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Interdisciplinarity in Action: building and using a conceptual infrastructure for interdisciplinary studies of risk

Karen Evans, Seppo Kontiainen, Ingrid Schoon, and Martin Weale

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Karen Evans, Seppo Kontiainen, Ingrid Schoon, and Martin Weale

Centre for Learning and Life Chances in Knowledge Economies and Societies (LLAKES), Institute of Education, University of London

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Abstract

The paper emphasizes the importance of finding ways for different disciplines to communicate across the conceptual boundaries between them. Four different fields of study i.e. economics, psychology, sociology and education bring concepts into this study to become integrated in a framework for analyses of risk. The context of the study is lifelong education.

A previous LLAKES thematic paper started a process of mapping relationships between Life Chances, Learning and the Dynamics of Risk in the Life Course, bringing together evidence and different perspectives within an integrative framework (Evans, Schoon and Weale 2010). This paper provided the point of departure for developing a conceptual infrastructure whose purpose is to allow people who work in different disciplines to develop an understanding of what cognate disciplines bring to the discussion of a particular socio-economic problem.

As a first methodological step, the authors have selected key concepts and their attributes (risk, opportunity, adaptability, security, responsibility, education, incentive to learn, motivation, aspiration, earnings, employment, personal agency and life chances). Dynamic Concept Analysis (Kontiainen 2002) has been used to build the interdisciplinary conceptual infrastructure, i.e. a matrix of relationships between the thirteen concepts identified as key constructs related to risk. Finally, two conceptual models have been constructed as examples of how this infrastructure can be used in conceptual analyses.

The paper is in two parts. Part One shows how the interdisciplinary conceptual infrastructure has been built for studies of risk. The second part is an analysis of risk and responsibility in which this common infrastructure provides the database to produce two different models.

A conceptual model gives a comprehensive picture of how the concepts are related in a given combination of attributes. Comparisons between the above two models show how only one difference under one concept (individual or collective responsibility) results in different dynamics between the concepts of the study. This approach makes it possible to understand how the content and meaning of each concept varies according to the relations a concept has with the other concepts. It is not enough to have only one definition for a concept or an attribute because the role and function of a concept may vary according to how it is related to the other concepts.

The conceptual infrastructure of this paper is linked to accessible and publicly available software in which it is possible to use the data base of this paper for various risk related analyses: http://www.edu.helsinki.fi/dca/.

Keywords: interdisciplinary studies, conceptual analysis, risk, responsibility, lifelong learning, Dynamic Concept Analysis.

Introduction

Interdisciplinarity is much talked about but the avenues for achieving synthesis rather than simple juxtaposition of disciplinary perspectives are under-developed. Inquiries that are termed 'interdisciplinary' can take many different forms. According to Lyall et al (2011), interdisciplinarity can be pursued through:

(a) developing conceptual links using a perspective in one discipline to modify a perspective in another

(b) using research techniques developed in one discipline to elaborate a theoretical model in another

(c) modifying and extending a theoretical framework from one domain to apply in another

(d) developing a new theoretical framework that may re-conceptualise research in separate domains as it attempts to integrate them.

The work outlined in this paper starts with (a) as perspectives from social psychology, economics and sociology which are brought into dialogue; it moves towards (d) as an extended dialogue between ideas and evidence develops between the disciplines, using Dynamic Concept Analysis to build an interdisciplinary conceptual infrastructure.

Points of departure for the interdisciplinary analysis

The origins of the paper lie in our work as an interdisciplinary team conducting research in the Centre for Learning and Life Chances in Knowledge Economies and Societies (LLAKES). We identified, early in our collaboration, the need for a unifying framework for understanding the processes and consequences of learning through the life-course, the part played by social risks and the ways in which individuals navigate these risks in youth and adult life.

In developing this framework, we found that the debates about risk often come to revolve around questions of responsibility, individual and collective, and the ways in which risk and responsibility are mediated by other factors, such as incentives, security, motivation etc. These concepts and understandings about their relationships run through political decision-making.

Risk will be understood differently depending on the perspective adopted and other qualities related to it at the time. The ways in which risk is conceptualised and investigated differ substantially between disciplines. Economic perspectives make the assumption that differences in human behaviour, when people are faced with risks, stem from their circumstances; sociologists see the social regularities in the differences as rooted in social structures and the playing out of social processes, while psychologists focus primarily on processes internal to the individual (see Evans, Schoon and Weale 2010). An interdisciplinary analysis of risk and its relationships with responsibility requires a process not only of conceptual clarification but also a means of arriving at shared understandings. In this paper, we show how dynamic concept analysis (DCA) begins a process of clarifying and sharing concepts, in order to develop an interdisciplinary understanding based on integration of information from a variety of sources. In this respect, the paper represents one example of how interdisciplinary connections can be forged.

Fragmented knowledge in disciplines

There is a general tendency of different fields of research to drill deeply down in particular directions. Fuzzy and sliding concepts characterise most attempts at connecting ideas across disciplinary boundaries. Terms are used to mean different things. As Bogg and Geyer (2013) have observed, the search for common definitions reveals the ways in which individuals coming from different disciplinary perspectives 'bend' definitions to their own needs and core concerns. Emergent definitions can be shaped by multiple interactions and can be used to expand explanation, providing this malleability does not lead to loss of veracity (Willis, 2013:6). The process of sharing and translating meanings is a necessary first step to clarifying and agreeing on meaning. In this work, an early step has been to arrive at a set of short definitions of key concepts related to risk that researchers from different disciplines and traditions can agree on.

The case for lifelong learning policies in contemporary society is often linked to questions or assumptions about the risks people face in their day-to-day lives, of becoming less employable as skills requirements alter, more vulnerable to the effects of social or environmental change or more exposed as consumers to mis-selling. Risk is held to be part of the slow crisis of modern societies with links to questions of individual and collective responsibility (Evans, Schoon and Weale, 2013). This led us to consider questions of riskiness in the life course from different disciplinary perspectives. The disciplines meet

where they aim to examine the interactions between individual and context. This interconnection had been recognised; yet, research has developed independently in recent decades. Within sociology, research has focused on the study of the life course as externally shaped by institutions, structural opportunities, and historical change, in which life-course dynamics and expressions of individual agency are contingent on a given socio-historical context. Psychology, conversely, has concentrated on the study of individual adaptation and development across the life span, conceptualised as lifelong adaptive processes, emphasising principles of self-regulation and psychological functioning. Although the malleability of individual development and functioning through social influences is acknowledged within psychology, the focus is mostly on the more proximal social contexts, such as the family, social networks, and peers, rather than on more distal socio-historical or institutional influences (Roberts, 2009). Economics focuses on individual 'rational' choice, explained according to individual ability and expectations about income and related benefits that are associated with and consequent upon those choices. Taking as an example the approaches of different disciplines to the question of people's choices on leaving school, economists typically argue that the person has an underlying ability and forms a view of the income they will accrue through that ability. In pursuit of that level of income, some will go down paths that lead to stable jobs while others will take risks in pursuing more uncertain careers. Psychologists, by contrast will focus on variations in the internal decision-making processes themselves, and how these are influenced by family members and peers. Sociologists will approach 'choice' by analysing the societal opportunity structures that structure people's options on leaving school, arguing that opportunity structures are formed primarily by the inter-relationships between family backgrounds, education, labour market processes and employers' recruitment practices, that their combined predictive power is strong and that "poverty of aspiration" and young people making the "wrong choices" cannot explain risks and imbalances in youth labour markets.

Our inter-disciplinary approach leads us to ask here whether increasing the field of view of sociologists, psychologists and economists to take into account different perspectives on individual motivation and preferences will result in a better understanding of individual decision making and choice, processes involved in skill acquisition, and modes of individual agency in the life course. For example, for psychologists to take into account the role of institutions and social structures might contribute to a better understanding of individual adaptation in times of social change and provide the means to assess how social and

institutional change is affecting individual functioning. An integrated approach would enhance our understanding of human behaviour in a changing social context and enable us to answer questions such as: How do, economic and cultural factors influence and impede individuals' attempts to control their lives, and their ability to respond to opportunities and to manage the consequences of their choices? In what ways do degrees of 'riskiness' in socio-economic environments have consequences for individual life chances across the life course, the ways in which individuals react to these risks and the extent to which differences in socio-economic outcomes are influenced by factors such as parental background, educational attainments and participation in education and training after entering the workforce. How do individuals respond to and cope with a sudden downturn in employment opportunities or increased pressure to continue with further education?

In discussion of such risks, each disciplinary perspective brings its own concepts into the discussion. In order to discuss risk an economist brings earnings and employment; social psychologists bring in the individual characteristics such as motivation and aspiration; sociologists bring in social structures of opportunity and concepts of agency. This initial interdisciplinary discussion of risk thus generated the list of key concepts arrived at for the analysis of risk and responsibility.

