread Conference Center, Wisconsin 1998). However, it can be questioned how we can assess 'if an activity raises threats of harm' when there is scientific uncertainty and even ignorance. It is impossible to give someone the benefit of the doubt because scientific uncertainty and ignorance can be used as a lack of proof of harm (cf. the position of the supposed polluter) and as a basis for risk reduction or a suspension of those activities which are supposed to be harmful (cf. the position of groups seeking environmental protection).

Nevertheless, this case study has shown that people's perceived need for decontamination was positively related to thoughts about sustainability and to the perceived limits of experts' knowledge (cf. chapter 3). Hazard and risk

perception also related to people's demand for risk mitigation, yet people's judgements of the physical health risks seemed to be better understood as beliefs. The latter beliefs were actively constructed in the ecological history of the neighbourhood and the broader political context (cf. chapter 2) and are more difficult to change than perceptions or so-called cognitive limitations of lay people. In addition, hazard perception did not significantly relate to risk perception. Further, independently assessed risk and people's knowledge about the risk assessments related to hazard perception but not to people's risk perception or their demand for risk mitigation. As the latter variable is linked more closely to residents' willingness to act, it is recommended to shift the attention from the re-education of the public by technical criteria to social or symbolic matter (i.e. thoughts about sustainability, non-scientific criteria that influence the risk assessments).

In line with the latter policy implication, several scholars called for a democratization of science and expertise by public participation in decision making (cf. Habermas, 1984; Beck, 1990; Dryzek, 2000). The rise of environmental problems or the increased awareness by the lay public of experts' bounded rationality, requires a post-normal science wherein scientific truths are complemented with extended facts such as experts' background assumptions or laypeople's experience-based knowledge of local conditions (cf. Funtowicz & Ravetz, 1992; Wynne, 1992; Irwin, Simmons & Walker, 1999). To reassemble facts and values, and to enhance people's sense of inclusion in consultation over environmental problems, some deliberative strategies to facilitate communicative forms of actions have been suggested (e.g. public meetings, consensus conferences, etc.). In the Kouterwijk, a residents' expert was assigned to function as a flexible interface for the residents and the Public Waste Agency. Several residents had a positive attitude toward the residents' expert and the organisation of home-visits. However, the independent risk communicator was appointed only after some major decisions and judgements were made (e.g. the risk assessments, the decision to decontaminate, etc.). Therefore, it is advised to assign a resident's expert from the first phase of the risk evaluation process (i.e. hazard assessment).

Finally, within the context of the decontamination of historical soil contamination in neighbourhoods, and the mitigation of environmental risks on the initiative of government agencies, it is recommended to develop new public spheres wherein the knowledge and interests of every stakeholder are considered. While the realization of this idea can be an empirical rather than a theoretical question, and although several factors can complicate real consensus, it is argued that the combination of technical and social risk assessments is the only way to bridge the expert-lay gap. Firstly, concerning technical risk assessments, it is argued that scientific rationality may be enhanced by social rationality and vice versa. Secondly, with regard to social risk assessments, it is argued that other than scientific criteria must be deliberately discussed. Further, it is recommended to show how local actions toward risk mitigation by government order are embedded in a broader project on sustainability. A social risk assessment not only points to the need for an assessment of values and interests in a particular risk conflict, but requires a public debate about the concept of 'sustainability'. In sum, within the context of the reflexive regulation of environmental hazards, it is argued that the search for shared meanings about living in a sustainable society is a prerequisite to bridge the expert-lay gap.

Theoretical implications and future research

In a first part of the conclusion the general framework of this dissertation was outlined and the findings of this study were summarized. Subsequently, the methodological and policy implications of the results were discussed. In this final section we go back the theoretical. We will consider the theoretical implications of this study and postulate some final suggestions for future research.

