A TIME AND PLACE FOR EVERYTHING?

Social Visualisation Tools and Critical Literacies

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Time, I have come to realise, is a strange and fascinating thing. I have now spent several years researching the temporal (and geographical) as structuring devices for information and found both to be highly interesting constructs and research objects. In one’s own life, time seems, perhaps, slightly less fascinating but equally peculiar. In one way, it feels like I have done this forever (has life ever been different?); in another, like I have only just started. And by another temporal order, it is undeniably time to stop writing. The best way to do that is of course by trying to formulate into words the one dominant emotion at this time, namely that of gratitude towards all the persons that, in different capacities, have helped along the road. Whatever errors that remain in the text are my responsibilities alone.

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environments, contacts and PhD courses. In particular, the LearnIT conferences and research seminars and the opportunities for more formal presentations of stages of this work to other doctoral students and senior researchers in the LinCS network have been highly valuable and helpful.

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I dedicate this book to the memory of my mother and grandmothers, Karin, Eva and Inga, to whom I owe everything. And to my sweet beloved daughter Alice, I dedicate all my evenings and weekends to come.

Veronica Johansson
Göteborg, November 2012
1

INTRODUCTION

This dissertation explores ways in which study participants critically approach and use social visualisation tools as information resources; it is about social visualisation tools and critical literacies. The central concept of critical literacies as used here extends and redefines prior critical literacy definitions within an overall constructionist framework through the application of sociocultural theories on tools and sociotechnical theories on inscriptions. Critical literacies hereby comes to denote pluralistic situated enactments of meaning by which the study participants identify, question and transform bias, restrictions and power related aspects of access, control and use in relation to the tools.

The analysis draws on two ethnographically inspired studies of participants’ interactions with visualisation tools selected to accommodate two points of interest in particular. Firstly, the tools incorporate social data, meaning data relating to human beings, doings, and relations. Secondly, the tools make use of, but differ markedly in their emphasis on, time and place for their visual representations of data sets. In other words, one of the tools foremost represents change over time, expressed as dynamic animations along a time axis, whereas the other can primarily be identified as a geographical map based visualisation (geographic information system, GIS).

The results of the analysis demonstrate that the study participants enact a richly varied set of critical literacies categorised into three main directionalities as reactive, proactive, and adaptive, of which the adaptive varieties seem thus far largely
overlooked. Each critical literacy directionality is also seen to correspond with specific idea traditions and views on information and to construct the tools as information resources in various ways. It is suggested on the basis of these findings that dominant cognitivist and positivist popular and academic narratives of visualisations should be replaced with more nuanced alternatives that emphasise the potentials of visualisation tools as evocative and non-blackboxed information resources that inspire new questions and enable repeated analyses from alternative perspectives rather than as enunciative tools providing true answers. It is concluded that shifting attention in this way can help bring about developments and uses of visualisation tools that support critical literacies.

1.1 BACKGROUND TO THE STUDY

Since my decision to study visualisation tools I have met surprisingly many blank faces and misconceptions. Someone thought visualisation was all about statistics, another discarded them as similar to unintelligible and nonsensical computer games. So what do people in general really know about visualisation tools? It is at least safe to say that even if the term visualisation tool seems unfamiliar, the tools themselves are most certainly not, as by now they have comfortably gentrified their way from science to popular mainstream. If you have ever watched the weather presentation in the TV news, used a GPS to plan and find your way for a car travel, created a ‘friend wheel’ of your Facebook contacts, or requested a map display of nearby sushi restaurants to your smart phone – and my guess is that you have – then you are not only acquainted with them, but a user of them.

But visualisation tools are difficult to pinpoint. They are everywhere, from web browsers and web portals to mobile devices and desktop computers and the media’s breaking news stories. Some are ‘free’, some are highly expensive. They can

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1 To not unnecessarily agitate my readers already in the first lines of the dissertation, let me make clear that I find this latter dismissal to be as unfortunate and mistaken about computer games as about visualisation tools.

2 As a descriptor, ‘free’ as in ‘free software’ and the like is a complicated affair. The often high costs involved in granting the public access without up-front charges naturally have to be covered in other ways. The costs are thus not direct but the user might still be considered taxed through being used for both the production and reception of targeted advertising, and since the products are often subsidised by large corporations aiming to – eventually – attract ‘consumers’ rather than ‘users’. See for example Dodge and Perkins (2009, p. 1) on this issue in relation to Google Earth and Klang (2005) on free software and open source.
incorporate all kinds of data into every conceivable interactive and visual representational mode, from tree-map visualisations of library and bibliographic databases to dynamic network depictions of social relations on the Internet (Friendly, 2009, p. 2; Zhu & Chen, 2005). When the data represented are of a social nature, meaning that they specifically relate to people, their activities, and interactions as in the GPS travel route and sushi restaurants examples, the more specific term social visualisation tool is sometimes used (Sluijs, 2008) and these types of tools are particularly popular among the general public. Aesthetically, the tools are often colourful and appealing; aiming for intuitive and eye-catching displays such as bouncing shape and colour shifting bubbles, interactive time-series animations, and geographical displays of easy-to-read data symbols or document miniatures on top of maps or satellite imagery. Visualisation tools are also deployed by a highly heterogeneous set of actors and users, from states and organisations using them to govern, educate or advocate; to companies seeking profitable new products and markets; to leisure activity or interest-driven social communities; to self-monitoring, self-exploring individuals.

To mention a few examples, there is the comparatively well-known Darfur crisis visualisation from the United States Holocaust Memorial Museum (USHMM) and Google Earth (USHMM, n.d.). Through satellite imagery of the Darfur region, users gain interactive access to photographs, written reports, video clips and data on shelters, refugees and damaged villages (c.f. e.g., Parks, 2009). There is also the IBM produced Sense.us showing a time-series representation of the U.S. labour force broken down by gender (Heer, Viégas, & Wattenberg, 2007; Sluijs, 2008). At the other end of the spectrum there are social grass-root Internet communities such as Many Eyes where individuals share, discuss and question data, visualisations and analyses on topics that range all the way from soccer statistics to personal integrity issues (Many Eyes, n.d.) and a host of other sites for more or less commercialised mash-ups and points of interest (POIs) from speed cameras to Bible landmarks for other users to access, download or complement (e.g., Blamont, 2008). For the more egocentric user, there are also tools for “self-surveillance” in various areas such as physical health and fitness (SugarStats, FitDay and FatSecret) and environmental concerns (The Personal Environmental Impact Report [PEIR], and WattzOn) along with more generalised self-surveillance tools (such as Me-trics, Daytum and Yourflowingdata) as described by Yau & Schneider (2009).

3 Examples of this type also tie into a subset of mobile, real-time visualisation applications sometimes described as location-based services (LBS) and augmented reality (AR) (see further section 2.2 below).
Despite the striking multitude and variety, though, all visualisation tools have in common that they also function, in some way or other, as information resources. This, among other qualities and functions, makes them interesting objects of study within the library and information science (LIS) discipline. And from this perspective, an area in particular need of research and to which the aim of this dissertation (see section 1.3. below) contributes to a certain extent concerns more specifically how visualisation tools function – or are made to function – as information resources, and with what consequences.

My identification of, and interest in, this research topic grew gradually from an initial research proposal and subsequent reception of funds from the Swedish Knowledge Foundation’s (KK-stiftelsen) national research program LearnIT. This program was a strategic start-up investment for the establishment of broad and interdisciplinary platforms for research on learning and IT in Swedish universities. The particular research call from LearnIT to which my proposal responded was not specified beyond a broad concern with “markup and learning” and so, as a co-funded dissertation project between LearnIT and the Swedish School of Library and Information Science (SSLIS) at the University of Borås, there was room for me to rework this into a more specific topic of – hopefully – mutual interest. The LearnIT network was essentially operative between 2000 and 2009, and I conducted the first part of my doctoral work as a member thereof. For the latter half of my research, I have been affiliated with the topically related but considerably larger and more long-term established research environment the Linnaeus Centre for Research on Learning, Interaction and Mediated Communication in Contemporary Society (LinCS), based at the University of Gothenburg. LinCS is a national research centre of excellence with focus on learning and media funded by the Swedish Research Council (Vetenskapsrådet).

And so, with one foot in SSLIS and the other in LearnIT/LinCS, I came to adapt and concretise the theme of markup and learning into this study on social visualisation tools and critical literacies. The process that led me to this is echoed in the first part of this dissertation (chapters 2 and 3) which largely deals with research object conceptualisation and research tradition positioning. The below and immediately following sections of this introductory chapter, in contrast, describe the research problem, aim, relevance and contributions in more concrete terms and

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4 Visualisation tools can, depending upon situation and perspective, also be conceived not primarily as information resources but as tools for data illustration, animation, management and archiving.
present the research topic as an issue of disciplinary, professional and social importance and relevance.

1.2 RESEARCH PROBLEM

While there is no doubt that visualisation is found interesting, relevant, and topical for the LIS field, there seems to be some rather one-sided tendencies towards largely uncritical system oriented research and development approaches. A common argument is that LIS researchers and professionals can and should support and improve the rapidly escalating development in society at large towards a visual culture and information base. In a 2009 special “visual” issue of the Bulletin of the American Society for Information Science and Technology sponsored by the Special Interest Group/Visualization, Images and Sound (SIG/VIS), for example, editor Irene L. Travis states that “there are few areas of research in our field that are as important and challenging as working with images and visualisation” (Travis, 2009, p. 2) after which guest editor Diane Neal proceeds to highlight two topics of main interest. The first concerns representation, search and retrieval of the already existing and fast-increasing body of visual material, translated into a need to develop better visual web browsers and metadata for videos, photos and data visualisations. The other concerns the development and design of tools for the creation of visualisations that are as intuitive as possible in order to maximise the speed and analytical power obtained from combining “human vision and cognitive processing” with “visual displays of quantitative information” (Neal, 2009, pp. 7–9). Questions concerning the meanings, functions, and uses of visualisation tools as information resources, however, are rarely mentioned and there is an almost total lack of empirical situated studies.

The body of research that does relate to uses of visualisation tools as information resources is instead of two main types. The first, and dominant, consists of empirical but laboratory based experiments of tool use that usually aim to validate and test predefined measures of ‘usability’, ‘success’, and ‘failure’ (Ma, 2004, p. 154; Zhu & Chen, 2005, p. 166). Because of its decontextualised nature, this type of research is beside the interests of this dissertation. The other type of research consists of rather generalised and theoretical perspectives on visualisation tools’ social and political functions and effects. Although performed at a different level of analysis, this type of research provides interesting examples of characteristics and effects commonly associated with the uses of visualisation tools as information resources. On the positive side, there are descriptions of the visualisation tool
development and proliferation as a democratising improvement that will make data easier to access and use by, and in the interests of, individuals, the public and non-governmental organisations (NGOs) (e.g., Blamont, 2008; Gartner, Bennett, & Morita, 2007; Goodchild, 2004; Latham, 2006; Sluijs, 2008; Tulloch, 2007). On the negative side, there are concerns about non-critical uses, recreations and reinforcements of bias and oppression, and – when social data are involved – caveats and fears regarding integrity, security and ethics (e.g., Blamont, 2008; Crutcher & Zook, 2009; Latham, 2006; Parks, 2009; Yau & Schneider, 2009).

The use of visualisation tools as information resources on a broad scale, thus, also triggers concerns regarding the public’s ability to apply, read and interpret them in the proverbial ‘right way’. But with few empirical and situated studies there is little research based knowledge of the characteristics of user-tool interactions and relations beyond conjectures of ‘hopes and fears’ type. The default option in primarily the professional library and information fields for dealing with uncertainties in users’ interactions with various types of information resources is by defining and teaching “information literacy” which usually covers the whole spectrum of information needs, seeking, and use (e.g., Webber & Johnston, 2000). But there is wide agreement among LIS researchers that these types of library-developed information literacy definitions and instructions largely ignore or trivialise the justifications of and complexities involved in real-world situated information activities and practices (e.g., Andersen, 2006; Bawden, 2001; Bruce, 1997; Kapitzke, 2003a; 2003b; Limberg & Sundin, 2006; Limberg, Sundin, & Talja, 2012; Lloyd, 2007; Pawley, 2003; Simmons, 2005; Sundin & Johannisson, 2005a; Tuominen, Savolainen, & Talja, 2005).