Dynamic Concept Analysis (DCA) as a research tool for building a common conceptual infrastructure

Dynamic Concept Analysis (DCA), developed by one of the authors of this paper (Kontiainen 2002), can be used for analyses of complex phenomena in education, social sciences and other fields of study when there is a need to do structured conceptual analyses or to have a comprehensive picture of 'how parts make a whole'. In this paper we use DCA as a research method for interdisciplinary conceptual analyses. DCA allows systematic use of information for building conceptual models. The method makes it possible to build a bridge between nomothetic and idiographic approaches, i.e. to use the same conceptual framework for general descriptions of a phenomenon and for describing individual cases. The theoretical bases of this approach are given elsewhere (Kontiainen 2002a).

This paper includes two different parts:

(1) The main task of this paper is building an interdisciplinary conceptual infrastructure for social scientific studies of risk. Matrix 1 is a result of this study storing information on

relationships between concepts from four different fields of study. This phase of the study has produced information about concept relations to serve as a base for different applications in risk-related studies. The reader can test how well s/he agrees with the statements of concept relations that were originally built by assessments of the authors of this paper, as given in the Appendix. The more there is agreement with the statements the more reliable is the information in Matrix 1.

2) The second part is an analysis of risk and responsibility in which this common infrastructure (Matrix 1) gives the database to produce two different models (Model 1 and Model 2) in which only responsibility varies. This is to demonstrate how a given attribute combination results in two different models that are built by the common data bank in Matrix 1. So, this is only one application of this data out of numerous potential combinations of attributes that can be analysed by the information in Matrix 1.

Part One: Building an interdisciplinary conceptual infrastructure for studies of risk

Selecting the concepts

The first step of the process was to agree on a list of key concepts and brief definitions as common basis for our exploratory attempts to integrate knowledge – not a definitive but a working list. The second step is to assign attributes to each concept. This process of identifying concepts built on the work done by Evans, Weale and Schoon (2010) to produce a joint research paper that was designed to explore different disciplinary perspectives on how social risks and differences in opportunities relate to learning and action in the adult life course. Two or three key concepts from each disciplinary perspective were contributed as core variables that the discipline would use to explain and explore the phenomena: for example, earnings, incentives and employment from economics; motivation and aspiration from social psychology; education, incentives to learn and motivation from education; opportunity, agency and life chances from sociology.

The process of generating short concept statements led to some important clarifications. For example, there was a debate about whether the more appropriate concept is ‘adaptation’, often used as a key construct by social psychologists, or adaptability. Adaptation is about outcomes in relation to environments; adaptability is about propensities to behave in particular ways in the context of changes. The need for clarification and resolution of this difference became even more apparent when the assigning of attributes were discussed –

social psychologists choosing the attributes 'positive' and problematic' for adaptation, carrying value judgements to which sociologists, for example, do not subscribe. Adaptability was eventually selected as the agreed concept, with high and low adaptability agreed as the relevant attributes for the information matrix. This illustrates how steps 1and 2, in this case, proceeded iteratively – the differences in the ways attributes were being assigned clarified the conflicting understandings, enabling resolution of the problem. In a similar way, 'agency' was amended to 'personal agency' to clarify that the focus was on the individual for this particular concept, with attributes 'strong-medium-weak' rather than 'individual' or 'collective'. The attribute assignment was also very important in the case of responsibility. The attributes individual – collective were used here for theoretical reasons connected with the intellectual rationale for the whole exercise (see below). All of these points had to be clarified and decided upon before the analysis could proceed.

The agreed list of concepts and their attributes is given in Table 1.

Table 1. DEFINITIONS OF RISK RELATED CONCEPTS in the context of lifelong education

(1) ***RISK*** (**high-medium-low**) The probability of harmful things happening to you.

(2) ***OPPORTUNITY*** (**high-medium-low**) Circumstances or occurrences that provide possible ways of achieving one's desired goals.

(3) ***ADAPTABILITY*** (**high-medium-low**) Propensity to change behaviour in response to changing conditions.

(4) ***SECURITY*** (**high-medium-low**) The extent to which one is protected from the negative consequences of risk.

(5) ***RESPONSIBILITY*** **(individual-medium-collective**) A duty or obligation to act in particular ways, that must be fulfilled (with implied penalty for failure).

(6) ***EDUCATION*** (**good-medium-poor**) Level of education/qualification achieved.

(7) ***INCENTIVE to LEARN*** (**high-medium-low**) Something that motivates or encourages people to engage in further learning.

(8) ***MOTIVATION*** (**high-medium-low**) Desire or willingness to act in particular ways; in respect of learning it implies the purpose of improvement, whether self-improvement or improvement of one's life situation.

(9) ***ASPIRATION*** (**high-medium-low**) Hope or ambition to achieve something which is beyond one's immediate reach.

(10) ***EARNINGS*** (**high-medium-low**) Money obtained in return for labour or services.

(11) ***EMPLOYMENT*** (**high-medium-low**) State of having paid work.

(12) ***PERSONAL AGENCY*** (**strong-medium-weak**) Belief in your ability to shape what happens to you by your own efforts (related to action).

(13) **LIFE *CHANCES*** (**rich-medium-poor**) A range of opportunities a person has to improve his/her personal situation.

Defining the relationships between the concepts

The second step, after agreement of the list of concepts and attributes, was to define the relationships between the concepts, to appear in an information matrix of concept relations (i.e. the conceptual infrastructure of this study). The sources of information for this process include accumulated evidence from previous research and expert views. The identification of relationships, where there is some divergence but not outright conflict of opinion and evidence, can allow for 'tendencies' to be included. These relationships are arranged in a series of statements (cf. Appendix).

The process here was for each of the authors, from their disciplinary perspectives, to fill in the questionnaire (see Appendix) assessing each of the items in the series of statements generated through step 1. (The statements for which 'strongly disagree' responses were excluded, leading to a exclusion of a number of two-way relationships from the matrix. For example, it was not considered sensible to state under Concept 11 (Employment) that 'the higher earnings, the better employment' (this leaves the Cell 11/10 empty in the matrix). However, it is stated in relation to Concept 10 (Earnings) that 'the higher employment the better earnings'. Above excludes a two-way relation between these concepts, but allows a one-way relation from Concept 11 to Concept 10.

This enabled, through several iterations, a final version to be produced in which no strong disagreements remained between the perspectives; for relationships which had ratings 1,2,4 as the pattern of response, this was treated as a 'tendency towards' in the final version, (requiring a degree of compromise). Agreeing the final version was a case of agreeing that the final set was 'good enough', containing no positions with which the contributors would totally disagree.

The information was then moved into an information matrix (here: the conceptual infrastructure), using the DCA coding system as explained in Kontiainen 2002a[1]. For example, in this case, insert examples of how conclusions were arrived at in completing the information matrix (a matrix of concept relationships). This conceptual infrastructure provides common basis for doing analysis in general or in individual cases, as illustrated in the section 'How to read Matrix 1'

The dimension of individual- collective responsibility was identified as a promising avenue for exploration of concept relations as the question of individual/collective responsibility lies at the heart of political decision-making (micro and macro). Debates about the emergence of a 'risk society' (Beck 1992) have focused on the ways in which uncertainties 'manufactured' in modern societies have been framed as risks to imply manageability and control, extending to poverty risks, health risks, ecological risks. The notions of Individual and Collective responsibility for the management of risk are present in discussions across disciplinary boundaries of social phenomena. Giddens (1998), for example, refers to the transformation of tradition and custom, observing that forward decisions have to be made and responsibility has to be taken for their consequences. Taking responsibility for the future consequences of present actions is part and parcel of the 'risk society' as articulated by Beck (1992). This applies to nations, groups and individuals. According to Beck, within the individualised 'risk society' individuals must learn to conceive of themselves as the centre of action, as the planning office with respect to their own personal biographies, as collective patterns are pushed aside. How far the collective dimensions of class culture and family roles are being dissolved in the 'social surge of individualisation' that Beck and Giddens claim is a matter that is strongly contested, particularly among sociologists who view risks as direct consequences of social, relations and processes as organisations, institutions and families and individuals attempt to manage and control risk activity. How far social inequalities operate at the level of the individual rather than according to 'group membership' is hotly debated by thinkers who argue that underlying the social changes, the chains of human inter-dependence which produce and reproduce inequalities are kept intact, and require collective, structural solutions if the social distribution of risk is to be tackled (See, for example, Furlong and Cartmel [1997], and Engel and Strasser [1998]). Economists, by contrast, focus on the consequences of, for example, income uncertainty and the presumed exercise of rational

[1] See Chapter 1 in Kontiainen, S. (2002), Dynamic Concept Analysis, Theoretical Basis, pp 36-41 http://www.edu.helsinki.fi/dca/ [accessed 17.7.14]

choice (e.g. Deaton, 1991), while social psychologists focus on the factors that contribute to the accumulation of risks during the life courses of individuals (e.g. Rutter, 1988). Dimensions of responsibility are often present as underlying assumptions, not made explicit but playing an integral part in the perspective. We chose to focus on this area of often implicit assumption, to show how changing assumed attributes of responsibility from individual to collective generates different realities and scenarios that can be debated across disciplinary boundaries.