In the first stage of theory development about new species of trouble such as contaminated communities, several scholars paid attention to the distinguishing characteristics of the psychosocial consequences of natural and man-made crises (cf. Baum, Fleming, & Singer, 1983; Couch & Kroll-Smith, 1985). It was argued that natural disasters induce acute distress, whereas the latter induce chronic psychosocial consequences as they develop slowly and persist for a relative longer time. The findings of this study are partially in accordance with this theory. Kouterwijk's residents experienced psychosocial impacts such as

heightened stress levels and sleeping disorders even five years after the discovery of the contaminants. This is in accordance with other case studies about chronic technical disasters (CTD's) that illustrated the chronic nature of the psychosocial effects they induce (Picou et al., 1992; Matthies et al., 2000; Couch & Mercuri 2007). In addition, followers of the CTD-perspective assumed that the uncertainties surrounding the human and environmental effects of exposure to chemical contaminants induce conflicting claims about the situation between victims, likely to result in a decrease of social cohesion and people's sense of community (Couch & Kroll-Smith, 1985; Freudenburg 1997; Picou, Marshall, & Gill, 2004). It is argued that people's shared meanings about natural disruptions cause the development of therapeutic communities, whereas man-made or hybrid crises induce corrosive communities (Freudenburg 1997). In contrast, the findings of the study show that hazardous events related to the human interference with the natural and built environment can induce a corrosive expert culture where experts highly disagree about the risks. Besides, several residents said they experienced a positive increase in social contacts. Before the announcement of the contamination they talked about the weather, but since then they had common interests, both in the financial sphere (e.g., to rebuild the common walls) and in the mental sphere, that is as a problem and an emotional coping strategy (e.g., providing information to one another, talks about other problems to forget one's worries, etc.). As such, it is suggested to broaden the CTD perspective as it has been shown that man-made risks may induce a corrosive community among the experts, and that people may still experience chronic environmental distress, despite their increased sense of community.

In a second stage of theory development, previous research has used an ecological-symbolic approach (ESA) to study the variation among several man-made risks and the specific dynamics within a particular context (Kroll-Smith & Couch, 1991, 1993; Picou et al., 1992; Gunter, Aronoff, & Joel, 1999; Zavestoski et al., 2002; Ritchie & Gill, 2007). An ESA proposes to study "the reciprocal impacts of physical agents on built, modified, and natural environments and the effects that human perceptions of those impacts have on social structure" (Kroll-Smith & Couch, 1993: 48). In the Kouterwijk there were two 'non-social stimuli'. A first one concerned the chemicals and its potential effects on people's gardens and their physical health, and a second one related to the impact of the

decontamination of the neighbourhood on the natural and built environment. The findings of this study show that (appraisals of) secondary problems caused by the social construction of risk can be more disruptive than the threat of the contamination itself. Although the local social changes were limited because the residents collectively defined the situation as hazardous, yet risk-free with regard to physical health impacts, several people experienced increased levels of distress. The latter were caused by social concerns (e.g. lack of public participation) and environmental factors (i.e. the transformation of the environment as caused by the decontamination). However, concerns about the impact of the chemicals on people's health and their gardens did not relate to the psychosocial disruptions. In other words, the social and cultural system rather than the presence of natural hazards were the primary stressors. Nevertheless, the presence of chemicals and its social construction induced changes in people's built environment that in turn caused psychosocial impacts. These results fit to the reciprocal nature of the ecological-symbolic perspective as it attempts to show that "stressors are created in the interaction between environmental conditions and the need to interpret those conditions" (Kroll-Smith & Couch, 1993: 67).

Furthermore, in this study the ESA was used to examine residents' hazard and risk perception and their demand for risk mitigation. Attention was paid to how people experience environmental risk and hazards in everyday life, how a local environmental risk network consists of social and non-social factors, and how these factors relate to each other. Previous research examined the ecological part of the ESA by paying attention to several types of environments, yet in this study attention was paid to the variation in ecological data within the affected community. By doing so we observed that ecological parameters only related to people's hazard awareness. Risk perception and need for decontamination (which is more closely linked to people's willingness to provoke socio-environmental changes), did not relate to the nature of the threat. Thus, the impact of the symbolic rather than ecological aspects of risk came to the fore, both concerning psychosocial consequences and people's risk judgements. From this some environmental sociologists would probably find support for their (strong) social constructivist program. However, although social constructions were of major importance to understand people's responses, these social constructions referred to meanings about something from the non-social

environment (polyaromatic hydrocarbons, cranes, garden houses, etc., cf. Hacking, 1999). Moreover, the generalisation of particular findings to a preferred ontological or epistemological position runs the risk to sustain fractal distinctions (e.g. constructivism/realism, see Abbott, 2001). Therefore, it is argued that we need more empirical studies about the variation of the interdependence between social and ecological parameters, rather than more abstract discussions about the ontological state of the environment.