A further shortcoming of such information literacy definitions is that they are clearly moulded from a stereotypical print, text-based, human-authored document type, which makes them difficult, if not impossible, to translate to visualisation tools (Johansson, 2009). The deficiencies of definitions based on traditional and print-culture adapted critical assessments of author and publisher has been demonstrated not least in relation to the anonymisation of the so-called web 2.05 with its new types of dynamic, collaborative, and non-expert information resources such as Wikipedia and blogs (Lankes, 2008; Sundin & Francke, 2009). To a certain extent, this applies to visualisation tools as well, since they too are characterised by similar high interactivity characteristics. But visualisation tools also challenge these constraints of information literacy definitions one step further since,

5 For a more elaborate discussion and explanation of web 2.0, the history of the term, the claims presented alongside it, and critique against it, see e.g., O’Reilly (2007).
normally, they do not even contain or come accompanied by text and propositions and altogether lack easily distinguishable equivalents to human authors. And so, to reach beyond both the conjecture-type of societal-level research on the assumed ‘effects’ of large-scale social visualisation tool use as well as the shortcomings of monocentric, generic, and authoritarian checklists of ‘right’ and ‘wrong’ ways to approach and use information resources, there is clearly need for complementary micro-level situated empirical studies of actual visualisation tool use.

Yet another reason for the need for this type of research becomes apparent when considering the knowledge views and claims that permeate common visualisation discourse and definitions. In spite of the public popularisation, the main purpose of the whole multifarious family of visualisation tools is described in common definitions in scientific terms, said to go beyond mere displays of things already known to the unravelling or generation of completely “new knowledge” (e.g., Friendly, 2009, p. 2; Jessop, 2006; c.f. also section 2.1). Accounts of this type portray visualisation tools as powerful and authoritative sources of knowledge in manners reminiscent of positivism, objectivism, and the oft-critiqued so-called immaterial information view (c.f. section 3.1.1). The effect is to construct ‘visualisation’ in simplistic misconceptions as abstract, true and objective information or knowledge that exists outside of and remains unaffected by social relations and representational modes and practices.

The above is not to say, though, that users are helpless uncritical victims to alleged knowledge claims almost automatically conjured by visualisation tools. On the contrary, this discussion is intended to demonstrate that the current lack of research in the areas mentioned leaves us with a number of quite urgent but thus far largely unaddressed questions. For example: what authority do users attribute to visualisation tools as information resources? How and why is that enacted and negotiated? Who and what determine which data attributes and representational modes that are selected and which are not – in effect, who and what determine what is shown and what is hidden from view? In lack of explicitly and textually formulated knowledge claims, how does interpretation of meaning occur, and how can a consensus of interpretation of meaning be achieved?

This dissertation responds to some aspects of these questions in the way specified by the formulation of research aim below.
1.3 Research Aim

One of the main outcomes of this study is to open up and demonstrate the relevance and potential of a so far largely unexplored territory in LIS. This territory emerges through the positioning of the research objects (visualisation tools as information resources) in between two well-established LIS research traditions. The first is characterised by critical studies of and perspectives on information organisation, which to date overwhelmingly translates into critical analyses of classification systems. The other is characterised by situated use approaches in the form of literacies research. In my interpretation, the combination of these two so far largely separate LIS traditions means that I acknowledge and draw upon previous research that demonstrate problems relating to cultural, structural, political, and even practical bias and constraints as inevitably reflected in and recreated by all sorts of information organisation systems, but that my main point of interest is directed towards how such sorts of bias and constraints take form and play out in local, situated, user interactions and how this shapes the tools as information resources.

Whereas critical theories on and studies of classification systems seem to have remained fairly consistent throughout LIS history and nearby fields (e.g., Berman, 1971; Bowker & Star, 1999; Hansson, 1999; Nyström, 2011; Olson, 2001; Tennis, 2008; Weinberger, 2007), literacy research has undergone considerable change reflected by a both terminological and disciplinary shift into a growing field of mutual concern to primarily LIS and pedagogy where today many prefer to speak of literacies in the plural (e.g., Limberg et al., 2012; Lloyd, 2007; Sundin & Johannisson, 2005a; Tuominen et al., 2005). Most importantly, these new approaches conceive of literacies as simultaneously enacted variations of social, contextually situated and locally meaningful tool-mediated activities and practices.

However, since my research interest resides in the overlap between critical perspectives on information organisation and subsequent user interactions, I direct focus in the following to the more specific concept of ‘critical literacies’. I do so in order to elaborate on the above described one-sided predominance of system oriented and societal-level perspectives and complicate popular immaterial, cognitivist and positivistic misconstructions of visualisation (c.f. section 2.1). For this purpose, ‘critical literacies’ is (re-)defined here through combining this more recent understanding of and move towards literacies in the plural with prior generic and normative definitions of ‘critical literacy’ and further elaborated with the help of aspects from the sociocultural and science and technology studies (S&TS) theoretical...
perspectives on human-tool interactions. Through these moves, critical literacies comes to denote pluralistic situated enactments of meanings through which the study participants identify, question and transform perceived cultural, material bias and restrictions; power related aspects of access, control and use; as well as other possible expressions of distanced and questioning approaches to and uses of the tools. Moreover, the social constructionist and sociologically inspired perspectives that frame and guide this study mean that emphasis is placed on the mutual shaping of tools and practices. In summary, the area of interest here can be expressed in a formulation of overarching research aim as an intention to analyse mutual enactments of critical literacies and social visualisation tools as information resources.

From the larger tradition of literacies research, this also means that I define and study critical literacies as situated and emergent activities that are to be considered rational and meaningful for the individual from his or her perspective in the context of activity. Analytically, I look for ways in which the users critically approach and use the visualisation tools as expressed in user-tool interactions and in the users’ own descriptions of how they use and perceive the tools. The research aim is later operationalised by the formulation of more specific research questions following the presentation of the study’s theoretical framework.

Empirically, I pursue the research aim in two case studies of visualisation tools in use. To highlight potentially interesting aspects relating to certain specific types of visual representational modes, I have chosen visualisation tools that both include social data, but that vary in their reliance on time and place for their visualisations:

— Through the case hereafter referred to as “Geo”, I study the use of a primarily geographically based visualisation tool, which means that data are visually represented as geographically distributed on top of maps or aerial imagery. In Geo, the tool used is a GIS (geographic information system) called MapInfo, situated at the Traffic and Public Transport Agency in Gothenburg city and some related sites of use. MapInfo is here primarily used for the purpose to improve safety and reduce accidents in city traffic.

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6 By ‘representational mode’, I refer to the different graphical layouts or “display formats” (Library of Congress, n.d.a) used to represent the inputs of data as visualisations. Examples of different types of representational modes are for example the geographical map and the colour coded bar chart. In a later section (3.2.2), I elaborate on this issue and suggest that Buckland and Ramos’ (2010) concept of “structuring device” might also serve as an alternative and possibly more ‘LIS generic’ descriptor for connecting the representational functionalities of interest in this study to more traditional LIS research on information organisation from critical perspectives.
Through the case hereafter referred to as “Trends”, I study the use of a predominantly temporally based visualisation tool, which in this case means that data are represented according to their temporal attributes with the help of animated movement along a time axis. In Trends, the tool used is the application Trendalyzer, situated at the Stockholm based Gapminder foundation and two external sites of use. In these sites, Trendalyzer is mainly used for purposes to analyse and spread knowledge about the state and development of areas such as health and economy for the countries of the world.

The empirical material was produced with qualitative and ethnographically inspired methods in the form of semi-structured interviews, observations, contextual inquiry, and studies of technology and documents central to the practices in each case. The analysis was performed with the help of a theoretical framework combining features from the sociocultural perspective and science and technology studies (S&TS). Particular emphasis is placed on those theoretical concepts that were deemed useful to elaborate my understanding of critical literacies, both conceptually and analytically, from a clear focus on the mutual shaping of tools and practices in situated interactions; more specifically externalisation, mobilisation and appropriation.

### 1.4 Relevance and Contributions

The results of this study emanating from the analysis of the empirical material can be summarised as providing a more nuanced understanding of interpretations and uses of social visualisation tools as information resources; of enactments and meanings of critical literacies; and, above all, of relations between the two. These research results and contributions should be of interest not only to LIS, but also to other academic disciplines and subfields as well as related professions.

From the fields of geography, visualisation and pedagogy, there are, for example, explicit demands for new and complementary approaches from so far uninvolved disciplines to dominant technical and system oriented non-critical approaches to visualisation tools and related technologies. Geographers Dodge and Perkins (2009, p. 4) contend that “[t]here is real scope for original research that questions the ontological surety of satellite imagery and epistemological implications of online portals like Google Earth”. Visualisation researchers Zhu and Chen (2005, pp. 167–169) believe that although laboratory experimentation has been useful in
information visualisation research, other qualitative and contextual methods such as interviews and ethnography need to be considered in order to gain knowledge about real-life complex uses. And in pedagogy and education, visualisation and literacy have been placed at the top of the research and future development agenda.

The sixth annual *Horizon Report* from the New Media Consortium (NMC) and the Educause Learning Initiative (ELI) in early 2009 (Johnson, Levine, & Smith, 2009), presents the tell-tale labelled area of “Geo-everything” as one of the six most important technology and practice developments likely to have a large impact on teaching, learning, research, and creative expression within the next two to three years. They also identify and rank visualisation tools as the fourth most important new trend, and the development of new skills for information, visual, and technology literacies as the number one challenge over the next five-year period.

Still in the 2011 version of the report, “digital media literacy continues its rise in importance as a key skill in every discipline and profession” (Johnson, Smith, Willis, Levine, & Haywood, 2011, p. 3) and the report goes on to assert that “there is a greater need than ever for effective tools and filters for finding, interpreting, organizing, and retrieving the data that is important to us” (p. 4). In this dissertation, all these areas of “geo-everything”, visualisation tools, and literacy are problematised, analysed and explored as interrelated elements in situated information activities.

On the most overarching level, however, this dissertation will hopefully also contribute to LIS as an academic discipline by opening up and identifying a largely unexplored research area in between critically oriented analyses of information and knowledge organisation systems and situated studies of user activities and practices. The conceptual discussion presented here argues that the research area that can be identified and established in an overlap between these two traditions holds particular merit by promising to add additional layers or levels of understanding to both: from the perspectives of critical studies of information and knowledge organisation systems, it is interesting to also follow through and investigate which and in what ways those aspects of cultural and value related bias and restrictions previously identified in the systems become enacted in user interactions. From the perspective of literacies studies, it is interesting to also reflect upon what possible prior and external actors, interests, knowledge views and values that can explain information activities and enactments of meaning in situated use-interactions.

On the subject-level of LIS contributions, the reconceptualisation of visualisation tools as documents and representational artefacts advanced here should also be able to contribute to a broader recognition of visualisation tools as interesting and relevant research objects for LIS in their own right. In this view, visualisations are not only products ‘out there’ that require information organisation and retrieval
developments and adaptations but also recognised as a species of information resources of widespread use. With a focus promoting historical continuity rather than technologically determined differences, there are valuable things to understand and learn about visualisation tools from the history and contemporary state of document and information organisation research. And from the opposite perspective of these established traditions, new light, new questions, and new understandings of information resources and representational artefacts in general are to be gained from the incorporation of such new and somewhat concept-stretching examples of documents such as visualisation tools.

Further, this study also to some extent purports to contribute to theoretical and methodological development in LIS. The theoretical contributions come in the form of presenting a case for applying a combination of sociotechnical theories on inscriptions and sociocultural perspectives on tools to conduct simultaneously critically oriented and situated studies on enactments of meanings and interactions with representational artefacts. The combinatorial approach allows a fruitful focus on the mediating nature of artefacts and provides an avenue for comprehensively addressing and exploring how the meanings of representational artefacts are variously and iteratively constructed in many different sites and times that inter-twine micro level actions and interests with macro level institutions and cultures.