Initial modelling of concept relations showed how changing only one concept while keeping other constant revealed some substantial differences, leading to re-definition of the role of every concept. As an example in this paper Models 1 and 2 demonstrate how risk will be understood in the sense that people are collectively looked after and, alternatively, in the sense that they are supported to solve problems individually/independently.

The five stages of the process are summarised below:

Summary of the Five Stages

Part 1:

1. **Key Concepts**: researchers from four different fields of study (economics, psychology, sociology and education) selected thirteen key concepts for this Risk related study (cf. **Table 1**). A joint agreement was made between the researchers of a general definition of each concept and three attributes for each were given to specify different levels of a concept.

2. **Definition of Relationships** between concepts and their attributes: Preliminary **statements of concept relations** were given to each researcher to assess (using a questionnaire and a rating scale). These assessments were taken into account when making the final statements for this study. The statements used in this study are given in the **Appendix.**

(3) Information Matrix (**Matrix 1**) of Concept Relations provides the conceptual infrastructure of this study. Assessments gave the basis for using the DCA coding system to move this information into the matrix. The matrix serves as a common basis for doing conceptual analyses in general and/or in specific cases as in this paper. The matrix includes both linear and non-linear relationships between concepts.

The information on relationships can be driven from quantitative or qualitative studies, by expert statements (as here) or by using findings of other studies if available. Altogether, there are five different ways to specify the key concepts and their relationships: (1) by a empirical study when relations between the concepts are based on statistical analyses and findings in the

study, or (2) concepts and their relations are based on expert statements as in this paper, or (3) concepts and relationships are based on critical analyses of research papers in a field, or (4) concepts and the relations are based on soft data, e.g. interviews, or (5) by various sources involving any combination of above possible ways; a matrix can absorb any relevant information of relationships between concepts.

Part 2:

(4) **Conceptual models** can be produced for any combination of attributes in the matrix. The matrix serves as a common basis for building conceptual models in this conceptual framework. A computer software programme is linked to this paper to build conceptual models (Kontiainen 2002). A conceptual model visualises how the attributes are working together in a given case. **Model 1** and **Model 2** are given as examples of how individual and collective responsibility function in a chosen combination of attributes. The conceptual models actually illuminate how to make a comprehensive picture based on fragmented information, and conceptual models specify the meaning and function of each attribute in a given attribute combination.

(5) **Description and interpretation** of these two risk related models is given in **Table 4** (a comparison of roles and functions of individual and collective responsibility) with a description of the role and function of each attribute in these two combinations.

Stages 1-3: Building the conceptual infrastructure - Part One

Stages 4-5: Using Matrix 1 as basis for analysis of risk and responsibility; Models 1 and 2 - Part Two.

The key concepts and the attributes of this study were given in **Table 1**. The relationships between concepts are specified in **Matrix 1** that forms the conceptual infrastructure for producing conceptual models for any combination of attributes.

Matrix 1. THE DYNAMICS of RISK (the conceptual infrastructure of this study)

Relations between the Concepts and their Attributes

CONCEPTS		1 a n b	2 a n b	3 a n b	4 a n b	5 a n b	6 a n b	7 a n b	8 a n b	9 a n b	10 a n b	11 a n b	12 a n b	13 a n b
1.RISK	1a high	a	n b	b	b	a	b	b	b		n b	b	n b	b
	1n medium	n	n	n	n	n	n	n	n		n	n	n	n
	1b low	b	a n	a	a	b	a	a	a		a n	a	a n	a
2.OPPORTUNITY	2a high	n b	a	a		n b	a	a n	a	a n	a n	a	a	a
	2n medium	n	n	n		n	n	n	n	n	n	n	n	n
	2b low	a n	b	b		a n	b	n b	b	n b	n b	b	b	b
3.ADAPTABILITY	3a high	a n	a n	a	a n	a	a	a	a	a				
	3n medium	n	n	n	n	n	n	n	n	n				
	3b low	n b	n b	b	n b	b	b	b	b	b				
4.SECURITY	4a high	b	a	a	a	b	a	a			a	a	a n	a n
	4n medium	n	n	n	n	n	n	n			n	n	n	n
	4b low	a	b	b	b	a	b	b			b	b	n b	n b
5.RESPONSIBILITY	5a individual	n b	a		b	a	a	a	a	a		a	a	a n
	5n medium	n	n		n	n	n	n	n	n		n	n	n
	5b collective	a n	b		a	b	b	b	b	b		b	b	n b
6.EDUCATION	6a good		a n				a	a	a	a				
	6n medium		n				n	n	n	n				
	6b poor		n b				b	b	b	b				
7.INCENTIVE	7a high	n	a	a n	n b		a	a	a n	a		n b	a	a
	7n medium	n	n	n	n		n	n	n	n		n	n	n
	7b low	a b	b	n b	a n		b	b	n b	b		a n	b	b
8.MOTIVATION	8a high	a n	a	a n	n	a n	a	a	a	a	a n	a n	a	a
	8n medium	n	n	n	a b	n	n	n	n	n	n	n	n	n
	8b low	n b	b	n b	n	n b	b	b	b	b	n b	n b	b	b
9.ASPIRATION	9a high	a n	a n	a n			a	a	a	a			a	a
	9n medium	n	n	n			n	n	n	n			n	n
	9b low	n b	n b	n b			b	b	b	b			b	b
10.EARNINGS	10a high		a	a			a	a n	a	a	a	a n	a	a
	10n medium		n	n			n	n	n	n	n	n	n	n
	10b low		b	b			b	n b	b	b	b	n b	b	b
11.EMPLOYMENT	11a high	b	a	a	a n	b	a	a	a	a		a	a n	a
	11n medium	n	n	n	n	n	n	n	n	n		n	n	n
	11b low	a	b	b	n b	a	b	b	b	b		b	n b	b
12.AGENCY	12a strong	n b	a		a n		a	a	a	a			a	a
	12n medium	n	n		n		n	n	n	n			n	n
	12b weak	a n	b		n b		b	b	b	b			b	b
13.LifeCHANCES	13a rich	n b	a	a	a n		a	a	a n	a		a	a n	a
	13n medium	n	n	n	n		n	n	n	n		n	n	n
	13b poor	a n	b	b	n b		b	b	n b	b		b	n b	b

How to read Matrix 1:

(1) A ROW in the matrix shows the attributes that have a one-way relation (A←B) to the attribute in question. For instance: The content and meaning of 'High Risk' (**Row 1**) in this

combination of concepts will be specified by the following attributes: 2n or 2b, 3b, 4b, 5a, 6b, 7b, 8b, 10n of 10b, 11b, 12n or 12b, and 13b. These attributes are linked to high risk, but it depends on the combination of attributes how they will be employed in a study. For instance, later in this paper risk with individual responsibility (Table 3a and Model 1) only 4b, 5a, 6b, 7b and 10b have a one-way relation to 1a High Risk.

Note: these one-way relations may develop into two-way relations when studying the influences of risk has on the above attributes (this will become realised when building conceptual models based on all the information in Matrix 1).

(2) A CELL shows how another concept is related to the concept in question. For instance:

(**Cell 1/2**) *Concept 2 Opportunities* has a relationship to Concept 1 Risk as expressed in the list of Statements (Table 2): 'The less opportunities the higher the risk*'. Cell 1/2 shows that there is a tendency (*) towards the relationship as stated (more variation is given).

(**Cell 1/3**) *Concept 3 Adaptability* is related to *Concept 1 Risk* as stated: 'The less adaptability the higher the risk'.

(**Cell 1/5**) The relationship *Concept 5 Responsibility* has to *Concept 1 Risk.* This relationship in the matrix is based on the statement: 'The more individual responsibility the higher the risk'.

(3) AN EMPTY CELL indicates that it has not been considered reasonable to state that a concept has a direct influence on the concept in question. This does not exclude a possibility that a one-way relationship may appear in the matrix when studying the qualities of the other concept. For instance:

(Cell 1/9) it has been stated that *Concept 9 Aspiration* does not have a direct influence on *Concept 1 Risk*. (However, it is stated in Cell 9/1 that Concept 1 Risk regulates level of aspiration. So, there is a one-way relationship from Risk to Aspiration, but not vice versa from Aspiration to Risk).

(4) A NONLINEAR RELATIONSHIP, for instance**:**

(Cell 7/1) *Concept 1 Risk has* a nonlinear relationship to *Concept 7 Incentive to learn*. It is stated that 'Medium risk is likely to lead to high incentive to learn' and 'Both high and low risk are likely to result in low incentive to learn'.

(5) There is NO DIRECT RELATIONSHIP between the two concepts. They can be linked to each other through the other concepts. For instance:

In **Cell 5/10** it is stated that *Concept 10 Earnings* does not have a direct influence on *Concept 5 Responsibility*, and vice versa in **Cell 10/5** it is stated that *Concept 5 Responsibility* does not have a direct influence on *Concept 10 Earnings*. (Both of these concepts have various links through the other concepts in Matrix 1.)