In what is termed the 3rd stage of theory development, it is proposed to extent the scope of the ESA. In particular, previous studies about chemical contamination mainly focussed on victim responses. This resulted from the lack of attention by technical risk analysts and regulators for the psychological and social impacts of chemical contamination. By doing so, however, several scholars seemed to forget that the ESA also encourages social scientists to consider man-made risks as political drama (cf. Kroll-Smith & Couch, 1993). The results of this case study underscore the importance of this broader political context. It was shown that the process of risk-assessment is not a purely scientific affair. Facts, values, and self-interests intermingle and disagreements between experts about risk and risk mitigation enhanced people's risk disbelief. These findings imply that future research that considers victim and experts' responses could be more suitable to understand local social changes and the psychosocial impacts resulting from the expert-lay gap. In addition, we think that more attention could be paid to the presence of corrosive expert cultures and the extent to which communicative forms of actions can increase people's resources to cope with chemical contamination. Future research might also examine to what extent the limits of deliberative methods induce 'normal environmental distress'. Parallel to Perrow's (1984) concept 'normal accidents' that refers to the inevitable occurrence of technological catastrophe, the concept 'normal environmental distress' could be used to refer to the inevitable and negative psychosocial effects of new species of trouble (Erikson, 1991). In sum, it is argued that empirical studies about conflicting definitions between as well as within experts and lay people will be more appropriate to understand the changeable and unchangeable nature of the psychological and social consequences of chronic technical crises.

Next to the inclusion of ecological data and the study of victim and experts' definitions, in the 3rd stage of theory development it was proposed to include a range of theories that can assist the ESA in understanding the complexity of human responses to chemical contamination. Firstly, with respect to psychosocial impacts, previous research has emphasized the relation between objective risk and environmental distress. This relates to Beck's version of the risk society (Beck, 1992, 1994) as his thesis suggests that the perceived pervasiveness of risks causes risk-aversion and anxiety among the public. Further, whereas the risk society framework assumes that people's risk consciousness reflect the 'real risks', environmental stress theory acknowledges that risk perception can induce psychosocial effects regardless of the presence of risks 'out there'. The findings of this study, however, vastly differ from both theories. The psychosocial effects in the Kousterwijk associated with the transformation of the neighbourhood as caused by the decontamination of the site (cf. chapter 4), and a lack of citizens' involvement in the decisions embedded in the process of risk regulation (cf. chapter 5), rather than with actual and perceived exposure. This implies that more attention should be paid to the stressful nature of secondary problems (e.g. risk mitigation, conflicts between victims and experts). In addition, future research could consider research questions derived from community psychology in general and empowerment theory in particular (e.g. what kind of deliberative methods are best suited to shape empowerment in a diverse range of local environmental hazards).

Further, this study paid attention to some specific hypotheses derived from the psychometric paradigm (Slovic, Fischhoff, & Lichtenstein, 1980; Slovic, 1987). The adherents of this approach attempt to explore the relation between risk perception and a diverse range of risk dimensions (catastrophic potential, newness, etc.). In this study we focussed on the role of knowledge and personal exposure. Firstly, the psychometric paradigm assumes a challenge response model by pointing to the positive relation between personal exposure and risk perception. Secondly, the psychometric paradigm assumes a knowledge deficit model because it considers differences between expert and lay perceptions to be a consequence of laypeople's lack of knowledge (Jasanoff, 1998). The findings of this study, however, conflict with both models. Independently assessed risk, objective knowledge, and self-estimated knowledge did not significantly relate to risk perception. The resulting policy implications have been discussed in the