Methodologically, the combination of several and differently oriented ethnographically inspired research methods to answer to the areas of interest pursued in this dissertation will hopefully inspire further elaborations of such approaches. The results of this study illustrate how the meanings that the study participants ascribe to the visualisation tools are expressed in strikingly different ways in the interview sessions compared to the contextual inquiry inspired parts of data production. These results therefore present strong arguments for using methods that address both such knowledge that study participants are able to describe and formulate in words as well as ways to study also expressions of tacit and embodied knowledge to produce richer and more varied understandings of characteristics of, and relations between, tool interactions and enactments of meanings.

Outside the academic realm, the community of library and information professionals might also find that the questions raised and results found here direct attention to some new challenges but also possibilities that visualisation tools present. In particular, the findings suggest that there is a need to temper tendencies to exaggerate visualisation tool differences compared to print, text-based and other more traditional information resource modalities and substitute overly simplistic and counterproductive narratives of visualisation tools as objective, fact-based and automated generators of new knowledge with more nuanced alternatives. The
results may also be of interest to policy- and decision makers such as governments, agencies, and NGOs that either control and regulate the development, design and use of data and visualisation tools, or employ them as information resources in their own daily routines and activities of monitoring, advocacy and decision making.

1.5 OUTLINE OF THE DISSERTATION

The dissertation consists of nine chapters of which the remaining eight, after this introduction, are divided into four parts.

Part I – Describing and Positioning the Research Object has a predominantly introductory and orienting purpose and includes chapters 2 and 3. In chapter 2, I present a background and terminological overview to representation connected to visualisation and maps, concluded by the arguments for choosing instead to speak in terms of (social) visualisation tools in this dissertation. In chapter 3, visualisation tools are (re)conceptualised as an LIS relevant research object and positioned in previously established LIS research traditions in three steps. Firstly, visualisation tools are conceived as documents and representational artefacts. Secondly, the problematising and critical approach advanced in this study is described as related with an LIS ‘problem of representation’ research tradition within knowledge and information organisation. And thirdly, it is explained how the analytical level and focus of interest from which this problem of representation tradition is addressed here proceeds to push this study into the growing field of literacies research. In effect, thus, this dissertation is positioned in an area where critical perspectives on information organisation and literacies research overlap. In conclusion, the ways in which these views interrelate and lead up to the choice of theoretical perspectives are presented.

Part II – Design and Description of the Study consists of chapters 4 and 5. In chapter 4 on theory, the social constructionist stance in and sociological orientation of this dissertation is discussed, followed by a presentation of the aspects of science and technology studies (S&TS) and sociocultural theoretical perspectives that are adapted into an analytical framework for the study. The chapter concludes by the formulation of theoretically guided research questions that operationalise the research aim. In chapter 5 on method, the backgrounds to, and specifics of, the two empirical cases are described as an introduction to the tools, settings and participants in the study. The methodological choices and procedures for the production of empirical material and subsequent analyses are also explained. In conclusion, the
ways in which different methods for data production and analysis correspond to the different research questions are also indicated.

Part III – Analysis and Results, contains chapters 6 to 8. Here, the three primary analyses are presented, along with illustrating examples from the empirical material. Each chapter corresponds to one research question (as presented in section 4.3). Chapter 6 presents findings of the study participants’ enactments of the tools as cultural, material artefacts (and instances in which they disregard and obliterate the same). Chapter 7 gathers examples of the study participants’ views of the tools and themselves as unfavourably afflicted by other actors’ power and political related actions, as well as examples in which the participants also mobilise data and the tools to further their own interests. And chapter 8 illustrates additional and alternative ways in which the participants critically approach and use the tools in situated interactions.

Part IV – Final Discussion, Reflections and Recommendations, finally, holds the concluding chapter 9. Here, the results from the preceding analyses are drawn together in a discussion of how the findings relate to each other and to the overarching research motivation and aim of the study. The discussion presents two main conclusions in terms of a categorisation of overall directionalities of critical literacies and their relations to constructions of the tools as information resources, and arguments for the development of a new narrative of visualisation tools. A discussion of shortcomings due to methodological and other choices and restrictions concludes the chapter, together with suggested future research based on the study’s findings.
PART I

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DESCRIBING AND POSITIONING

THE RESEARCH OBJECT
The two applications studied here are related, in particular, to two dominant fields of practice and research with adjoining and influential terminological clusters: visualisation and maps (cartography). Both are also umbrella terms with a multitude of sub-terms that cause problems when used, as here, to refer to a specific research object in an academic and disciplinary context. In this sense, the clusters of visualisation and map terms are problematic since they tend to be very broad and vague; to simultaneously refer to technological applications, their outputs and associated practices as well as the scientific study of them all; to overlap; to refer only to modern technology in some instances and to all forms of technology throughout history in others; to mix metaphors; and to shift between using the characteristics of the objects (the data), the representational modes, or the contexts and purposes of use as internally differentiating labels. With the aim to minimise confusion here, this chapter is devoted to a brief introduction to the most common terminology in these areas. In conclusion, the reasons for choosing to primarily speak of the research objects studied here in terms of (social) visualisation tools rather than other conceivable terms such as (information) visualisation, data visualisation, or (dynamic) maps are outlined.
2.1 VISUALISATION

Starting with visualisation, this is a term that is often used interchangeably with information visualisation (or InfoVis). These terms are broad enough to include almost anything that is the product of some kind of graphic representation and organisation, and are also used to denote the processes of creating such products as well as the interdisciplinary study of both (Friendly, 2009). On this most overarching level, visualisation includes virtually every form of representational mode and technology throughout history, as all forms of

tables, graphs, maps and even text, whether static or dynamic, provide some means to see what lies within, determine the answer to a question, find relations, and perhaps apprehend things which could not be seen so readily in other forms. In this sense, information visualization takes us back to the earliest scratches of forms on rocks, to the development of pictorial as mnemonic devices in illuminated manuscripts, and to the earliest use of diagrams in the history of science and mathematics. (Friendly, 2009, p. 2)

Highly influential figures in information visualisation such as Edward Tufte and Ben Schneiderman also include old historic examples to illustrate and discuss visualisation (e.g., Card, Mackinlay, & Schneiderman, 1999; Tufte, 2001; 2006). In effect, though, today’s definitions are usually delimited to computerised visualisations, most of them also stress interactivity, and many also argue that such (information) visualisation is better adapted to the workings of the human brain and is therefore a more effective representational modality compared to other and more traditional alternatives such as (static) numbers and written text.

Of particular interest here is that definitions of visualisation tend to portray them in abstract ways as objective generators or revealers of new knowledge that is simply ‘there’, ‘within’ data sets or other collections of information, waiting to be uncovered and retrieved, and thereafter seamlessly transferred into the minds of users (c.f., Few, 2010). Card, Mackinlay and Schneiderman (1999), for instance, describe information visualisation as the use of computer-supported, interactive, visual representations of abstract data to amplify cognition; Chen (2006) as visual representations of the semantics, or meaning, of information; Zhu and Chen (2005, p. 139) as “a link between … two potent systems, the human eye and the computer … helping to identify patterns and to extract insights from large amounts
of information”; and Ma (2004, pp. 152–153) as the transformation of data into pictures “that exploit the superior visual processing capability of the human brain to detect patterns and draw inferences, revealing insights hidden in the data.” These examples are representative of a fairly unanimous collection of visualisation definitions that predominantly ring of positivism, cognitivism and the so-called immaterial information view (c.f., Buckland, 1991; Frohmann, 2004; Levy, 2003). Both of these views run counter to the approach in this dissertation, and accordingly, they are dismantled in favour of a situated, material view below (section 3.1.1).

However, as the scope of the term visualisation remains very wide even after delimitations to computerised and interactive characteristics, increased specificity is also sought through a host of add-on definitions. Accordingly, there has been a veritable boom in the invention of new and more explicitly specialised terms. At the point of writing (November, 2012), the English Wikipedia entry for ‘visualization’ includes nine such specifications: creative, flow, geo, interactive, music, scientific, software, systems, and spatial visualisation (Visualization [Computer Graphics], n.d.). Visual-Literacy.org, an e-learning tutorial on visualisation from three European universities, presents a “periodic table” of visualisation methods that also enumerate six, although slightly different visualisations, namely: data, information, concept, strategy, metaphor and compound (combining two or more of the previous ones) visualisations. Each of these categories is further subdivided into visualisations that depict either processes or structures (Visual-Literacy.Org, n.d.). Zhu and Chen (2005, p. 140), on the other hand, mention ‘only’ three varieties: scientific, software, and information visualisation.

But the most notable attempts at specificity include a determination of the object of visualisation in terms of data, and so speak of, e.g., data visualisation. This “slightly narrower” domain identifies “data” as “information which has been abstracted in some schematic form, including attributes or variables for the units of information” (Friendly, 2009, p. 2). Friendly speaks of this data-information partitioning predominantly in terms of a separation between numerical and non-numerical information, whereas Few (2010) describes data visualisation as concerned with abstract information on the grounds that they describe things that are not physical (which includes, but is not limited to, all sorts of statistics). A more common and seemingly less arbitrary (see section 3.1.1 below) way of denoting and delimiting the objects of visualisations are to speak of them in terms of ‘data’ more generally, but with different levels of structure. Murtagh (2004), e.g., describes data organised according to classes and relationships in a database as “structured data”; continually captured or generated data from online feeds in finance or meteorology
as “partially” or “semi-structured data”; and raw text or tables from websites or articles as “unstructured data”.

The less structured the data, the more structure needs to be “imposed” on them, often expressed in terms of “coding” before viewing and analysing them (Murtagh, 2004, pp. 371–372; c.f. also Zhu & Chen, 2005, pp. 145–146). For data defined as abstract information, Few (2010) even speaks of this process in rather poetic terms as giving “form to that which has none”, a “translation of the abstract into physical attributes of vision (length, position, shape, and color, to name a few)”. This is of course an understanding that is common to most researchers and practitioners in the field but there is also a major difference in how these form-giving practices are conceived. Sometimes they are described in terms of ‘right’ or ‘wrong’ correspondence to human cognition and perception (as in Few, 2010); sometimes they are rather described in terms of cultural conventions as soci ally agreed upon forms and meanings of visual representations (as in Blackwell, 2011). In the visualisation context, however, the perspective provided by Blackwell – and which is also in line with the views in this dissertation – seems strikingly rare.

Further, the connotations and internal relationships of all these visualisation term specifications remain unclear as they rely on descriptors of different types and levels. Sometimes, the objects of visualisations are used to create a more specific label, such as data visualisation and concept visualisation. At other times, the specifications refer to context and intentionality, such as scientific and educational visualisation. The result is that the terms frequently overlap as it is, e.g., quite likely that a scientific visualisation could also be described as a data visualisation, or that a concept visualisation could also be described as an educational visualisation. The alternative terminological cluster related to maps is similarly fuzzy and heterogeneous.

2.2 MAPS

Map is a concept that can either be seen as a synonym to, or a particular instance of, information visualisation. And like this previously discussed term, its connotations stretch very far and it is frequently specified with various attributes such as electronic or digital maps, geographical maps, dynamic maps or interactive maps.

Most commonly, the term “map” refers to the symbolic depiction of geographic features and relationships in an area, a geographical map, and maps in this sense are the most common form of geographic information (Goodchild, 2004, p. 282). Some geographical maps are set to scale which means that they are geometrically accurate. Geographical maps, whether geometric or not, can also be further
specified as for example ‘physical’, ‘political’ or ‘thematic’. The physical map shows features of geography such as land, water and mountains as well as infrastructural elements such as roads and buildings; the political map shows territorial borders; and thematic maps represent other types of spatial, cultural and social data, such as population density, geology, or the dominant religions in different areas (c.f., Merriam, 1996, p. 95). These distinctions also express a basic separation between literal or physical and abstract or thematic representations of information of which only the second form is of interest here. In simple terms, it means that this study is not concerned with geographical representations as projections of (areas of) the globe, but with the use of these representations as structuring devices,\(^7\) as information organisation means for visualising geographically relevant relations for \emph{other types} of information or attributes (in the case of Geo here, for social data relating to traffic accidents) – i.e., as \emph{thematic maps}.

The craftsmanship of making maps and the study of this practice are both traditionally called cartography, but although many maps are still static, flat (two-dimensional) representations or projections of three-dimensional space, an increasing number of maps are now in computerised and digital form also dynamic, interactive and even three-dimensional. Due to the nature of the systems studied here, particular attention is paid to descriptions of the extent and impact of recent Geographic Information Systems (GIS)\(^8\) developments, associated with considerable multiplication of the functionality of geographic maps.