Part Two: How to use the common matrix: an example

A conceptual model gives a comprehensive picture of how the concepts are related in a given combination of attributes.

In this second part, this common infrastructure provides the database to produce two different models in an analysis of relationships between risk and responsibility. In this analysis the attribute combination shown below was chosen for building two conceptual models of Risk. Our purpose in choosing this attribute combination has been to illustrate whether a focus on individual responsibility generates a different understanding of a problematic 'risk' situation compared to that produced through a focus on collective responsibility, within a particular scenario. Thus, the only difference between the two combinations is in Concept 5 Responsibility: in the first combination 5a individual responsibility is taken in, and in the other 5b collective responsibility is in the attribute combination. All the other attributes are the same in these two combinations:

Attributes chosen for this study*:

1a Risk high 2a Opportunity high 3a Adaptability high 4b Security low Responsibility 5a individual or 5b collective 6b Education poor	7b Incentive to learn low 8a Motivation high 9n Aspiration medium 10b Earnings low 11a Employment high 12a Agency strong 13n Life Chances medium

*It should be noted that other attributes could have been chosen.

Table 2 gives information of how many possible combinations there are available with different numbers of concepts included in a study:

Table 2. Number of Attribute combinations (and Models)

Number of concepts	Total number of combinations	Number of combinations with one attribute
(n)	**(3^n)**	**(3^{n-1})**
2	9	3
3	27	9
4	81	27
5	243	81
6	729	243
7	2 187	729
8	6 561	2 187
9	19 683	6 561
10	59 049	19 683

(Kontiainen 2002, 41)

For instance**,** in this paper there are altogether 13 concepts (with three attributes in each). One attribute may potentially result in more than half a million different attribute combinations and respectively in as many more or less different conceptual models. The total number of possible combinations of attributes is about 1.6 million. All the models for these combinations of attributes can be built by the information of concept relations in **Matrix 1**.

Two models of the dynamics of risk and responsibility

In the following, two conceptual models have been produced by the information in **Matrix 1** in the attribute combination chosen for this study: **Model 1** Dynamics of risk with individual responsibility and **Model 2** Dynamics of risk with collective responsibility.

In this paper only two slightly different attribute combinations have been chosen to illustrate roles that individual and collective responsibility play in this attribute combination. **Model 1** and **Model 2** have the other attributes identical; only responsibility (Concept 5) varies.

How to read Model 1:

A list attached to Model 1 gives the attributes in this combination that have a one-way relation to an attribute in question. These relations may develop into two-way relations when information of one-way relations on the list to all attributes is taken into account. This information has been put together in Table 3a.

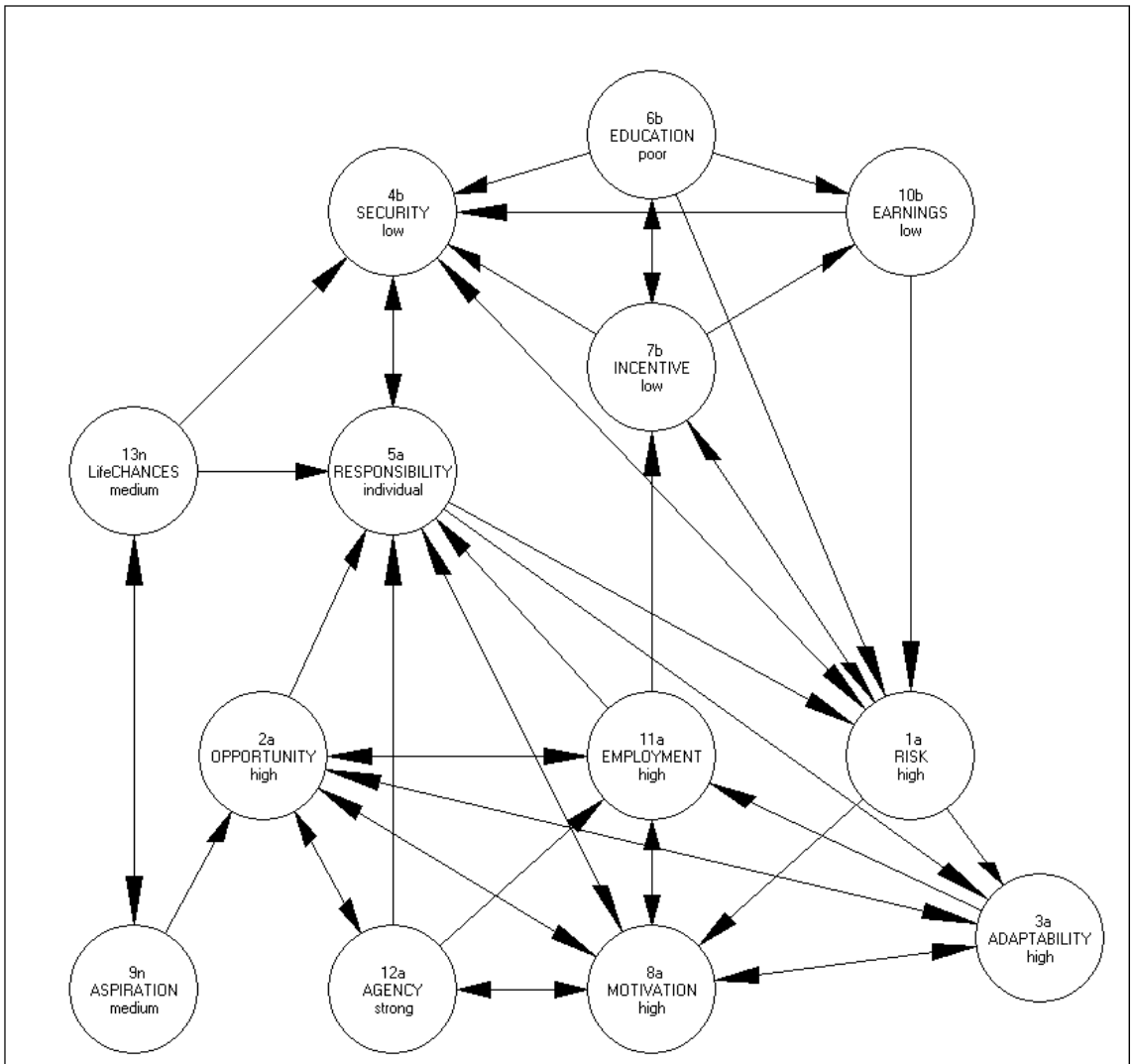
Table 3a. RELATIONS of the Attributes in Model 1 (with 5a individual responsibility):

Leads to this attribute →	ATTRIBUTES	→ Leads to the other attributes
4b 5a 6b 7b 10b	1a high RISK	3a 4b 7b 8a
3a 8a 9n 11a 12a	2a high OPPORTUNITY	3a 5a 8a 11a 12a
1a 2a 5a 8a	3a high ADAPTABILITY	2a 8a 11a
1a 5a 6b 7b 10b 13n	4b low SECURITY	1a 5a
2a 4b 8a 11a 12a 13n	5a individual RESPONSIBILITY	1a 3a 4b 8a
7b	6b poor EDUCATION	1a 4b 7b 10b
1a 6b 11a	7b low INCENTIVE	1a 4b 6b 10b
1a 2a 3a 5a 11a 12a	8a high MOTIVATION	2a 3a 5a 11a 12a
13n	9n medium ASPIRATION	2a 13n
6b 7b	10b low EARNINGS	1a 4b
2a 3a 8a 12a	11a high EMPLOYMENT	2a 5a 7b 8a
2a 8a	12a strong AGENCY	2a 5a 8a 11a
9n	13n medium life CHANCES	5a 4b 9n

When an attribute (left on the table) leads to an attribute in question, and this attribute in turn leads to this attribute (right on table) it results in the model as a two-way relationship: A ↔ B.