previous section, yet the latter results have also theoretical relevance. Firstly, this study shows that the relations between ecological variables and the appraisals of those variables depend on the local context in which those appraisals are embedded. This contradicts with the psychometric risk studies that attribute the variation in the mean scores of perceptions of a broad spectrum of risks by definition to risk characteristics. Further, the conclusion that knowledge variables seem to be of limited importance to understand residents' risk perceptions indicates that we should consider independent variables that relate to the social and political context. In addition, up to now the psychometric paradigm has mainly focussed on risk perception as a dependent variable. However, this study has shown that risk perceptions can be different from people's demand for risk mitigation. The conclusion that the psychometric paradigm fails to bridge the gap between cognitions and social actions on the one hand, and the limited importance of cognitions and hazard characteristics on the other hand, asks for sociological theories of risk.

Next to theories about natural versus man-made risks, environmental distress, empowerment, and the psychometrics of risk, we used two prominent sociological theories of risk: cultural risk theory and the risk society framework. Firstly, by focussing on supra-individual factors (i.e. grid and group characteristics), Douglas' and Wildavsky's cultural theory directed the attention to socio-cultural aspects of risk-perception and behaviour. The latter would be induced by cultural bias that relate to several ways of life (i.e. individualists, egalitarians, hierarchists and fatalists, cf. Douglas & Wildavsky, 1982). However, based on previous research and critiques (e.g.: Wynne, 1992; Sjöberg, 2000; Lash, 2001), we argued that this theory is too static to be useful. Therefore we used cultural theory's mobile version that assumes that cultural theory should be limited to explaining risk judgements in a particular context (Rayner, 1992). In this study it was shown that demand for risk mitigation positively related with thoughts about sustainability. Although measured at the individual level, thoughts about sustainability closely relate to the underlying assumptions of the egalitarian versus non-egalitarian groups. Additional research is needed to examine to the relevance of other distinctions in a diverse range of risk situations. Further, it is suggested that future research could not only test the four-part typology in particular settings, but look for the relative importance of specific distinctions according to the nature of the threat. In addition, and what is

perhaps more important, is that future research should consider how environmental hazards and its social constructions induce changes in people's life-style (cf. Edelstein, 2004), rather than examine how fixed ways of life influence people's appraisals of environmental hazards.

One of the prominent sociological theories of risk that concentrate at the impact of new environmental hazards on our risk consciousness is the risk society thesis (Beck, 1992, 1994). Briefly stated, the latter theory assumes that, whereas the main issue in the first modernity concerned the distribution of wealth, in the second modernity people increasingly confront new manufactured uncertainties (cf. Giddens, 1990). During this societal change people's class consciousness is replaced by a risk consciousness that operates as a source of risk-related anxieties as well as a catalyst for social change (Ekberg, 2007). In Beck's view people's risk consciousness "reflects 'real risk' just as 'class consciousness' was said to reflect 'real class inequality'; 'being' still 'determines consciousness' in the risk society (despite Beck's protestations to the contrary)" (Scott, 2000: 38). As such, Beck's thesis can be better labelled as a 'risk-averse society' or an 'angst society' (Scott, 2000). Further, whereas Beck emphasizes a decline in deference to scientific knowledge, in Giddens view trust in expert-systems (i.e. faceless trust) becomes a substitute for knowledge. However, in this study it was firstly shown that people's psychosocial health was influenced by social factors rather than real risks. In addition, environmental hazards and the social construction of risk produced a hazard awareness rather than an alarming risk consciousness. Further, as several people distrusted expert-knowledge and perceived to control the exposure-routes, people gave the benefit of the doubt to their experience-based knowledge rather than to the output of experts' risk assessments. These results indicate that this case study is not a case of the risk society. From this it is not concluded that by definition the risk society thesis and its variants (cf. Beck, Giddens & Lash, 1994) is useless or wrong. However, these results show that future research needs other than risk society perspectives to understand people's responses to a variety of risk-situations.