Although in simple terms, Goodchild (2004, pp. 281–282) describes GIS as a “computerized collection of maps” he also notes two important differences. Firstly, GIS incorporate many more and different types of information compared with traditional maps, such as company customer records that have been assigned tags (or references, c.f., Hill, 2006) for geographic location. Secondly, they support virtually all operations that can be performed on geographic information, whether “editing and compilation, analysis, mining, summarizing, or visualization and display.” And a much debated effect of the GIS development is that their enabling of comparatively cheap and easy production of computerised geographic maps (Goodchild, 2004, p. 286) has been described in democratising terms as leading to a new form of “ubiquitous cartography” marking a revolution in “populist map-making” (Gartner et al., 2007, p. 247).

\(^7\) For a description and elaboration of the concept of ‘structuring device’, see section 3.2.2.

\(^8\) The acronym GIS is used for both the singular and the plural form of Geographic Information System.
GIS make use of geospatial resources which “convey information about the Earth, the location of specific features, and attributes and properties of specific geolocated features” (Library of Congress, n.d.a; n.d.b). These resources and the formats used to represent them comprise information in three forms: a) raster or bitmap images, b) vector images consisting of points, lines, polygons and areas, and c) data values that express attributes associated with geographic locations or features (Goodchild, 2004, p. 282; Library of Congress, n.d.a; n.d.b). The raster form may represent pixel-based datasets and is used for satellite imagery with different spatial resolutions, creating zoomable and searchable real-time or asynchronous representations of the globe and its regions. Vector data may include attribute information with vector-based shapes, for example to label features such as roads and political boundaries. A GIS typically contains all three formats and supports “overlays” or “layering”, i.e., “operations that combine spatial and attribute data from different sources in a vertical merge of a single layer” (Library of Congress, n.d.a). This superimposition of data into a combined layer produces map based (geographic, geospatial, cartographic, or georeferenced) visualisations that serve as the foundations for more complex querying and exploration of relationships and correlations (Goodchild, 2004, p. 282; Library of Congress, n.d.a).

Formally, however, maps are often defined in broader terms as “representations of things in space” (Edson, 2001, p. 1899) or as “a graphic representation of spatial concepts” (Merriam, 1996, p. 95). A map, thus, can represent non-geographical relationships of spatial nature, such as a chart of the solar system or a chronological outline of historical events presented on a temporal continuum. And the map concept can stretch even further to sometimes include the depiction of all sorts of relationships in a more general sense, such as logical or semantic relationships between people in a community or network or words in a particular literary work or language. Common representational modes in this category include diagrams of both graph and chart types such as Venn diagrams, tree maps, network diagrams, clustering/scatter plots, pie charts and bar charts (c.f. e.g., Edson, 2001; Jessop, 2006; Merriam, 1996).

In fact, stretched to their fullest, the map and chart concepts reach a point where they essentially overlap as relying, in Blackwell’s (2011) terms, on “basic diagrammatic conventions” that have to do with a “quantitative correspondence between a direction on the surface and a continuous quantity such as time or distance”. The historical trajectories of these representational conventions are moreover

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9 The viability of this latter example would naturally be dependent on whether one includes the concept of ‘time’ in the concept of ‘space’ or not.
fairly intact. A modern day radar screen visualising directions of and distances be-
tween objects in relation to a central reference point is similarly structured as the
Hereford Mappa Mundi from the 14th century, visually organising and representing
objects and locations in relation to Jerusalem as the centre. Likewise, the horizontal
time axes of oscilloscopes showing variations of quantities over time are based on
the same principles as William Playfair’s pioneering charts from 1786 of the British
economy (Blackwell, 2011; Few, 2010).

And the concept of diagrams, to continue, covers an even broader range of
graphic information organisation and representation. Hill separates between two
fundamentally different categories of spatial relationships, the geometric and the
topological. The difference is that geometric relationships rely on formal spatial
referencing (coordinate) systems for measurable distance and absolute direction,
whereas topological relations do not (Hill, 2006, p. 188). Topological data, thus,
are data whose relationships are considered largely unaffected by stretching or
distortion of the geographic space onto which they are mapped and visually
represented (Goodchild, 2004, p. 282). Likewise, topological maps disregard scale
and distance and only focus on depicting relationships and connectivity of elements
of a certain importance, such as a map of an amusement park or – the most famous
example of them all – the London underground map as we know it today (c.f.,
Blackwell, 2011; Hill, 2006, p. 188). Interestingly, though, the inventor of this
map first presented in 1933, electrical engineer Henry Beck, insisted – although in
vain – that it was not a map, but a diagram. Blackwell (2011) describes the resulting
popular ‘map’ label as a sad result of the widespread belief that a diagram would
have to be technical and hard to understand. And it is a testament to the confused
terminological situation that some are fully content with describing the London
Underground representation as a (topological) map (e.g., Goodchild, 2004), where-
as others are careful to retain it is a separate class of circuit connectivity diagram of
node-and-link type, a visual representational mode for which the exact location of
components are irrelevant to its function, and which is essentially unrelated to the
principles for graphs and charts (Blackwell, 2011).

Like visualisations, maps are also sometimes divided into static and dynamic
types, and according to Jessop, these two types of maps suit different types of data.
Traditional static geographical representations that yield maps of snap-shot nature,
frozen at certain points in time, he says, are well suited for mapping earth science
and other inert types of data. Social data, on the other hand, are far better represen-
ted with dynamic electronic maps as these types of data often concern the con-
tantly changing history of past and current human endeavour. Usually, according
to Jessop, it is the incorporation of the element of time into more traditional GIS
types of maps that transforms them from static to dynamic and thereby opens up their real potential for disciplines concerned with social data (Jessop, 2006, pp. 70–71). For Jessop (p. 69), unlike e.g. Friendly (2009), the dynamic quality is also largely seen as the necessary criterion for a map to reach its full potential as a tool for the discovery of new knowledge, rather than merely displaying that which is already known. Temporal attributes are, however, not well developed in most geographical satellite or map based visualisations (Blamont, 2008; Dodge & Perkins, 2009, p. 2; Jessop, 2006; Parks, 2009).

While temporal representation might not be the strongest aspect of map based visualisation, real-time incorporations of users and additional information about geographical locations and objects in so-called location-based services (LBS) and augmented reality (AR) illustrate on the other hand highly successful geovisualisation advances (e.g., Graham, Zook, & Boulton, 2012). Developments in hardware, software and network have allowed for real-time transfer and mobile computing in hand-helds and wearables, making it possible to merge the virtual and the real in new ways.

With these types of applications and services, users can download or generate maps adapted to their current spatial position with adaptations to direction of travel and other preferences and intentions of use. The user can become part of the map as an avatar, positioned in real time using GPS, and the map can become part of the space in which the user is located by AR context-adaptation. The results are to allow users to see and experience things that for some reason or other are beyond ordinary biologically granted sensory reach. Mobile GIS, for example, can be used to ‘see’ under the surface of streets; to assist visually impaired persons; to superimpose historic views on the field of view; and to find locations of nearby businesses of interest such as gas stations or restaurants displayed in map form on the screen of a portable device such as a cell phone or PDA (Gartner, Bennett, & Morita, 2007, p. 249; Goodchild, 2004, p. 285; Ma, 2004, p. 153).

Like advances in information visualisation, AR visualisations are anticipated to reduce the “cognitive burden” placed on users by static map representations that make individuals “struggle to forge the link between a map and reality” and that are also thought to risk restricting the users to overly map-filtered, “carto-centric” views of the world. In contrast, context-adapted and adaptive AR cartography is, at least by some, anticipated to reduce this burden by shifting focus to what is described as an effortless, intuitive and tailor-made “user-centered or egocentric view” (Gartner et al., 2007, p. 249; c.f. the here previously presented critique of similar descriptions of visualisations in section 2.1).
2.3 CONCLUSIONS: (SOCIAL) VISUALISATION TOOLS

The two applications studied in this dissertation are obviously commonly and officially labelled in the terms presented above. The so-called Trendalyzer in the Trends case is most commonly referred to as a chart or a (data/information) visualisation and the MapInfo system in Geo is unquestionably a geographic information system (GIS) with all the accompanying map terminology. The fuzzy and overlapping backgrounds and connotations of all the visualisation and map related concepts presented above, however, illustrate some of my reasons for avoiding them in my own references to the research objects, but there are others as well. To be able to talk in common terms about both applications studied here, I need a concept that covers both time series animated graphs and map-based GIS.

The term GIS, for example, is too narrow and too broad at the same time, as it excludes non-geographical visual representations whilst including many more operations and functions than are of interest here. And although formally very broad concepts, ‘map’ and related terms are still in practice too closely associated with geographical maps. Charts and diagrams, on the other hand, do not necessarily exclude geographic representations, but lean heavily toward technical subjects and formal connotations of exact measurements and relations. (Information) visualisation is a more useful term, but through common definitions, it suffers from much of the immaterial and positivist notions that also haunt the concept of information (c.f., Frohmann, 2004; see also section 3.1.1 below). For the research interests and knowledge views advanced here, quite opposite aspects of materiality, construction, and situated use are crucial. And to that end, I have chosen to use the term ‘visualisation tool’ to represent a small but distinct alternative and opposition to dominant discourses in several ways.

To my knowledge, there are no comparable widespread and formal definitions of visualisation tool as a term, but its mundane, literal connotations nevertheless help emphasise a sociocultural understanding in the way that also Sluijs (2008) has previously introduced and used this term. The tool label evokes connotations of materiality and craftsmanship which accentuates that, in line with the sociocultural and sociotechnical theoretical perspectives applied here (see chapter 4 on theory), visualisation tools are to be understood as mediated artefacts that shape and are shaped by social communicative interaction. By avoiding the dominant visualisation and map terminology and instead referring to visualisation tools, I avoid having to choose between restraining distinctions based upon 1) representational
mode (such as either a geographical map display or some other graphic type of visualisation), 2) presence or absence of dynamic qualities (primarily meaning animations representing change over time), 3) type of content (data or information; numerical or non-numerical; structured or unstructured, etc.), and 4) type of context or purpose of use (signalled by prefixes such as pedagogical or scientific).

Instead, in my interpretation and use the scope of the term visualisation tool incorporates all types of data, all types of representational modes (or combinations thereof), all types of contexts and purposes, and both static and dynamic qualities. The inclusiveness of this terminological choice is important since, as described in the introductory chapter, I am specifically interested in social data (data relating to human beings, doings, and relations) – hence the use of the more specific term social visualisation tool when relevant. And with a delimited focus on a specific type of data, it becomes even more interesting to explore whether the different types of representational modes such as the relatively static GIS map and the relatively dynamic time series animation in the two case studies (Geo and Trends, respectively) can be related to different aspects and enactments of critical literacies in the users’ interactions with the tools.

Nonetheless, the above presented terminological choice and definition does not necessarily place visualisation tools among a self-evident category of LIS relevant research objects. In fact, visualisation tools may even appear more problematic than usual in this sense, as they do not readily conform to the characteristics of more traditional research objects such as (print) documents. On the contrary, they seem to stretch and challenge traditional notions in a number of ways that need to be clarified early on. To that end, the following chapter attends to the conceptualisation of visualisation tools as an LIS relevant research object in terms of documents and representational artefacts, followed by a positioning of this study in the intersection between two established LIS research traditions: information and knowledge organisation, and literacies research.
3

CONCEPTUALISING VISUALISATION TOOLS
AS AN LIS RESEARCH OBJECT

This chapter consists of three main sections that in different ways contribute to the overall conceptualisation of visualisation tools as an LIS research object. In the first section I (re-)conceptualise visualisation tools in classical terms as information resources and documents by reference to a media-transgressing ‘representational artefact’ understanding. The primary objective of this move is to shift focus from dominant perceptions of ‘visualisations’ as an indirect LIS concern in that their existence prompts search and retrieval developments, to a more direct concern with the functions and uses of visualisation tools as information resources. In this way, I also aspire to move away from the misleading immaterial information view that permeates discourses surrounding visualisation tools (c.f. section 2.1) towards a situated, material document understanding. The two following sections present a research tradition positioning through which this study is placed in a previously largely unexplored area in between what I refer to as a critically oriented ‘problem of representation’ tradition in LIS research on information and knowledge organisation, and the renewed, growing and branching field of literacies research. In the concluding section I demonstrate how these research traditions and approaches are here made to relate to each other, to the aim of this research, and to the choice of theoretical perspectives.
3.1 A DOCUMENT PERSPECTIVE

The work and theories of the so-called document perspective are said to constitute a distinguishing and central mark of the LIS field\(^\text{10}\) (e.g., Buckland, 1991, 1997; Hjørland, 2000; Levy, 2003; Rayward, 1997), but even though many visualisation related definitions almost exactly matches the Latin etymon of the word document as \textit{a tool} or \textit{a means to educate or inform} (Buckland, 1991, p. 47; c.f. also ch. 2 above), it might not be entirely obvious how, or even why, a digital visualisation tool should be conceived in terms of ‘document’. The answer, for the purposes of this dissertation, is that the application of a document perspective is thought to provide \textit{one} useful and established – although by no means the \textit{only} possible – way to oppose the troublesome tendency in academic and popular visualisation tool discourses to rely on and convey the immaterial information view that was briefly mentioned above and that will be elaborated here below.