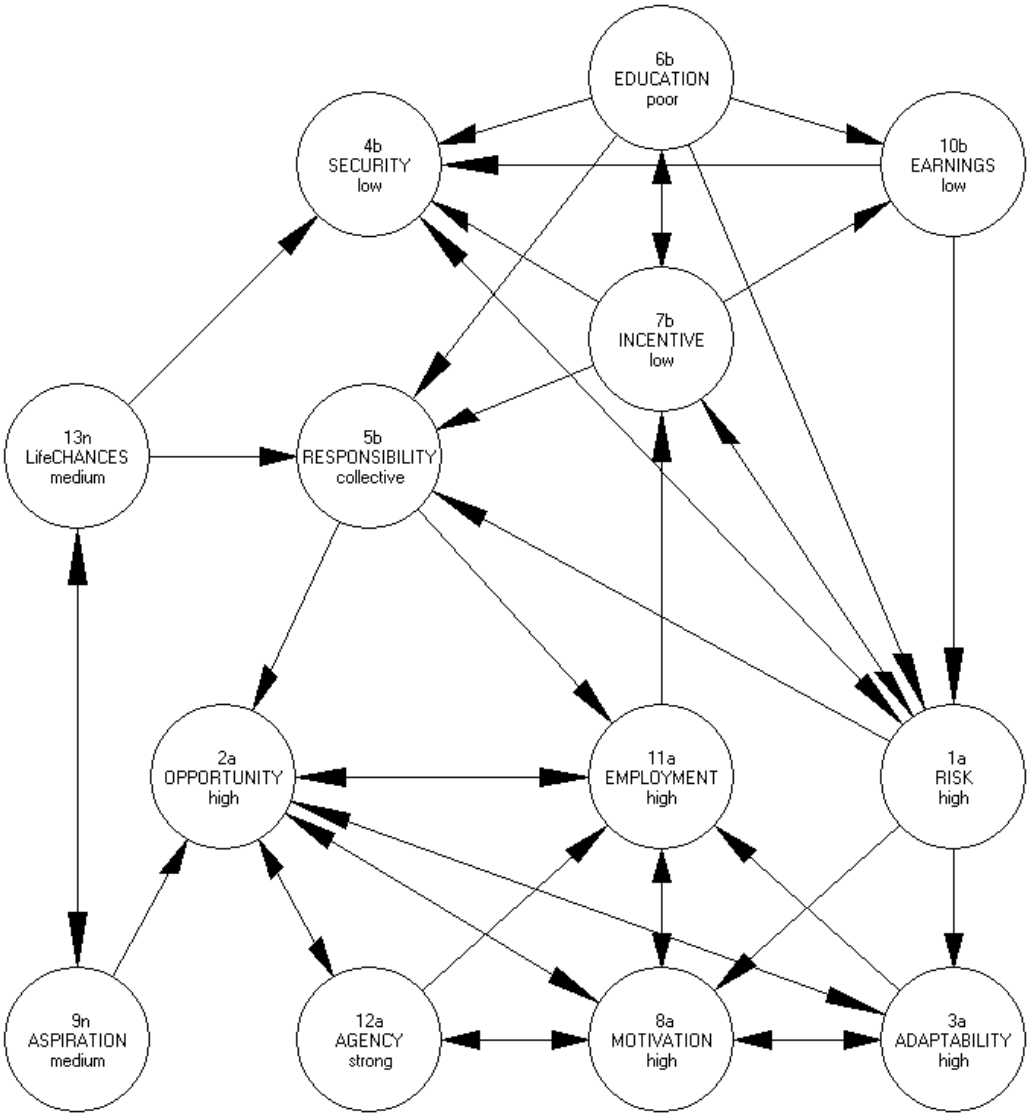
When there is only one-way relationship between these two attributes, this results in the model either as A → B or A ← B.

MODEL 1: Dynamics of Risk with <u>individual</u> responsibility



1a: RISK high	<--	4b 5a 6b 7b 10b
2a: OPPORTUNITY high	<--	3a 8a 9n 11a 12a
3a: ADAPTABILITY high	<--	1a 2a 5a 8a
4b: SECURITY low	<--	1a 5a 6b 7b 10b 13n
5a: RESPONSIBILITY individual	<--	2a 4b 8a 11a 12a 13n
6b: EDUCATION poor	<--	7b
7b: INCENTIVE low	<--	1a 6b 11a
8a: MOTIVATION high	<--	1a 2a 3a 5a 11a 12a
9n: ASPIRATION medium	<--	13n
10b: EARNINGS low	<--	6b 7b
11a: EMPLOYMENT high	<--	2a 3a 8a 12a
12a: AGENCY strong	<--	2a 8a
13n: LifeCHANCES medium	<--	9n

MODEL 2. Dynamics of Risk with 5b <u>collective</u> responsibility



1a: RISK high	<--	4b 6b 7b 10b
2a: OPPORTUNITY high	<--	3a 5b 8a 9n 11a 12a
3a: ADAPTABILITY high	<--	1a 2a 8a
4b: SECURITY low	<--	1a 6b 7b 10b 13n
5b: RESPONSIBILITY collective	<--	1a 6b 7b 13n
6b: EDUCATION poor	<--	7b
7b: INCENTIVE low	<--	1a 6b 11a
8a: MOTIVATION high	<--	1a 2a 3a 11a 12a
9n: ASPIRATION medium	<--	13n
10b: EARNINGS low	<--	6b 7b
11a: EMPLOYMENT high	<--	2a 3a 5b 8a 12a
12a: AGENCY strong	<--	2a 8a
13n: LifeCHANCES medium	<--	9n

How to read Model 2:

As above with Model 1 a similar summary of relationships is produced for Model 2.

A list of the other attributes in this combination that have a one-way relation to an attribute is given below. These relations may develop into two-way relations when information of one-way relations in the list for all attributes are taken into account. This information has been put together in Table 3b, showing in the left-hand column, the contributions to each listed attribute of each concept in the centre column, and what, in turn' each listed attribute leads to, in the Model for which responsibility has the attribute ' collective'.

Table 3b. RELATIONS of the Attributes in Model 2 (with 5b collective responsibility):

Leads to this attribute →	**ATTRIBUTES**	→ **Leads to** the other attributes
4b 6b 7b 10b	**1a high RISK**	**3a 4b 5b 7b 8a 10b**
3a 5b 8a 9n 11a 12a	**2a high OPPORTUNITY**	**3a 8a 11a 12a**
1a 2a 8a	**3a high ADAPTABILITY**	**2a 8a 11a**
1a 6b 7b 10b, 13n	**4b low SECURITY**	**1a**
1a 6b 7b 13n	**5b collective RESPONSIBILITY**	**2a 11a**
7b	**6b poor EDUCATION**	**1a 4b 5b 7b 10b**
1a 6b 11a	**7b low INCENTIVE**	**1a 4b 5b 6b 10b**
1a 2a 3a 11a 12a	**8a high MOTIVATION**	**2a 3a 11a 12a**
13n	**9n medium ASPIRATION**	**2a 13n**
6b 7b	**10b low EARNINGS**	**1a 4b**
2a 3a 5b 8a 12a	**11a high EMPLOYMENT**	**2a 7b 8a**
2a 8a	**12a strong AGENCY**	**2a 8a 11a**
9n	**13n medium life CHANCES**	**4b 5b 9n**

The following analysis shows how differences of content and meaning are generated when the one concept (responsibility) is varied, all others being kept constant.

Description and interpretation of Model 1 and Model 2:

Comparing the roles of individual responsibility (5a) and collective responsibility (5b) play in this risk related situation. (Note: if the combination of attributes were chosen differently individual and collective responsibility can have more or less different roles in the models as compared with the following descriptions that are bound, as examples, to a particular combination of attributes).

Table 4. RISK and RESPONSIBILITY: Comparison of Model 1 and Model 2.

(In Models 1 and 2 all the other attributes are the same; only Concept 5 Responsibility varies)

Concepts and Attributes of RISK	***Specific information in MODEL 1*** *with* **INDIVIDUAL RESPONSIBILITY** (5a)	***Specific Information in MODEL 2*** *with* **COLLECTIVE RESPONSIBILITY** (5b)
1. RISK **1a high** 1n medium 1b low	In ***Model 1*** individual responsibility has a one-way relation to the risk i.e. it is one aspect among others to characterise high risk. In practice, it his likely that the individuals are left to respond to the problems on their own.	***Model 2*** indicates that taking collective responsibility is a possible response to the risk related problems in practice.
2. OPPORTUNITY **2a high** 2n medium 2b low	In ***Model 1*** Individual responsibility has an interesting role to enable people to use good opportunities in the labour market. What actually happens in practice is again up to people themselves.	In ***Model 2*** collective responsibility is likely to increase opportunities in the labour market.
3. ADAPTABILITY **3a high** 3n medium 3b low	In ***Model 1*** Individual responsibility is likely to strengthen high adaptability directly and also by keeping the motivation high (cf. a two-way relationship with 5a and 8a in Model 1).	*In* ***Model 2*** collective responsibility does not have a direct relation with adaptability; connections in the model appear through the other concepts. This happens primarily by developing good opportunities in the labour market (an arrow from 5b to 2a).
4. SECURITY 4a high 4n medium **4b low**	***Model 1*** indicates that in this problematic situation individuals are left to look after themselves.	***Model 2*** shows that collective responsibility has no direct link to low security but it is connected to low security through some other variables; for instance, to respond collectively to low earnings and to poor education.
5.RESPONSIBILITY **5a individual** 5n medium **5b collective**	(5a) ***INDIVIDUAL responsibility*** is the most central attribute in ***Model 1***. Although low security may increase individual responsibility, some other aspects make it easier to become responsible of your own activities: high employment with high opportunity, high motivation, and moderate or medium chances. In addition, strong agency (i.e. self belief) supports taking responsibility of your own actions.	(5b**)** ***COLLECTIVE responsibility*** in ***Model 2*** is seen as a reaction to high risk, poor education, low incentive to learn, and moderate chances. Collective responsibility is supporting high opportunities and high employment (cf. arrows from 5b to 2a and 11a).