A sociological theory of risk that can assist the latter program is Frank Furedi's *Culture of Fear* (1997). Unlike most other writings about the growth of a risk consciousness, Furedi questions the attempt to relate people's risk consciousness to the rise of new environmental risks. In contrast to Beck, he points to the link between risk consciousness and the rise of a new etiquette

whereby "the absence of certainty underwrites the message of caution that in turn justifies itself through the continuous inflation of risks" (Furedi, 1997: 150). In his view, differences between good and evil are increasingly replaced by the technical language of risk management. According to Furedi, this new perspective of safety and the message of caution denigrate people's problem-solving potential and enhance people's feelings of powerlessness. Although Furedi's theory may sound provocative to environmental activists and the adherents of what Dunlap and Catton called a 'real environmental sociology', it was argued previously that the interdependence between social and ecological variables (rather than the presence of natural agents) is ultimately an empirical question. Indeed, in this study the concerns of many residents related to moral rather than environmental issues. Specifically, people did not worry about physical health risks in part because they perceived to control the exposure routes (i.e. the role of agency). In addition, residents higher levels of distress related to a lack of belief in the necessity of risk mitigation coupled with a lack of citizen participation (i.e. an undervaluation of agency). Given the indeterminate, invisible, and chronic nature of the threat, the regulators and their consulted experts were not able to prove the risks (rather than the presence of chemicals) and to justify their decision to decontaminate (i.e. a lack of scientific principles or structures). Ultimately, this lack of proof was replaced by an invisible structure (i.e. the precautionary principle). The people from the Kousterwijk questioned the sudden regulation of chemicals and government's decision to decontaminate because it was not only based on an assessment of invisible threats but, more importantly, on the application of an invisible principle. Thus, different from the development of a risk consciousness in a risk society, this case study suggests that people may offer resistance to a culture of fear. As a result it is argued that, next to the inclusion of ecological variables, future research can benefit from the empirical assessment of the role of moral issues in terms of structure-agency relations. Moreover, if Furedi's *Culture of Fear* is the antithesis of Beck's *Risk Society* thesis we think that future research should provide new directions for a synthesis. Although there could be different ways to attain this goal, it is postulated that the main idea behind structuration theory (i.e. "structure is both medium and outcome of the reproduction of practices", cf.: Giddens, 1979:5) can be useful to transcend Furedi's hope for more agency on the one hand, and Beck's emphasis on the rise of new eco-structures on the other hand. In

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particular, what we have learned from this case study is that a substitute structure (i.e. the precautionary principle) should be a medium to act locally rather than a self-evident external structure.

References

- Abbott, A. (2001). *Chaos of disciplines*. Chicago: University of Chicago Press.
- Aronoff, M., & Gunter, V. (1992). Defining disaster: Local constructions for recovery in the aftermath of chemical contamination. *Social Problems, 39*(4), 345–365.
- Baum, A., Fleming, R., & Singer, J. E. (1983). Coping with victimization by technological disaster. *Journal of Social Issues, 39*(2), 117-138.
- Beck, U. (1992). *Risk society: Towards a new modernity*. London: Sage.
- Beck, U. (1994). The reinvention of politics: Towards a theory of reflexive modernization, in: U. Beck, A. Giddens, & S. Lash (Eds.), *Reflexive modernization: Politics, tradition and aesthetics in the modern social order*. Stanford, CA: Stanford University Press.
- Blowers, A. (1993). *Planning for a sustainable development*. London: Earthscan.
- Buttel, F. (1987). New directions in environmental sociology. *Annual Review of Sociology, 13*, 465-488.
- Buttel, F. (2003). Environmental sociology and the explanation of environmental reform. *Organization & Environment, 16*(3), 306-344.
- Catton, W. & Dunlap, R. (1978). Environmental sociology. A new paradigm. *The American Sociologist, 13*(1), 41-49.
- Couch, S. R., & Kroll-Smith, J. S. (1985). The chronic technical disaster: Toward a social scientific perspective. *Social Science Quarterly 66*, 564–575.
- Couch, S., & Mercuri, E. (2007). Toxic water and the anthill effect: The development of a subculture of distress in a once contaminated community. *Research in Social Problems and Public Policy, 14*, 117-137.
- Catton, W. & Dunlap, R. (1980). A new ecological paradigm for post-exuberant sociology. *American Behavioral Scientist, 24*(1), 15-47.
- Douglas, M., & Wildavsky, A. (1982). *Risk and culture*. Berkeley, CA: University of California Press.
- Dryzek, J. (2000). *Deliberative democracy and beyond: liberals, critics, contestations*. Oxford, New York: Oxford University Press.
- Dunlap, R. (2002). Environmental sociology. A personal perspective on its first quarter century. *Organization & Environment. 15*(1), 10-29.
- Edelstein, M. R. (2004). *Contaminated communities: The social and psychological impacts of residential toxic exposure* (2nd ed.). Boulder, CO: Westview.
- Ekberg, M. (2007). The parameters of the risk society. A review and exploration. *Current Sociology, 55*(3), 343-366.
- Elliot, S. J., Taylor, S. M., Hampson, C., Dunn, J., Eyles, J., Walter, S., et al. (1997). It's not because you like it any better: Residents' reappraisal of a landfill site. *Journal of Environmental Psychology, 17*, 229–241.