The constructionist epistemology and sociology-inspired interest in this dissertation (see chapter 4 on theory) means, on the contrary, that I recognise and emphasise aspects of materiality and situatedness at all stages of information related activities. The irreconcilable immaterial information view, however, is not only avoided but directly problematised here. The reason for this active engagement with an opposing knowledge view is its prevalence, which is thought likely to encourage inclinations in both academic and popular discourses to overemphasise interactive and automated characteristics of abstract ‘visualisations’ which in their turn fuel a number of additional misconceptions.

The way I specifically go about both of these objectives, thus, is by reference to the document perspective. First, however, it might be useful to define the central

\(^{10}\) There seems to be a growing and broadening interest in theorising and researching documents and documentary practices, mainly dedicated to the study of various types of documents and their social roles and functions. Internationally, this interest is expressed, for example, in The Document Academy (DOCAM), a “loosely coupled international network of scholars, artists, and professionals, in various fields, interested in the exploration of the document as a useful approach, concept and tool, in Sciences, Arts, Business and Society, in general” (Windfeld Lund, 2006). The DOCAM network is a co-organised collaboration between the Department of Documentation Studies at the University of Tromsø and the School of Information Management & Systems (SIMS) at the University of California, Berkeley, with LIS professors Niels Windfeld Lund and Michael Buckland among the leading figures (Windfeld Lund & Buckland, 2008).
terms ‘data’, ‘information’, ‘knowledge’, and ‘document’ and their internal relations as used in this dissertation.

3.1.1 Data, Information, Knowledge and Documents

My understanding and use of the concept of information follows Michael Buckland’s (1991, ch. 5) description of information as “potential evidence”; as things from which one can be informed, or, in a slightly different phrasing, as everything that has an informative potential. This broad definition includes almost everything from numbers, text, and images to objects and events as “species of information” and in particular, Buckland suggests it wise “not to assume any firm distinction among data, document, and text” (Buckland, 1991, pp. 46, 49). This understanding is of particular significance here as it means that data, the ‘raw material’ of visualisation tools, are placed at the same level as other types of potential information sources, and not, as is so often the case, hierarchically below – or prior to – ‘information’ in linear or pyramid models of ‘data – information – knowledge’ (as in e.g., Friendly, 2009, p. 2; Murtagh, 2004, p. 371; c.f. also the data – information – knowledge – hierarchy [DIKW] overview by Rowley, 2007).

The ‘species of information’ levelling provided by Buckland’s ‘potential evidence’ definition also has the benefit of working against the common tendency to interpret data, literally meaning ‘things that have been given’, as pieces of truth, as objective facts, that are ‘given by nature’. Instead, it emphasises that data, like all other types of potential information “do not just appear or lie around waiting to be casually picked up by some passing social researcher”, but have to be made relevant in a subjective and situated process of selection, interpretation, and representation within a framework which “constitutes them [the data] as evidential materials for some purpose” (Ackroyd & Hughes, 1992, pp. 3–4). Of even greater importance is Buckland’s assertion that it is only as material manifestations – as “recorded knowledge”, “knowledge representations”, or “information-as-thing” (1991, ch. 5), quite simply, as documents – that we can share and study ‘information’. This provides a more pragmatic way to, by reference to aspects of materiality and intentionality, delimit ‘information’ as research object further into the concept of ‘document’. Information-as-thing takes many forms through acts of physical representations of abstract knowledge into text, images, maps, diagrams and so on, and it is also the only form of information with which (technological) information systems can deal directly (Buckland, 1991, pp. 43, 48, 54).
The processes whereby 'knowledge' travels to 'recorded knowledge' (document) are seen to involve, as described by Buckland, translations or representations from 'intangible' to 'tangible', from 'abstract' to 'material'. These translations are complex processes that Buckland lines with caveats: a) what is usually described as 'knowledge' should not be glorified beyond its actual status as belief or opinion; b) representations are something else entirely from the abstractions they are meant to represent; c) the 'knowledge' that people draw from representations in interpretations of meaning are, likewise, new and different 'knowledges' each time; and d) documents, as 'recorded knowledge', thus, are the very embodiments of all these complexities (Buckland, 1991, pp. 40–41).

From Buckland’s discussions on how documents neither carry nor convey ‘knowledge’ in any objective or realist sense also follows, as I will elaborate in the following, that what comes to be recognised and valued as ‘knowledge’ should be understood as local accomplishments. ‘Knowledge’ is here understood as pluralistic and situated (it changes between contexts and over time), collectively shared products of social and cultural negotiations and agreements (c.f., ch. 4 on theory). From this understanding, the really interesting thing about all types of potential information sources (or information resources) is not the pursuit of final, universal, ontological definitions, but the ongoing inquiries into their situated meanings and associated ‘effects’ in line with the sociology of documents presented by Brown and Duguid (1996; c.f. also section 4.1.3).

The origin of today’s document perspective that acknowledges such material and situated aspects for studying documents and their social roles and functions (as expressed, e.g., in the previously quoted DOCAM network description) is usually traced back to the Belgian Paul Otlet and his early 20th century contemporary colleagues (Frits Donker Duyvis, Suzanne Briet and others). On the surface, this is a contradictory connection since this group is also commonly described as the forerunners of information science (IS) as a field of study and research preoccupied with abstract information and a content-based focus (Rayward, 1997; c.f. also Buckland, 1991; Levy, 2003; Rayward, 1994). However, I mainly follow here the interpretation and theories of David M. Levy (2003) who describes the main contribution of Otlet and contemporaries as the identification and bounding of documents as the set of phenomena with which LIS primarily (although not exclusively) is and should be concerned.

Transferring the traditional document concept and theories into digital environments, however, is not straightforward and self-evident due to prevailing,

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11 For an historic overview of these early documentalists, see Buckland (1997).
powerful and restricting influences from historically rooted document connotations. Early understandings of the term ‘document’ have been described as connoting a (physical) medium with inscriptions (Pédauque, 2003; although c.f. also Windfeld Lund, 2010, p. 740 for a wider etymological account). Even today, Levy (2003, p. 29) finds the term predominantly associated with writing, paper, and (legal) evidence as in contracts and passports. It is in this area not least – besides certain disconcerting elements of positivist fact-obsession (see above and 3.1.2 below) – that the work of Otlet and colleagues, the so-called “second generation documentalists”\(^\text{12}\) has helped pave the way for today’s “third generation” by stretching and broadening the scope of the term document through early endeavours to include for example three-dimensional artefacts and natural objects\(^\text{13}\) (c.f., Buckland, 1997).

To incorporate also non-physical expressions such as electronic documents into the concept, Levy (2003) returns to this preoccupation with the categorisation of documents and asks: given the immense range of forms, media, and technologies, by what characteristics can documents be grouped; what makes them distinguishable as a kind? His answer is to redefine documents as “representational artefacts”, or “talking things” (pp. 26; 30–31). This redefinition is particularly useful here as it allows for a material understanding of documents to oppose the immaterial information view, even when the documents in question are particularly concept-stretching, as in the case of visualisation tools.

### 3.1.2 Digital Inclusion: Documents as Representational Artefacts

As described above, then, I have two main (and overlapping) reasons for turning to modern-day elaborations of the document concept: firstly, to conceptualise visualisation tools as LIS relevant research objects in their own rights as information resources and documents; secondly, to replace the immaterial information view of dominant visualisation and related definitions with a material one. This is motivated not only because the immaterial view presents an epistemological opposite to the constructionist stance of this dissertation, but also since its prevalence is related to a number of misconceptions. For example, common and established definitions

\(^{12}\) Rayward (1997, p. 290) describes, before the “second” “Otlet generation” a first generation of documentalists consisting of special librarians specifically handling scientific and technical information.

\(^{13}\) Famous examples of such stretches of the document and information resource concepts to include natural and non-intentional objects that by inference come to function as information resources are cloud and landscape formations (Goodman, 1985; McKenzie, 1999) as well as sea and animal characteristics, occurrences and arrangements (Briet, 1951; Gladwin, 1970).
describe visualisations as possessing a certain power compared to other means of dealing with information and the assumptions of this power seem to be grounded in the mistaken equation of data with facts and in the understanding of both as constituting knowledge and truths (c.f., ch. 2). From other epistemological perspectives, such views are critiqued for harbouring objectivist, positivist and rationalist ideals that result in reductionist understandings of information as “isolated pieces of facts, opinion or ideas that can be processed and managed in information systems” (Hjørland, 2000, p. 32).

The immaterial information view, in other words, presents information as separate, distinguishable entities that exist independently of, and remain unaffected by, different modes and acts of representation. It disregards social constructions and material manifestations of information, involving interpretations, technology and practices and the concept of document becomes, by association, reduced to a neutral container, a mere transport device for carrying information – without affecting it – from one person to another, or one system to another. This view, equally pervasive as, and a direct descendant to, the immaterial information view, is usually traced to Shannon and Weaver's (1949) model of communication, also described and criticised as the “channel”, “conduit” or “transmission” metaphor (e.g., Brown & Duguid, 1996; Day, 2000; Frohmann, 2004; Reddy, 1979; Säljö, 2000).

As a particularly troublesome consequence, the immaterial information view not only fuels the idea that information consists of pure, objective and true bits and pieces, but also that these are hidden or even muddled and confused in text and documents. In the interests of knowledge and science, then, emerges the goal to strive to target and filter them out, as when panning for gold, for example through the advancement of ‘optimal’ information organisation and retrieval systems. In some areas of the information retrieval (IR) field, this idea is prevalent even today as aspirations to ultimately store and retrieve merely the ‘facts’ or ‘information’ in documents, as described by Capurro and Hjørland (2003; c.f. also Hjørland, 2000, p. 32). However, visualisation definitions go even further and portray the tools and their outputs as automatically and almost magically generating new knowledge (c.f. section 2.1). The knowledge view implied is that it is merely a matter of arranging one type of ‘knowledge’ in a clever enough way in order to generate even better, more and ‘new knowledge’, and whatever happens before, between, and after ‘input’ and ‘output’ is generally neglected or dismissed.

As already mentioned, these views of information and knowledge are incompatible with the constructionist, material and situated view in this dissertation. But history holds many illustrative and spectacular examples of the full ramifications of fact glorification and assumptions about a sort of spontaneous generation of new,
‘true’, and objective knowledge from the skilled collection and organisation of ‘facts’ as implied also by many visualisation definitions. Such ideas have been powerful enough to approach status similar to an alchemist dream in information science (IS). Boyd W. Rayward, for example, describes in a series of historiographies (1994; 1997; 1999) two similar and high-profile suggested solutions to the same perceived problem in the years around World War II.