	Finally, individual responsibility leads to acknowledge the high risk, and the low security. At the same time 5a results in high adaptability, and in high motivation to use good opportunities that are available.	
6. EDUCATION 6a good 6n medium **6b poor**	In ***Model 1*** this package of poor education with high risk, low security, low incentive and low earnings is to be opened by individuals themselves.	***Model 2*** indicates that this problematic package is left to be opened and reacted collectively (cf. an arrow from 6b to 5b).
7. INCENTIVE to learn 7a high 7n medium **7b low**	In **Model 1** individuals are left to solve their problems on their own. This could easily lead one to give up and/or to feel helpless in these difficult circumstances. Nevertheless, strong agency, high motivation and high adaptability, good opportunities, and high employment may help, at least temporally, to avoid some negative effects of low incentive.	***Model 2*** shows that much is left to collective responsibility to solve these problems (arrow from 7b to 5b).
8. MOTIVATION **8a high** 8n medium 8b low	It is interesting to see in ***Model 1*** that individual responsibility has a tight (two-way relationship) with high motivation. This indicates that high motivation makes one to take responsibility him/herself and vice versa; individual responsibility encourages high motivation.	***Model 2*** shows that collective responsibility is not directly linked to high motivation but it is an important variable to back other variables. It is linked to motivation via high opportunity, and high employment that both have a tight two-way relationship with high motivation.
9. ASPIRATION 9a high **9n medium** 9b low	In ***Model 1*** medium life chances together with medium aspiration build a link to individual responsibility (cf. an arrow from 13n to 5a). High opportunities may stimulate some activities that follow your own aspiration (an arrow from 2a to 5a).	In ***Model 2*** Collective responsibility is not directly linked to medium aspiration but it builds connections through medium life chances as in Model 1 (an arrow from 13n to 5b). However, collective responsibility is backing (an arrow from 5b to 2a) high opportunities, and there is a moderate aspiration to use these options in the labour market (an arrow from 9n to 2a).
10. EARNINGS 10a high 10n medium **10b low**	In ***Model 1*** a person is left to cope with low earnings on his/her own in a disposition of strong agency, high motivation and high adaptability (arrows from 3a, 8a and 12a to 5a). Good opportunities may help to find work.	In ***Model 2*** collective responsibility does not have a direct link to low earnings. Nevertheless, some collective actions may be needed to look after everyday problems (cf. an arrow from 1a high risk to 5b collective responsibility).

11.EMPLOYMENT **11a high** 11n medium 11b low	***Model 1*** demonstrates how high employment is likely to encourage people to take more individual responsibility (an arrow from 11a to 5a). High employment also gives more opportunities, and is likely to keep motivation high. However, high employment may lead to low incentive to learn perhaps because many options are ready made and tailored for you in the labour market.	In ***Model 2*** collective responsibility could be seen as a background variable (an arrow from 5b to 11a) to advance high employment. This could be understood either as a collective will in a society to find places in the labour market for as many as possible or as a collective positive value related to work in the society. Collective responsibility also reflects to the opportunities (an arrow from 5b to 2a).
12. Personal AGENCY **12a strong** 12n medium 12b weak	***Model 1*** shows how strong self-beliefs and positive self image lead to the person taking individual responsibility (an arrow from 12a to 5a). Individual responsibility could be seen here as a general value to support individual activities for individual gain.	It is interesting to see in ***Model 2*** that strong agency and collective responsibility do not have a direct influence on each other. Collective responsibility could be seen here more as supporting high employment and high opportunities (arrows from 5b to 2a and 11a).
13. Life CHANCES 13a rich **13n medium** 13b poor	In ***Model 1*** medium chances lead to take individual responsibility. Moderate chances keep the security low (an arrow from 13n to 4b). Nevertheless, there is moderate aspiration to do something for this situation.	In ***Model 2*** medium chances in one's life lead to wait collective responsibility to help (an arrow from 13n to 5b). Moderate aspiration in this insecure situation is not necessarily enough.

<u>Individual or collective responsibility: summary comparisons of Model 1 and Model 2.</u>

Models 1 and 2 demonstrate how only one difference in one concept (here: Concept 5 Responsibility) may reflect on the dynamics between the given set of concepts, and may change the function and role the other concepts, too. Actually the content and meaning of each attribute will be finally specified in these two models that are built by the information in Matrix.

The following summarises the roles of 5a individual responsibility and 5b collective responsibility in this conceptual context, when only responsibility varies:

1a high Risk: Individual responsibility is likely to feed high risk, while collective responsibility is in a role of responding to the problems caused by high risk.

2a high Opportunity: Collective responsibility is likely to increase opportunities, but good opportunities enable people to build more on their personal responsibility.

3a high Adaptability: Individual responsibility is likely to increase adaptability. Collective responsibility does not have a direct role here but it has an indirect function e.g. by increasing opportunities in the labour market.

4b low Security: Individual responsibility feeds low security, and low security in turn results in high risk and individual responsibility. Collective responsibility does not have a direct link to low security, but may help by responding to some other aspects that result in low security (e.g. poor education).

5a individual Responsibility: The list of attributes which most obviously result in individual responsibility in Model 1 are 2a, 4b, 8a, 11a, 12a and 13n. This indicates that high opportunities, high motivation, high employment, strong personal agency and medium life chances in an environment of low security foster taking individual responsibility. This keeps the risk high (1a), leading the individual to behave flexibly in this risky situation (3a), to cope with low security (4b), and still to keep motivation high (8a).

5b collective Responsibility: The attributes in Model 2 that lead to taking collective responsibility are 1a, 6b, 7b and 13n. This means that high risk with poor education and low incentive to learn and with some life chances foster taking collective responsibility, i.e. to respond to these problems by collective actions. Collective responsibility is likely to help in these circumstances in creating opportunities (2a) in the labour market and to keep employment high (11a).

6b poor Education: Poor education is here primarily due to low incentive to learn (7b). Individual responsibility does not have direct links with poor education. Collective responsibility tries to help to respond to poor education with its negative consequences.

7b low Incentive to learn: As above with poor education, neither individual nor collective responsibility leads directly to low incentive to learn. However, low incentive is likely to arouse some collective actions.

8a high Motivation: Individual responsibility has a tight two way relation with high motivation. This emphasises the role of personal engagement in keeping motivation high. Collective responsibility as such does not have a central role as related to motivation.

9n medium Aspiration: Neither individual nor collective responsibility has here any direct relation to moderate aspiration.

10b low Earnings: Neither individual nor collective responsibility has, in the Models 1 and 2, any direct relation to low earnings. It is primarily due to (6b) low education and (7b) low incentive to learn. In addition it is likely that low earnings increase the sense of (1a) high risk and feelings of low security (4b) in the two models.

11a high Employment: Collective actions (5b) are likely to help keeping the employment high in Model 2. Individual responsibility in Model 1 does not have directly similar influence, but in turn high employment may help one to take more individual responsibility.

12a strong Agency: High opportunities (2a) and high motivation (8a) are primary variables to strengthen strong agency. Strong agency is likely to foster individual responsibility. There is not a direct influence from strong agency to collective responsibility.

13n medium Life Chances: Medium level of aspiration (9n) is most central variable in Models 1 and 2 to influence medium life chances. However, medium chances could lead one to take either individual responsibility (5a in Model 1) or to wait for collective actions (5b in Model 2).

These two different models show how replacement of the attribute of individual responsibility with that of collective responsibility generates different versions of reality. But the different models are not mutually exclusive in practice and there are many instances where it would be reasonable to combine the advantages of individual and collective responsibility in planning policies and actions that can achieve sustainable change. For example, the models show that individual responsibility has an interesting role to enable people to use good opportunities in the labour market; while the exercise of collective responsibility is likely to increase opportunities in the labour market. It makes sense to hold these two versions of reality in some kind of balance. Similarly, when individuals are left to cope with low earnings on their own in a disposition of strong agency, high motivation and high adaptability, good opportunities may help them to find higher paid work. At the same time, and keeping both models in view, some collective actions are likely to be needed to look after everyday problems and provide short term support for the well-being of families affected by changes that are beyond their control.

Finding a balance between options or courses of action is central to the effective planning of interventions or change strategies, whether in public policy, in institutions or at the personal level. Simulations using conceptual models may help in finding an optimal balance, through the systematic exploration of relationships in given situations.

How to do simulations using conceptual models

A conceptual model shows the dynamic nature of relationships between the concepts in a given situation. In this paper there are two examples (Model 1 and Model 2) of how the relationships between concepts vary according to the attributes taken into a model, and of how different attribute combinations specify the content and meaning of each attribute in a given combination. Although we are here dealing with a particular set of thirteen concepts with their attributes, every concept will be finally defined by its relations with the other concepts and their attributes. This means, for instance, that 'high risk' may potentially become defined by about half a million more or less different ways depending on what are the other attributes in the combination to illuminate a given situation or a moment in a process of change. Conceptual models could be produced for all these potential cases by using the information of concept relations in Matrix 1.