Chapter 6: Conclusion and discussion

Erikson, K. T. (1991). A new species of trouble, in: S. R. Couch & J. S. Kroll-Smith (Eds.), *Communities at risk: Collective responses to technological hazards*. New-York: Peter Lang.

Freudenburg, W. (1997). Contamination, corrosion, and the social order: an overview. *Current Sociology*, 45, 19-39.

Funtowicz, S., & Ravetz, J. (1992). Three types of risk assessment and the emergence of post-normal science, in: S. Krimsky & D. Golding (Eds.), *Social theories of risk*. London: Praeger.

Furedi, F. (1997). *Culture of fear: risk-taking and the morality of low expectation*. London: Cassell.

Germonprez, N. (2001). Sociologische opvolging en evaluatie van de betrokkenen bij een bodemsanering in een woonwijk. *OVAM*, bestek SI010901.

Giddens, A. (1979). *Central problems in social theory: Action, structure and contradiction in social analysis*. London: MacMillan.

Giddens, A. (1990). *The consequences of modernity*. Cambridge: Polity press.

Gunter, V., Aronoff, M., & Joel, S. (1999). Toxic contamination and communities: Using an ecological-symbolic perspective to theorize response contingencies. *The Sociological Quarterly*, 40(4), 623-640.

Habermas, J. (1984). *The theory of communicative action. Reason and the rationalization of society* (transl. by T. McCarthy). Boston: Beacon.

Hacking, I. (1999). *The Social Construction of What?* Cambridge: Harvard University Press.

Irwin, A., Dale, A., & Smith, D. (1996). Science and Hell's kitchen: the local understanding of hazard issues. In A. Irwin & B. Wynne (Eds.), *Misunderstanding science? The public reconstruction of science and technology*, Cambridge, UK: Cambridge University Press.

Irwin, A., Simmons, P., & Walker, G. (1999). Faulty environments and risk reasoning: The local understanding of industrial hazards. *Environment and Planning A*, 31, 1311-1326.

Jasanoff, S. (1998). The political science of risk perception. *Reliability Engineering and System Safety*, 59, 91-99

Kroll-Smith, J. S., & Couch, S. R. (1991). What is a disaster? An ecological-symbolic approach to resolving the definitional debate. *International Journal of Mass Emergencies and Disasters*, 9(3), 355-366.

Kroll-Smith, J. S., & Couch, S. R. (1993). Symbols, ecology, and contamination: Case studies in the ecological-symbolic approach to disaster. *Research in Social Problems and Public Policy*, 5, 47-73.

Lash, S. (2000). Risk culture, in: B. Adam, U. Beck, & J. van Loon (Eds.), *The risk society and beyond: Critical issues for social theory*. London: Sage.

Lockie, S. (2004). Social nature: The environmental challenge to mainstream social theory, in: R. White (Ed.) *Controversies in Environmental Sociology*. Cambridge: Cambridge University Press.