The English author, journalist, historian and social reformist H. G. Wells spoke of urgent intellectual problems due to “the immense amount of incoherent learning” with chaotic clamours of “statement, misstatement and counter-statement” in a world “smothered in a multiplicity of books” (Wells; in Rayward, 1999, pp. 560–562), and Paul Otlet (see above) thought documents incomplete, error-filled, repetitive, fragmented and frustratingly enough not arranged so as to present information according to its degree of importance (Rayward, 1994, p. 240). Books, to Wells and Otlet, were merely raw material from which the real contributions to new knowledge, i.e., facts, could and should be disentangled (p. 247). Both also devised elaborate schemes for identifying and liberating these facts from the obfuscating writings of authors – whether by scissors or manual transcription – for subsequent codification and organisation according to detailed subject relationships. The envisioned results (Otlet’s ‘Universal Encyclopaedia’ and Wells’ ‘World Brain’) would be databases of the entire world’s knowledge and yield, basically, pure and undisputable artificial intelligence (Rayward, 1994; 1997; 1999, p. 561).

Even though the Otlet and Wells examples are extreme, related ideas of universal knowledge and ordered access are ubiquitous and persistent throughout history (c.f. e.g. the historical to present-day analysis of encyclopaedic ventures in Haider & Sundin, 2010) and recur thus also in more mundane understandings of information and information resources as shown in relation to visualisation tools above. And this is where modern document perspectives can provide important alternative and opposing understandings. From this view, what might be called intellectual or epistemic content is seen as inseparable from its material manifestations (and also from particular sociocultural contexts; c.f., ch. 4). The obvious intangible character of digital document manifestations, however, sometimes cause conceptual confusion but as alluded to above, Levy (2003) addresses and resolves this by reconceptualising documents as ‘representational artefacts’ or ‘talking things’.

With the proliferation of non-print, non-textual challengers and candidates for the document title, “talking things” render documents of all sorts in all simplicity as “bits of the material world (clay, stone, animal skin, plant fiber, sand) that we’ve imbued with the ability to speak ... While this doesn’t literally bring the inert material to life, it is nonetheless an extraordinary act of ventriloquism” (Levy, 2003,
p. 30). From this it might seem that all artefacts can be considered documents that, in a sense, speak (the way, e.g., any house or car has a ‘story’ to tell), but the difference, according to Levy, is that documents are representational artefacts. Like Buckland (1991), then, he stresses both materiality and intentionality in stating that documents – at least as an LIS concern – are made to carry very particular messages in particular ways, which also means that much of their representational functions “work” even outside their original contexts. The most obvious case of such further articulation is language, but there are also many others, such as maps, diagrams, icons and all manner of other conventional and well-articulated nonverbal representation schemes (Levy, 2003, pp. 33–35; c.f. also Goodman, 1985; McKenzie, 1999).

The argument of the media-transgressing ‘representational artefact’ document definition thus, would seem to successfully incorporate also visualisation tools as a form of document, but their high degrees of interactivity introduce further challenges. Interactivity is often and almost by default seen as synonymous to fluid and anonymous characteristics that do not only contradict the widespread, deep-rooted print and text based connotations of documents that stress fixity and authorship, but that also seem to fail to comply even with Levy’s innovative representational artefact redefinition. By ‘document’ in either sense, it is common to imply an entity of a certain significant duration, something that “has a history, one or more authors or producers, a connection to other documents, and so on” (Hjørland, 2000, p. 35, my emphasis; c.f. also Levy, 2003; Windfeld Lund, 2010).

And so, in order to include visualisation tools in the document concept, the notion of interactivity in this context relies on the dismantling of perceived dichotomies between ‘interactive – fixed’ and ‘interactive – authored’ to instead see these characteristics as degrees on a scale; as simultaneously, but to varying extents, inherent features in all sorts of documents.\\footnote{Although not explicitly stated, I interpret both Buckland (1991) and Levy (2003) on this subject as implying that materiality essentially falls back on representation. This is also in line with the way I understand and use materiality in this dissertation and as elaborated below in chapter 4 on theory.}

\\footnote{One might ask, perhaps, why I bother with this discussion when the already existing theoretical apparatus of the document perspective houses document definitions that, essentially, declares the fixity–fluidity conflict something of a non-issue. Windfeld Lund, e.g., defines documents as: “any results of human efforts to tell, instruct, demonstrate, teach or produce a play, in short to document, by using some means in some ways” (Windfeld Lund, 2010, p. 743). The answer is that in such accounts, there is usually a broader application in mind than the definition of ‘proper’ LIS research objects, which is what I am interested in here.}
3.1.3 Interactivity, Fluidity, and the Authority of the Author

Definitions and implications of the concept of interactivity are mainly discussed outside of LIS as a cross-disciplinary theorising on the nature and characteristics of primarily video and computer games, and about a decade earlier as literary theorists’, visionaries’ and philosophers’ concerns with hypertext. But as will be shown here, the interactivity discussion is highly relevant also for the conceptualisation of visualisation tools as documents. The argument presented in the following is that the media transgressing representational artefact document understanding of visualisation tools also requires moving past excluding and counterproductive dichotomies between interactivity on the one hand and fixity and authorial origin on the other.

With respect to the relationship between interactivity and fixity, we can first of all note that interactivity in itself is a rather trivial term since any physical and cognitive engagement with a work can be said to constitute a sort of interaction, as described from a philosophical and aesthetic perspective on art and videogames by Grant Tavinor (2009). From a similar perspective, Dominic McIver Lopes (2001, p. 67) concludes that because of its sheer ubiquity as a technological buzzword, interactivity is prone to abuse and therefore of limited theoretical use without further specification. Game theorist Espen Aarseth declares the term downright meaningless (1997, p. 50) when used to distinguish between ‘digital’ and ‘print’ as markers of interactivity or not.16 And in specific relation to documents, finally, Levy chooses to describe all variations thereof as both fixed and fluid (2003, pp. 36–37). Any material that can be made to talk repeatedly, he argues, can be turned into or conceived

Windfeld Lund’s extremely broad definition is in fact intended to serve as unifying concept for a suggested new ‘super discipline’ of documentation studies, reaching across humanities, social sciences, and natural sciences. I do agree with the idea that the document concept can comprise also ephemeral communication, like unrecorded speech and bodily gestures, but since I also retain Levy’s and Buckland’s ideas that LIS (not perhaps as entire discipline but with respect to many of its central topics) is probably best suited to deal with ‘information-as-thing’ or ‘repeatable representational artefacts’, there are still some unanswered questions here, actuated by certain document specimens that stretch and challenge rooted conceptions of materiality in the ‘information-as-thing’ sense. And since social visualisation tools are one of these, a brief discussion is included.

16 Aarseth (1997, p. 50) backs his argument by providing numerous examples of interactive works throughout history, e.g. the Chinese work I Ching from around 1000 B.C., and Raymond Queneau’s Cent mille milliards de poèmes from 1961.
of as documents. In digital form, the fixity of physically engraved marks and symbols is thereby replaced in Levy’s definition with a capability of sameness of performance. For example, even though an audio file is not fixed and static in the way a piece of parchment is, it can still be replayed at will with the exact same result and thereby fulfil his ‘document requirement’.

In answer to the question of whether digital ‘forms of talk’ are really repeatable, Levy retaliates that evidence to the contrary has been much exaggerated, primarily by the hypertext community. Print books are also fluid: with annotation, new editions, etc. they exhibit a sort of controlled, although slow, movement; digital documents such as Word files do have a “save” option; and a lot of time and effort go into developing preservation strategies for digital material (Levy, 2003, pp. 36–37; c.f. also Dahlström, 2006). Rather, Levy concludes that each genre has its own pattern of stasis and change, a natural consequence of the fact that each genre also has its own work to do, with various requirements. Every document has been produced for a specific purpose, and “speaks” in ways and carries content appropriate to the social practices in which it is embedded. Digital documents may be more fluid, but this should not be taken to mean that all digital talk will be ‘unfixable’ or ‘unrepeatable’ (Levy, 2003, pp. 36–37).

The repeatability requirement, however, surpasses mere document characteristic for Levy; to him, it also represents the very thing that makes documents valuable. The greatness of documents, he says, is precisely their reliable, repetitive abilities; that we can rely on them – in contrast to people – to speak the same thing over and over again. By virtue of their spatial and temporal fixity which allows us to externalise, stabilise, and share information across time and space, documents are the means by which social organisation and large-scale societies are achieved (Levy, 2003, pp. 38–39; c.f. also Bowker & Star, 1999; Brown & Duguid, 1996; Strum & Latour, 1999). Although the level of interactivity in visualisation tools might (at least in many instances) vastly surpass the audio file example, they are nonetheless ‘repeatable at will’ – at least in theory – and can thereby be placed on the gliding ‘fixed-fluid’ interactivity scale unlike, e.g., spoken utterances. Whatever variations different visualisations tools will exhibit in real life uses, then, are primarily empirical and analytical questions.

The fluidity implied by the sense of interactivity discussed, opposed and discarded above is also closely connected with the other, exaggerated, interactivity implication discussed here; the deferring or even absolving of the author function. In relation to conceptions of this type, Rayward (1994) makes an interesting connection from Otlet and Wells (see above), to their contemporary and Memex
visionary Vannevar Bush, up to the 1990’s leading hypertext theorists such as Theodor Nelson and George P. Landow. All of their ideas of World Brains, World Encyclopaedias, Memex, and hypertexts are found to share aspirations to, and celebrations of, absolving the autonomy and boundaries of texts and liberating their ‘real’ contents from whatever order the authors had intended to “force” upon their readers.

The ways in which these visionaries reconceived of documents as fluid, borderless, interlinked chunks of ‘nodes’ or ‘units of information’ that could be liberated and re-assembled by skilled documentalists or link-surfing ‘reader-writers’ led to reconceptualisations of the figure and function of the author (Rayward, 1994, p. 248). This is of particular interest here, as it illustrates the strong links between the understanding of interactivity and document conceptions. In these cases, the perceived level of interactivity determines the entity to which control over instantiations (as an answer to the question “What instances an instance?”) is ascribed, and the result is also to determine who or what that is attributed with – or stripped of – authorial power. Perhaps better explained in research on film and video games, we can return to Tavinor (2009) who notes that: “Effectively, the control of fictive events that in film is invested in the choices of the director, writer, editor – because it is they who play the crucial role in encoding the template from which the film is shown – is [in video games] ceded somewhat to the player.”

To dismantle also the implied binarity of ‘interactive – authored’, then, this relationship also needs to be reconceived as a scale of degrees. Following the same ‘interactivity’ theorists as above, such a scale would present, at the one end, what Aarseth calls ergodic texts (1997), McIver Lopes (2001) calls strongly interactive works, and Tavinor (2009) terms multiple instance works. All of these require a “non-trivial” effort of the “interactor”, the effects of which are to partly shape the structures of the work/text/document itself and the manner of its representation. At the other end of this ‘scale’, there would be the non-ergodic, weakly interactive, single instance works that also may involve choices, but of a comparatively trivial nature, such as choosing to read a footnote or skipping it, or deciding what elements to access and in what order; a mere navigation through a predefined structure that will not alter the work itself.

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17 Vannevar Bush, a scientist and engineer viewed as one of the forerunners of hypertext and the World Wide Web. His article “The Way We May Think” presented the idea of the “Memex” as “a device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory” (Bush, 1945).

18 I use the term “instantiation” in the more prosaic computer science sense of, roughly, ‘creating a new object’ of some sort, and not to describe any sort of ontological existence.
Fluidity in this sense, however, is not only tied to perceptions of human ‘instantiating’ influence by ‘original authors’ or subsequent ‘users’ but can also be found in high-tech contexts where document fluidity is more explicitly ascribed to technological processes. Highly automated applications for information processing tend to be associated with similar experienced consequences of discarding the traditional author function, although here, instead of ceding authorial power to the ‘reader’ or ‘interactor’, it would appear, as suggested by Jazayeri (2007, p. 211) that significant aspects of the information processing have been handed over to the technology, thereby removing the user several steps from central activities of processing and interpretation. As the concept of any form of human influence on ‘instantiations’ is thereby removed and replaced, the effect is to perceive of the ‘narrative voice’ in resulting documents as ‘true’ and ‘objective’ (c.f., Levy, 2003, on his discussion of seemingly anonymous and objective maps speaking ‘for themselves’; c.f. also section 4.1.2).