In planning for change it is essential to seek optimal directions and possible strategies for changing a given situation for the better, and for making alternative models. Planning for change may start by analysing a current model and by changing one or more attributes in the combination. As shown in this paper only one change in Model 1 results in a new Model 2 (a change from individual responsibility to collective responsibility), and the dynamics between the concepts in the models represent two slightly different realities.

Simulations by conceptual models follow the sequence:

(1) Select a particular combination of 13 attributes to describe a certain situation or a case.

(2) Produce a conceptual model by the information in Matrix 1.

(3) Change one or two attributes to see in the new model the new dynamics in the relations.

(4) Continue to do changes and simulations until more satisfactory models have been identified.

Simulations are easy to do by using the software: http://www.edu.helsinki.fi/dca/ (Matrix 1 is under Note 4).

After selecting a particular attribute combination and producing the respective model for it, a change can be done in a model by clicking any attribute and by selecting a new attribute of the concept. In new models some arrows may occasionally be partly covered by others; so this is a reason to move these attributes to a clearer position. If there are many changes at the same time it could be better to select a new attribute combination and a conceptual model for it instead of trying to make changes in a fixed model.

A current conceptual model gives a basis for understanding a particular situation in general or in individual cases. Simulations may help to find alternatives for future models in order to depict various directions for change. It is another question to find practical solutions to drive towards a change. However, the simulations as such may help to find new structures and new directions to solve problems at individual or at political level.

In general, such simulations aim at finding new ways to understand probable consequences of changes, and to develop new structured analyses of possible strategies for planning change and for policy making.

Conclusions

This paper has set out to show how an interdisciplinary dialogue can be set up around shared concepts in order to reveal hidden assumptions, bring in a wider range of concepts and open up lines of joint inquiry.

The thirteen key concepts with their attributes, and the interdisciplinary conceptual infrastructure (Matrix 1) are central to dynamic concept analyses of risk. It is possible to use the data base of the matrix to produce conceptual models for any combination of attributes, and to build comprehensive pictures of concept relations within them.

The findings of this study illustrate the context dependency of the relationship between the constructs. For example, the understanding of a ‘risk’ situation depends on whether a focus on individual responsibility is adopted, compared to focusing on collective responsibility. We chose to focus on this area of often implicit assumption, to show how changing assumed

attributes of responsibility from individual to collective generates different realities and scenarios that can be debated across disciplinary boundaries

The example has shown how two different models with ‘individual’ and ‘collective’ responsibility result in two different pictures of the reality. We have also emphasised that these different models do not necessarily exclude each other in practice. In using such models to consider options and plan for change, it is often reasonable to seek some kind of balance. In this case the balance might reasonably be sought between individual and collective responsibility in mitigating the effects of risk through employment, learning and individual action. For instance, the ways in which a society may be responsible collectively to build a good education policy could involve increasing individual responsibility in learning and in using various possibilities to advance employment and the quality of life. In a different case, of similar topicality, a society may be responsible collectively, through the tax system, for encouraging people to contribute to their own future security by saving towards pensions in their later life whilst in employment. Individuals’ responsibility and personal agency in accessing and using the funds accrued has to be balanced with the collective interests of the society which has contributed substantially, through its taxpayers, to the value of the savings. This involves complex questions about collective responsibility and the pooling of risk.

Each perspective creates a different scenario within which the notion of 'risk' is interpreted and perceived. Regarding the interdisciplinary study of risk and responsibility this analysis shows how depending on a disciplinary standpoint and assumptions the meaning and perceived content of a construct can vary. We have seen how, in order to discuss risk, an economist brings earnings and employment into the discussion; social psychologists bring in the individual characteristics such as motivation and aspiration; sociologists bring in social structures of opportunity and concepts of agency.

To instigate an interdisciplinary discourse it is thus important to be clear about these different vantage points and to render them explicit. To facilitate the interdisciplinary discourse, approaches like conceptual analysis are helpful to gain a better understanding and illustration of the dynamics and context dependency of constructs.

The approach can be used in a number of different ways and at different levels of complexity:

- to develop ways to put various subject areas into a dialogue with each other.
- to develop a common conceptual framework for different fields of study - to agree upon the key concepts needed to understand a problem under study.
- to enable joint analyses of various phenomena, and to cross conceptual boundaries between different fields of study.
- to make a joint conceptual data bank of concept relations to study a phenomenon in different realities in general and/or in individual cases.
- to study dynamic nature of a phenomenon by conceptual models
- to make simulations with conceptual models in order to find different directions for planning of change if needed.

Interdisciplinary working potentially opens up new ways of looking at dynamics between concurrent factors, generating innovative thinking about different strategies or policies that could overcome the existing problems by exploring new representations of a reality. Furthermore, simulations may help to find alternatives for future models in order to depict various directions for change, by understanding probable consequences of changes in different realities[2].

The potential of the approach for developing genuine interdisciplinarity in collaborative inquiry (as something real rather than just talked about) hinges on the ways in which it opens up, for individuals and teams who approach real world research issues from different disciplinary stances, new spaces for clarification and debate.

The lessons learned from working through this process for developing understandings across disciplines include the recognition that even the same person may develop different meanings for a concept in different contexts during a research process. Built on shared understandings which allow these ideas to be developed, the tools and methods give a basis for defining content and meaning of concepts in different combinations and scenarios as well as for restructuring analyses of strategies for planning change and for policy making.

[2] The study has provided a basis for various applications using the data. Actually the data base of this study can be used without going into any deeper conceptual analyses. Matrix 1 is linked to a software programme that makes it possible to use this conceptual infrastructure. In addition this link gives an open forum for users to do their own conceptual analyses with their own data bases, if needed. Therefore the database of this study can be used as such but it is also possible users to define their own concepts and database to fit better with particular needs.

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APPENDIX:

Appendix 1. STATEMENTS OF the RELATIONSHIPS between the CONCEPTS of RISK in MATRIX 1. (KIM)

The concepts which do not have a direct influence to the concept in question appear in brackets. (This excludes only a two-way relationship between the two attributes. A link may appear between these attributes in the analyses of the other concepts.)

* Indicates a tendency towards the relationship as stated.

1. RISK (high – medium – low)	agree disagree
2. The less opportunities the higher the risk*	1 2 3 4 5
3. The less adaptability the higher the risk	1 2 3 4 5
4. The lower security the higher the risk	1 2 3 4 5
5. The more individual responsibility the higher the risk	1 2 3 4 5
6. The lower the education (initial) the higher the risk	1 2 3 4 5
7. The lower the incentive to learn the higher the risk	1 2 3 4 5
8. The lower motivation to succeed the higher the risk	1 2 3 4 5
9. -(Aspiration) no direct link stated from aspiration to risk	1 2 3 4 5
10. The lower earnings the higher the risk*	1 2 3 4 5
11. The lower employment the higher the risk	1 2 3 4 5
12. The weaker the agency the higher the risk*	1 2 3 4 5
13. The poorer chances to shape personal situation the higher risk	1 2 3 4 5
2. OPPORTUNITY (high – medium – low)	agree disagree
1. The higher the risk the less opportunities*	1 2 3 4 5
3. The more adaptability the more opportunities	1 2 3 4 5
4. -(Security) no direct link stated from security to opportunities	1 2 3 4 5
5. The more collective responsibility the more opportunities*	1 2 3 4 5
6. The better education the more opportunities	1 2 3 4 5
7. The higher the incentive to learn the more opportunities*	1 2 3 4 5
8. The higher motivation the more opportunities	1 2 3 4 5
9. The higher aspiration the more opportunities*	1 2 3 4 5
10. The higher earnings the more opportunities *	1 2 3 4 5
11. The higher employment the more opportunities	1 2 3 4 5
12. The stronger beliefs (agency) the more opportunities	1 2 3 4 5
13. The richer chances the more opportunities	1 2 3 4 5
3. ADAPTABILITY (high – medium – low)	agree disagree
1. The higher the risk the higher adaptability*	1 2 3 4 5
2. The more opportunities the more adaptability	1 2 3 4 5
4. The more security the more adaptability*	1 2 3 4 5