Chapter 6: Conclusion and discussion

- Matthies, E., Höger, R., & Guski, R. (2000). Living on polluted soil: Determinants of stress symptoms. *Environment and Behavior*, 32(2), 270-286.
- Mol, A. (2006). From environmental sociologies to environmental sociology? A comparison of US and European environmental sociology. *Organization & Environment*, 19(1), 5-27.
- Perrow, C. (1984). *Normal accidents. Living with high-risk technologies*. New York: Basic Books.
- Petts, J. 2004. "Barriers to participation and deliberation in risk decisions: Evidence from waste management." *Journal of Risk Research* 7(2):115-133.
- Picou, J. S., Gill, D. A., Dyer, C. L., & Curry, E. W. (1992). Disruption and stress in an Alaskan fishing community: Initial and continuing impacts of the Exxon Valdez oil spill. *Industrial Crisis Quarterly*, 6, 235-257.
- Picou, S., Marshall, B., & Gill, D. (2004). Disaster, litigation and the corrosive community. *Social Forces*, 82(4), 1493-1522.
- Ragin, C. (1987). *The comparative method: Moving beyond qualitative and quantitative strategies*. Berkeley: University of California Press.
- Rayner, S. (1992). Cultural theory and risk analysis, in: S. Krimsky & D. Golding (Eds.), *Social theories of risk*. London: Praeger.
- Rich, R., Edelstein, M., Hallman, W., & Wandersman, A. (1995). Citizen participation and empowerment: The case of local environmental hazards. *American Journal of Community Psychology*, 23 (5), 657-676.
- Ritchie, L., & Gill, D. (2007). Social capital theory as an integrating theoretical framework in technological disaster research. *Sociological Spectrum*, 27(1), 103-129.
- Rueschemeyer, D., Stephens, E., & Stephens, D. (1992). *Capitalist development and democracy*. Cambridge: Polity Press.
- Scott, A. (2000). Risk society or angst society? Two views of risk, consciousness and community, in: B. Adam, U. Beck, & J. van Loon (Eds.), *The risk society and beyond: Critical issues for social theory*. London: Sage.
- Sjöberg, L. (2000). Factors in risk perception. *Risk Analysis*, 20(1), 1-11.
- Sjöberg, L. (2006). As time goes by: The beginnings of social and behavioural science risk research. *Journal of Risk Research*, 9(6), 601-604.
- Slovic, P., Fischhoff, B., & Lichtenstein, S. (1980). Facts and fears: Understanding perceived risks, in: R. C. Schwing & W. A. Albers (Eds.), *Societal Risk Assessment*. New York: Plenum Press.
- Slovic, P. (1987). Perception of risk. *Science*, 236, 280-285.
- Swanborn, P. (1999). *Evalueren : Het ontwerpen, begeleiden en evalueren van interventies: een methodische basis voor evaluatie-onderzoek*. Amsterdam: Boom.
- Taylor-Gooby, P., & Zinn, J. O. (2006). Current directions in risk research: New developments in psychology and sociology. *Risk Analysis*, 26(2), 397-411.

Chapter 6: Conclusion and discussion

Van der Pligt, J., & De Vries, N. K. (1995). *Opinies en attitudes. Meting, modellen en theorie*. Amsterdam: Boom.

Vandermoere, F., & Vincke, J. (2004). Sociological evaluation of the stakeholders involved with a soil-decontamination process in a community. A qualitative research. 78pp. Report for Public Waste Agency of Flanders (Flemish government).

White, L. (1967). The historical roots of our ecological crises. *Science*, *155*, 1203-1207.

Wynne, B. (1992). Misunderstood misunderstanding: Social identities and public uptake of science. *Public Understanding of Science*, *1*, 281-304.

Wynne, B., & Mayer, S. (1993). How science fails the environment. *New Scientist*, 33-35.

Zavestoski, S., Mignano, F., & Agnello, K., et al. (2002). Toxicity and complicity: Explaining consensual community response to a chronic technological disaster. *Sociological Quarterly*, *43*(3), 385-406.