The important thing to recognize is that it is not only uninteresting but also impossible to draw a definitive line of separation between works in one or the other category. But in both cases of high interactivity and high automation, the perceived or constructed effect is to transfer, hide, and ultimately obliterate the traditional conception of a stable, identifiable, human author conveying equally stable and intentional information. It implies an anonymisation of documents that may be more common in digital variants, but far from limited to certain forms. In Levy’s poignant words, the source of the voice behind a document can be a known person or a faceless organisation, and it can be apparent or disguised to varying degrees. And in cases such as maps (presumably whether print or digital), the voice may be so hidden as to make the document appear to speak objectively and to speak for itself (Levy, 2003, p. 30). It is, most likely, through this ‘disguised voice’ and automated characteristics of visualisation tools that they become disassociated from the author function as traditionally perceived. As in the first ‘interactivity-fixity’ case, however, they still fit on a gliding scale understanding of ‘interactivity – authored’ document characteristics.

By reconceptualising visualisation tools as documents in the way proposed here, their materiality and situated nature are brought to the fore and can also serve as interesting characteristics to consider in the analysis. But whereas the above demonstrates how I conceive of the research objects (the visualisation tools), the following two sections in this chapter present why and with what focus I approach and study them. It positions the research objects in an area of overlapping concern between what I have chosen to call a ‘problems of representation’ tradition and literacies research in LIS.
3.2 PROBLEMS OF REPRESENTATION

A research tradition can be defined by other criteria than shared research objects, methods, and/or theories, and I discern a family of research approaches in LIS and nearby fields – among which I place this study – as founded in perspectives on different types of information organisation systems and practices as expressions of what might be called ‘problems of representation’. It is a kinship that becomes visible from the vantage point of a broad understanding of information organisation and from conceiving of representations as social and cultural constructions. This broad connection seems previously unarticulated, and consequently, the researchers it concerns frame and position their studies in slightly different ways. Naturally, the differences between these studies are also significant as they investigate characteristics, causes and effects by different means (theories and methods) and in different manifestations (other research objects), and it is therefore probably best described as a critical tradition that cuts across research fields.

The purpose of including an elaboration on this topic here is not to argue for the existence or forming of a “new” research field, but to place this study in my understanding of a research tradition that has served as a major source of inspiration. My discernment of, and interest in, ‘problems of representation’ as common departure points in numerous interesting LIS studies has significantly contributed to the identification and formulation of the research problem (described in section 1.1). The tradition ‘unearthed’ here thus joins together a variety of studies on different information organisation systems and practices around what can be described in terms of a hallmark critical approach that the examples below are intended to illustrate.

3.2.1 Knowledge Organisation and Classification

Translated into specific LIS research, the ‘problem of representation’ view suggested here may have found its most influential and well-known applications within the information organisation subfield knowledge organisation (KO), the “field of scholarship concerned with the design, study and critique of the processes of organizing and representing documents that societies see as worthy of preserving” (Tennis, 2008, p. 103, my emphasis). The primordial KO example is of course classification systems, the notational representations of topics used for the physical and electronic organisation of library collections, and related systems such as subject
headings, the verbal representations of topics in library catalogues (definitions from Olson, 2001, p. 639).

A number of classification studies from critical perspectives have demonstrated that the manners in which information is organised will inevitably reflect, recreate and most likely also reinforce the manners in which we see and understand not only this information, but more generally the world and things and relations in it. Studies of this type describe classification systems as formed under the influence of culturally accepted forms of representing and exchanging knowledge, which reflect political interests, dominant worldviews, institutionalised genres of communication, and popular discourses. For researchers in this tradition, classification systems have therefore not only been objects of critique in themselves; they have also served as means to uncover what views of knowledge that characterise the societies and cultures of which they are parts. In the words of Tennis (2008, p. 104), every knowledge organisation system (KOS) reflects different narratives about knowledge.

In particular, but hardly surprising, it is the classification of information relating to humans that has been subject to critique for misrepresentations, exclusions, oppressions, and offenses. The librarian Sanford Berman was an early critic of what he described as prejudices and downright antipathies in the American Library of Congress Subject Headings (LCSH). The ‘social’ headings dealing with people and cultures, he says, can only satisfy “parochial, jingoistic Europeans and North Americans, white-hued, at least nominally Christian (and preferably Protestant) in faith ... fundamentally loyal to the Established Order, and heavily imbued with the transcendent, incomparable glory of Western civilization” (Berman, 1971, p. 15).

More recently, Hope A. Olson investigates bias in document representations, what she prefers to call the “naming of information”, and contends that although it is only natural that libraries, like other institutions, “reflect the marginalizations and exclusions of the society they serve” (2001, p. 639), the implications, in terms of limiting the expression of diversity, are “acute and systemic” (p. 639). In the same tradition but in a Swedish context, we also find Hansson’s (1999) critical hermeneutic reading of the Swedish libraries’ classification system from 1921 (the SAB-system) and Nyström’s (2011) analysis of the history subject as a knowledge organisation system.

But the problem of representation extends well beyond libraries, as classification is carried out virtually everywhere and always, from the arrangement of utensils in kitchen drawers to the placement of merchandise in stores (c.f., Bowker & Star, 1999; Soergel, 2004; Weinberger, 2007). In a highly influential work on classification outside the realm of libraries (Sorting Things Out: Classification and Its Consequences, 1999), Geoffrey Bowker and Susan Leigh Star demonstrate through a
variety of examples how the sometimes seemingly innocent and mundane practices of categorising people and things can have dramatic social, political, economic and individual impacts. The examples included thus range from the devastating classification of South Africans during apartheid to the unanticipated back-firing effects of a system intended to measure and thereby raise the appreciated value of nurses’ work at a hospital.

But in spite of the problems described here, most researchers also recognise classification systems as a necessity: although flawed and imperfect, there are no real alternatives if we are to manage and retrieve large quantities of information and so the best option is to improve and open up existing systems. Berman (1971), e.g., struggled continuously with seeking out and removing expressions of bias in the Library of Congress Subject Headings (LCSH). And Olson (2001) suggests that, rather than create a new standard for managing information, the limits of existing information systems should be made “permeable” by three strategies: 1) by applying technology in innovative and subversive ways; 2) by stretching classification and related standards; and 3) by adopting an active stance and create spaces in the boundaries for the voices of those who have been excluded (Olson, 2001, p. 659). The third strategy, Olson anticipates, is likely to be met with resistance among library and information professionals, since: “making space for the voice of the other means that we must relinquish some of our power to the other – power of voice, construction, and definition” (p. 659). Her argument thereby also demonstrates some of the ideological and political powers associated with classification.

David Weinberger (2007), on the other hand, argues instead from his technologist-philosopher perspective that since there are no perfect definitions and no perfect order to be uncovered or constructed, we should altogether abandon the limiting and necessarily failing hierarchical, subjective, binary classification systems that always end up with the residual category “Other”. The alternative is what he calls an “everything is miscellaneous” approach made possible by the Internet and digitalisation. Rather than determine from one point of view and for one purpose what something is about and where it should be placed, the miscellaneous approach embodies the contextual understanding that every attribute of every object can be of potential interest, and we should therefore exploit the digital technology’s capacity to allow for countless descriptions and manners of combinations in a non-hierarchical, non-exclusive structure.

In Weinberger’s ideas on classification, thus, we again see notable similarities with the early hypertext advocates and enthusiasts, such as Theodor Nelson with his Xanadu (Nelson, 1986; 1992; c.f. also Rayward, 1994). These visionaries sometimes hailed hypertext as introducing no less than a paradigm shift, marking a
revolution for human cognition as it was thought to tear down “conceptual systems founded upon ideas of centre, margin, hierarchy, and linearity and replace them with ones of multilinearity, nodes, links and networks” (Landow, 1997, p. 2). And much like some today think that collaborative tagging can bring about emancipating effects in relation to the controlled vocabulary ‘oppressions’ of formal knowledge organisation executed by a select few professionals (c.f. e.g., Macgregor & McCulloch, 2006), hypertext was also thought to make possible a sort of constantly changing and evolving canon of consensus (Moulthrop, 1991). In hindsight it is safe to say that hypertext did not bring about this kind of paradigm shift that some had hoped, but the example provides a testament to the ways in which interpretations of technology permeate both common understandings of ‘problems of representation’ and hopes and perceptions of solutions to the same.

Either way, classification is without doubt the star and poster-child of this problem of representation research tradition. But since formal and institutionalised classification systems are not only highly specific but also quite different from visualisation tools, it might be difficult to see how they share common ground with reference to problems of representation. To render this connection visible we therefore turn to a wider and more heterogeneous set of examples of information organisation systems and practices such as markup, tagging and referencing.

3.2.2 Information Organisation, Markup, and Other Structuring Devices

In a narrow sense, information organisation as a concept is used in a way close to knowledge organisation (KO) as referring to the creation of catalogues and indices for collections of documents in libraries by describing their attributes and intellectual content. Usually, two main purposes, or objectives, for KO practices are mentioned. One is to help users find and locate specific documents by providing “orderly access to the collections”. The other is to also present groups of documents that are similar to each other, thus helping the user find “more of the same” which might be of interest (Taylor, 2004, p. 242) and thereby serving, on an aggregated level, as “an inventory of human knowledge and culture” (Qin, 2000). In a historical reflection on the subject, however, Gunnarsson (2011, pp. 100–105) also describes an interesting and most likely ongoing shift from Cutter’s famous “cataloguing principles” from the beginning of the twentieth century, to the International Federation of Library Associations and Institutions (IFLA) Functional Requirements for Bibliographic Records (FRBR) at the very end of the same century. The shift, Gunnarsson argues, expresses a conflict between two sometimes competing objectives for classification in which the importance of the collocative
objectives for demonstrational and navigational purposes are losing out to the more descriptively oriented purposes of information access. The conflict is supposedly echoed in information retrieval (IR) as well with the increased focus on “querying” at the expense of “browsing” and Gunnarsson suggests that the different objectives are related to different cognitive perspectives.

Strictly speaking, though, information organisation is an umbrella term wide enough to cover almost any activity directed at information. Formally, information organisation has been defined as comprising different types of databases; templates for the internal organisation of documents, cataloguing and metadata; as well as knowledge organisation systems (KOS) such as classification schemes, taxonomies, ontologies, and thesauri (Soergel, 2004, p. 355). The basic principle that unites these systems is the so-called entity-relationship (E-R) approach which operates on determinations of object characteristics (or properties), often expressed as statements so that: “entities (nouns) are connected through relationships (verbs)” (Soergel, 2004, p. 355). A familiar example would be that apples (entity) are an ingredient in (relationship) apple pie (entity). The many different information organisation systems are further extended by the great variety of purposes for which they are applied to information, including to “collect and record it, retrieve it, evaluate and select it, understand it, process and analyze it, apply it, and rearrange and reuse it” (p. 355). In other words, the full definition of information organisation covers all means to organise information on the basis of creating relationships between and within entities (such as text documents, images, and data sets) for a wide range of purposes.

From this broad definition of information organisation, almost all of LIS research can be said to relate to information organisation in one way or another. One useful distinction might therefore be drawn, as proposed here, between approaches that primarily see information organisation as an unproblematic instrumental and technological endeavour for increasing the efficiency of information management and retrieval, and the aforementioned viewpoint that information organisation is afflicted by problems of representation. The first type is beside the point here and not further commented upon, but the latter is elaborated in the following by examples from markup, metadata, and tagging.

Markup, the basic requirements for creating, publishing, managing, retrieving, and displaying electronic documents, constitute a group of techniques for organising information that are often viewed from what I have described as problem of representation perspectives. The most obvious examples are content-related markup based on for example SGML (Standardised Generalized Markup) and XML (Extensible Markup Language). Content-related markup is applied in order to represent
the intellectual structure of a document’s content which requires a subjective interpretation of its “meaning” and structure not unlike the case of classification. More specific purposes of markup can be to assist preservation, retrieval and even understanding and learning. The markup applied can also be read and analysed by itself as an abstraction and ‘narrative’ of the text and its structure (Buckland & Ramos, 2010, p. 27).