5. The more individual responsibility the more adaptability	1 2 3 4 5
6. The better education the more adaptability	1 2 3 4 5
7. The higher the incentive to learn the higher adaptability	1 2 3 4 5
8. The higher motivation the higher adaptability	1 2 3 4 5
9. The higher aspiration the higher adaptability	1 2 3 4 5
10. -(Earnings)) no direct link from earnings to adaptability	1 2 3 4 5
11. -(Employment) no direct link from employment to adaptability	1 2 3 4 5
12. -(Agency) no direct link stated from agency to adaptability	1 2 3 4 5
13. -(Chance) no direct link stated from chances to adaptability	1 2 3 4 5
4. SECURITY (high – medium – low)	agree disagree
1. The lower the risk the higher the security	1 2 3 4 5
2. The more opportunities the more security	1 2 3 4 5
3. The more adaptability the more security	1 2 3 4 5
5. The more collective responsibility the more security	1 2 3 4 5
6. The better education the more security	1 2 3 4 5
7. The lower the incentive to learn the less security	1 2 3 4 5
8. - (Motivation) no direct influence from motivation on security	1 2 3 4 5
9. - (Aspiration) no direct influence from aspiration on security	1 2 3 4 5
10. The better earnings the more security	1 2 3 4 5
11. The better employment the better security	1 2 3 4 5
12. Higher beliefs (agency) the higher security*	1 2 3 4 5
13. The richer chances the more security*	1 2 3 4 5
5. RESPONSIBILITY (individual – neutral – collective)	agree disagree
1. The higher risk the more collective responsibility*	1 2 3 4 5
2. The more opportunities the more individual responsibility	1 2 3 4 5
3. -(Adaptability) - no direct link stated from adaptability to responsibility	1 2 3 4 5
4. The less security the more individual responsibility	1 2 3 4 5
6. The better (initial) education the more individual responsibility	1 2 3 4 5
7. The higher the incentive to learn the more individual responsibility	1 2 3 4 5
8. The higher motivation the more individual responsibility	1 2 3 4 5
9. The more aspiration the more individual responsibility	1 2 3 4 5
10 -(Earnings) no direct link stated from earnings to responsibility	1 2 3 4 5
11. The lower employment the more collective responsibility	1 2 3 4 5
12. The stronger agency the more individual responsibility	1 2 3 4 5
13. The richer chances the more individual responsibility*	1 2 3 4 5
6. Initial EDUCATION (good – medium – poor)	agree disagree
1. -(Risk) no direct link from risk to education	1 2 3 4 5
2. The more opportunities the better education*	1 2 3 4 5
3. -(Adaptability) no direct link from adaptability to education	1 2 3 4 5
4. -(Security) no direct link from security to initial education	1 2 3 4 5
5. The more collective responsibility the better education	1 2 3 4 5
7. The higher incentive to learn the better education	1 2 3 4 5
8. The higher motivation the better education	1 2 3 4 5
9. The higher aspiration the better education	1 2 3 4 5
10 -(Earnings) no direct link to initial education	1 2 3 4 5
11.-(Employment) no direct link from employment to initial education	1 2 3 4 5
12.-(Agency) no direct link from agency to initial education	1 2 3 4 5
13. -(Life Chances) no direct link from chances to education	1 2 3 4 5

7. INCENTIVE to learn (high-medium-low)	agree disagree
1. Medium risk leads to high incentive to learn	1 2 3 4 5
High and low risk result in low incentive to learn	1 2 3 4 5
2. The more opportunities the higher incentive to learn	1 2 3 4 5
3. The more adaptability the higher incentive to learn*	1 2 3 4 5
4. Medium security leads to high incentive to learn	1 2 3 4 5
High and low security lead to low incentive to learn	1 2 3 4 5
5. -(Responsibility) no direct link from responsibility to incentive to learn	1 2 3 4 5
6. The better education the higher incentive to learn	1 2 3 4 5
8. The higher motivation the higher incentive to learn	1 2 3 4 5
9. The higher aspiration the higher incentive to learn	1 2 3 4 5
10.-(Earnings) no direct link from earnings to incentive to learn	1 2 3 4 5
11. The lower employment the higher incentive to learn*	1 2 3 4 5
12. The stronger agency the higher incentive to learn	1 2 3 4 5
13. The richer chances the higher incentive to learn	1 2 3 4 5
8**. MOTIVATION to succeed (high - medium - low)**	agree disagree
1. The higher the risk the more motivation to succeed*	1 2 3 4 5
2. The more opportunities the higher motivation	1 2 3 4 5
3. The higher adaptability the higher motivation*	1 2 3 4 5
4. Medium security is likely to lead to high motivation	1 2 3 4 5
Both high and low security are likely to lead to medium motivation	1 2 3 4 5
5. The higher individual responsibility the higher motivation*	1 2 3 4 5
6. The better education the higher motivation	1 2 3 4 5
7. The higher incentive to learn the higher motivation*	1 2 3 4 5
9. The higher aspiration the higher motivation	1 2 3 4 5
10. The better earnings the higher motivation*	1 2 3 4 5
11. The higher employment the better motivation*	1 2 3 4 5
12. The stronger agency the higher motivation	1 2 3 4 5
13. The richer chances the higher motivation	1 2 3 4 5
9. **ASPIRATION (high-medium-low)**	agree disagree
1. The higher the risk the higher aspiration*	1 2 3 4 5
2. The more opportunities the higher aspiration*	1 2 3 4 5
3. The higher adaptability the higher aspiration*	1 2 3 4 5
4. -(Security) no direct link from security to aspiration	1 2 3 4 5
5. -(Responsibility) no direct link from responsibility to aspiration	1 2 3 4 5
6. The better initial education the higher aspiration	1 2 3 4 5
7. The higher incentive to learn the higher aspiration*	1 2 3 4 5
8. The higher motivation the higher aspiration	1 2 3 4 5
10. - (Earnings) no direct link to be stated from earnings to aspiration	1 2 3 4 5
11. - (Employment) no direct link from employment to aspiration	1 2 3 4 5
12. The stronger the agency the higher aspiration	1 2 3 4 5
13. The richer chances the higher aspiration	1 2 3 4 5
10. EARNINGS (high - medium - low)	agree disagree
1 -(Risk) no direct link stated from risk to earnings	1 2 3 4 5
2. The more opportunities the better earnings	1 2 3 4 5
3. The better adaptability the better earnings	1 2 3 4 5
4. -(Security) no direct link stated from security to earnings	1 2 3 4 5

5. -(Responsibility) no direct link stated from responsibility to earnings	1 2 3 4 5
6. The better education the better earnings	1 2 3 4 5
7. The higher incentive to learn the better earnings	1 2 3 4 5
8. The higher motivation the better earnings	1 2 3 4 5
9. The higher aspiration the better earnings	1 2 3 4 5
11. The higher employment the better earnings*	1 2 3 4 5
12. The stronger agency the better earnings	1 2 3 4 5
13. The more chances the better earnings	1 2 3 4 5
11. **EMPLOYMENT (high-medium -low)**	agree disagree
1. The lower the risk the better employment	1 2 3 4 5
2. The more opportunities the higher employment	1 2 3 4 5
3. The more adaptability the higher employment	1 2 3 4 5
4. The more security the higher employment*	1 2 3 4 5
5. The more collective responsibility the higher employment	1 2 3 4 5
6. The better education the higher employment	1 2 3 4 5
7. The higher incentive to learn the higher employment	1 2 3 4 5
8. The higher motivation to succeed the better employment	1 2 3 4 5
9. The more aspiration the better employment	1 2 3 4 5
10. -(Earnings) no direct link stated from earnings to employment	1 2 3 4 5
12. The stronger agency the better employment*	1 2 3 4 5
13. The more chances the better employment	1 2 3 4 5
12. AGENCY (strong-medium-weak)	agree disagree
1. The higher the risk the lower the agency*	1 2 3 4 5
2. The more opportunities the stronger the agency	1 2 3 4 5
3. - (Adaptability) no direct relation stated from adaptability to the agency	1 2 3 4 5
4. The higher security the higher the agency*	1 2 3 4 5
5. -(Responsibility) no direct link stated from responsibility to the agency	1 2 3 4 5
6. The better initial education the stronger the agency	1 2 3 4 5
7. The higher the incentive to learn the stronger the agency	1 2 3 4 5
8. The higher motivation the stronger the agency	1 2 3 4 5
9. The higher aspiration the stronger the agency	1 2 3 4 5
10. -(Earnings) no direct link stated from earnings to the agency	1 2 3 4 5
11. -(Employment) no direct link stated from employment to the agency	1 2 3 4 5
13. The more chances the stronger the agency*	1 2 3 4 5
13. Life CHANCES (rich-medium –poor)	agree disagree
1. The lower the risk the more chances*	1 2 3 4 5
2. The more opportunities the more chances	1 2 3 4 5
3. The more adaptability the more chances	1 2 3 4 5
4 The better security the richer chances*	1 2 3 4 5
5. -(Responsibility) no direct link from responsibility to chances	1 2 3 4 5
6. The better initial education the more chances	1 2 3 4 5
7. The higher incentive to learn the more chances	1 2 3 4 5
8. The higher motivation the more chances*	1 2 3 4 5
9. The higher aspiration the more chances	1 2 3 4 5
10. -(Earnings) no direct link stated from earnings to the life chances	1 2 3 4 5

11. The higher employment the more chances 12. The stronger agency the more chances*	1 2 3 4 5 1 2 3 4 5

For more information, please contact
llakescentre@ioe.ac.uk
LLAKES Centre
Institute of Education
20 Bedford Way
WC1H 0AL
London
UK

National
Institute of
Economic and
Social Research

UNIVERSITY OF
Southampton
School of Education

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ECONOMIC
& SOCIAL
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