Like most other practices, the choices made when adapting and assigning markup are very much dictated and limited by goals, interests and prerequisites that can be of both very hands-on pedagogical, budgetary and ‘level-of-knowledge’ character as described by Buckland and Ramos (2010), or as more abstract reflections of ideologies and epistemologies as described in the critical knowledge organisation studies. Like classification, then, markup practices and technologies express and reflect values, worldviews and politics (c.f., Johansson, 2004), a subject of critique not least from humanities (Buzzetti, 2002; Caton, 2001; Warner, 1990) and pedagogical perspectives (Nolin, 2010; Selfe & Selfe, 1994).

Visualisation tools, finally, primarily make use of yet another information organisation technique varyingly described as “referencing” or “tagging”, but these can also be said to constitute a form of content-related markup and entity-relationship approach. In the case of georeferencing, for example, the relations thus established are between different types of data and geographic locations. As for other types of markup, the purposes are to support retrieval with certain types of (in this specific case, geographical) search tools and enable specific (geographical) display options (representational modes in the form of map or satellite based visualisations) (c.f., Hill, 2006).

The relationships one chooses to emphasise and make explicit through selecting certain attributes rather than others when assigning tags and markup (e.g. making a ‘georeference’ that connects data to a certain place, rather than, e.g. a temporal reference to a certain point in time) can therefore also be seen to reveal what sorts of knowledge that were deemed significant at that time and in that context. Actions of referencing and markup say something about what the data are perceived to be about (their ‘aboutness’) and what ways of ‘knowing’ them that are deemed useful, valuable, or simply the best. Just as critical studies of classification systems have revealed, these types of actions represent judgment calls or non-reflective institutionalised practices that are similarly related to the surrounding social, cultural, and political context in general.

\[\text{(N.b. that this is a hypothetical example: in many cases, georeferenced data are also provided with temporal attributes and descriptions.)}\]
There is claimed to be, however, a lack of an infrastructure of information organisation systems and practices specifically targeting data sets comparable to the long-established infrastructure for publishing and bibliographic access formed with focus on textual documents in the print and paper paradigm that only recently – and long overdue, according to Buckland (2011) – has received serious attention. One of the major drivers for this change noted by Buckland is the increasingly data-intensive and interdisciplinary research in science and engineering reflected in several new policies, practices and trends. As prominent in the U.S. context, Buckland mentions the National Academy of Sciences’ 2009 established Board on Research Data and Information; the National Science Foundation’s Sustainable Digital Data Preservation and Access Network Partners (DataNet) program; the development of data repositories in universities; funding agencies such as the National Science Foundation’s and the National Institutes of Health’s requests for data management plans in all proposals; and several conferences on the topic (Buckland, 2011, pp. 34, 37). To Buckland’s US account can also be added similar trends in Europe, expressed not least through the European Commission’s PARSE.Insight (Permanent Access to the Records of Science in Europe) (PARSE.Insight, 2010) and DRIVER (Digital Repository Infrastructure for European Research) (Schmidt & Peters, 2008) projects, and leading national initiatives such as the UK government’s Open Data White Paper (Cabinet Office, 2012).

Whereas the political mandates for a sophisticated data infrastructure are thus now in place, Buckland (2011) continues to criticize how these demands have been met in terms of established library and information organisation concerns. Prior to a mid-twentieth century shift and narrowing of the objects and purposes of bibliography towards primarily denoting the examination of printed books as physical objects, he argues, bibliography was largely equivalent to today’s understanding of information organisation, incorporating all issues and problems related to organising and selecting documents. He continues to explain that whereas, as D. F. McKenzie argued already in 1985, bibliography ought to be extended (again) in two ways, firstly by moving beyond the book itself to include also its interpretation and social context, and secondly, by an interpretation of text that is broad enough to include other media and documents such as films, maps, and digital data sets, Buckland finds that only the first goal has been satisfactorily achieved. Much still remains to be done if also “data management” is to be considered and carried out as “bibliography” which also, then, represents a necessary requirement for achieving the envisaged large-scale knowledge and financial returns on research through widespread data reuse (Buckland, 2011).
Buckland argues primarily for proactive measures (policies, infrastructure, et cetera) to ‘channel’ forthcoming data sets from research projects into future and external accessibility, but in the field of digital humanities and cultural heritage research, another development from the ‘opposite’ direction with potential bearing on this problem complex is also emerging. Through the appropriation of tools and methods from law enforcement and computer security, “digital forensics” is suggested as a tool for the extraction of various sorts of data from already existing electronic files (c.f. e.g., Kirschenbaum, Ovenden, & Redwine, 2010). This approach, however, has thus far not attracted much attention within LIS.

In either case, due to the above described terminological histories and politics, it might be less constraining and more media and technology independent to investigate other terms for the systems, practices, and objectives of information organisation and bibliography referred to here. One alternative possibility is presented in a report on a project using markup to support learning and understanding of biographical documents, in which Buckland and Ramos (2010) describe their newly invented tool for encoding events as a “structuring device”. Such a term would actually work as a useful collective description of all the different types of information organisation system technologies, principles and practices that result in different types of representations. And all these different types of structuring devices can be seen as “narratives of knowledge” in their own right (c.f. Buckland & Ramos, 2010; Hansson, 1999; Nyström, 2011; Olson, 2001; Tennis, 2008).

For every representational practice there are – at least in theory – many different possible structuring devices, and choosing one over another, or developing a new structuring device founded on one set of principles rather than other ones, is a choice between all other conceivable ways to represent; it involves a choice to disregard (or simply not see) the other attributes and aspects of that object, event or relation that also might have been of interest. In a prosaic sense, these choices can perhaps be seen as ‘narratives of budget’, ‘narratives of policy’, or ‘narratives of time and knowledge constraints’. But in another sense, the extent to which we can talk about “choices” at all in this context also needs to be qualified by an understanding of how they are shaped and constrained by dominant views and values in the surrounding society and culture. To paraphrase Blackwell (2011), “visual representation” can be understood as the cultural conventions “by which markings on a surface are made and interpreted”. Taken together, these constitute decisive ways in which information organisation activities and systems are afflicted by limitations and bias; in short, by problems of representation.

It appears, however, that even though there is a rich tradition of critical studies of all sorts of information organisation from classification systems to text-
level markup in LIS and nearby fields they rather one-sidedly and overwhelmingly move ‘upwards’ from a close analysis of the system or practice in question to discern the way they reflect and reconstruct dominant ideologies and epistemologies in their surrounding societies. As such, information organisation systems are also used by researchers as tools for learning about the social values and historical trajectories out of which they are formed, with attention to similar societal-level effects (e.g., Bowker & Star, 1999; Hansson, 1999; Johansson, 2004; Nolin, 2012; Nyström, 2011; Olson, 2001; Rayward, 1994; 1997; 1999).

However, there are few examples of research that combines the understanding of information organisation systems and practices as examples of problems of representation with ethnography type studies of how such values, worldviews, knowledge claims and restrictions from which the systems are formed and with which they are imbued might actually play out – be enacted – in situated user interactions. And since this is the main point of interest here, this is also where this study straddles across to place its other foot in another LIS subject area; namely the field of literacies research.

3.3 CRITICAL LITERACIES

In (re-)directing the above described interest in problems of representation relating to the construction of social visualisation tools away from discourses and ideologies towards situated enactments, I position this dissertation amidst traditional LIS ‘literacy’ research – with two modifications. Firstly, I refer to the more specific terminology and traditions relating to critical literacy to denote a technology, modality and content overriding interest in critical questions about, and user positioning vis-à-vis, visualisation tools as information resources. Secondly, I move the critical literacy concept towards the plural understanding of literacies to denote that critical literacy is here understood not as one, but as numerous, variously enacted and locally evolving competences that involve other people, technological artefacts and cultural and situational contexts in constructions of meaning. It is through these two moves that problems of representation in relation to the visualisation tools as information resources here becomes expressed as an analysis of users’ critical literacies.
3.3.1 From Information Literacy to Critical Literacy

Information literacy is the literacy concept – referring to competences in reading and writing (Bawden, 2001) – domesticated to LIS relevant objects and practices in the information needs, seeking, evaluation and use area (c.f., Bruce, 2003; Webber & Johnston, 2000). But beyond this common conception, information literacy has many different meanings and purposes, from serving as an object of learning and teaching in library instruction (also described as library literacy and bibliographic instruction); to a development-enabling and democratizing human rights vision in political agendas and rhetoric (sometimes critiqued as the ‘literacy myth’); to denoting a broad LIS research field and often also more specifically an analytical construct developed by interpretations through various theoretical lenses (c.f., Buschman, 2009, p. 96; Limberg et al., 2012; Lindberg & Lundh, Eds., 2012; Lundh, 2011; Pilerot & Lindberg, 2011).

The nature of the research problem here naturally directs attention to the incorporation of critical elements into information literacy definitions, but even though such elements do exist, they are problematic and inadequate in several ways, “sometimes overused, and not well understood”, as described as early as 1996 by Gibson and Meade with currency still today.

Although variously articulated, critical elements in information literacy definitions rarely go beyond rather simple notions of source evaluation. Sometimes, these notions draw on information retrieval (IR) terminology and ideas to talk in a system-oriented tradition about evaluation in terms of precision and recall. In another sense, critical information literacy skills as defined and taught in library instruction programs are close to source criticism criteria as formulated for historic and journalistic research in relying on assessments of documents’ author related origin and authority and intra- and intertextual logics and relations such as bias, verifiability and logical consistency (Johansson, 2009; Sundin & Francke, 2009). Both notions operate on the assumption that upon acquiring certain related fixed and generic skills, the information literate person will be able to discriminate between ‘correct’ and ‘incorrect’ actions and ‘true’ and ‘false’ information.

Accordingly, these types of definitions are also frequently and heavily critiqued for drawing upon outdated or constricting frameworks, traditions and epistemologies such as print culture (Kapitzke, 2003b; Sundin & Francke, 2009), modernism

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20 In such cases, focus is placed on how well the documents retrieved from an information search match the search query, and how many relevant documents that were not retrieved.
(Kapitzke, 2003b), cognitivism and psychological science (Kapitzke, 2003a; 2003b), objectivism and positivism (Kapitzke, 2003a; 2003b; Pawley, 2003; Simmons, 2005), and Enlightenment ideals (Kapitzke, 2003a; Pawley 2003).

The critical element shortcomings to which all these critiques draw attention become particularly apparent in relation to the anonymisation and what some call a democratisation of authorship in the web 2.0 milieu with, most notably, Wikipedia and blogs. These information resource newcomers demonstrate that traditional source evaluation criteria that draw upon critical assessment of a document’s author or institution of origin are impossible when the author is unknown and can be virtually anyone, and the textual forms depart from institutionalised norms and genres (e.g., Sundin & Francke, 2009). By the same logic, visualisation tools as information resources push this challenge even further as normally they do not even come accompanied by text and propositions and altogether lack clear equivalents to human authors.

If the web 2.0 development represented by Wikipedia and blogs thus can be envisaged as challenging traditional source evaluation criteria by their relatively ‘anonymous’ and form-breaking characteristics, then visualisation tools take this one step further through what might be perceived of as ‘automated’ characteristics, apparently generated without the involvement of human interpretation and textual representation (c.f., Johansson, 2009). This, however, should not be mistaken for a technology deterministic argument; the view of documents advanced here directly opposes such causal explanations and favours instead an emphasis on documents as historically continuous representational artefacts that exhibit variations along a shared spectrum of characteristics (c.f. section 3.1.3 above on the authority of the author). The challenges that Wikipedia and visualisation tools pose to traditional source evaluation criteria, thus, are not new, merely momentarily accentuated because of their broadly assumed novelty and current popularity.

From the point of view advanced here, thus, there are many reasons to avoid the information literacy concept: it is associated with overly simplistic understandings of ‘critical’ (see above); the term ‘information’ by itself is troublesome enough to warrant avoidance (c.f., section 3.1.1); and all forms of ‘prefixed’ literacy concepts introduced over the years (such as computer literacy, digital literacy and visual literacy; c.f., Bawden, 2001; Limberg et al., 2012) emphasise precisely the

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21 As always in this popular manner of speaking, it is nonetheless important to keep stressing the vast amount of people that due to various structural barriers (relating to primarily economy, politics and education) remain excluded from even the most basic “web 1.0” uses (c.f. e.g., Castells, 2000b, ch. 2).
sorts of technology, content and modality determined differences between documents (with associated compartmentalisations of distinct competences) that I aim to avoid here. The nature of my research problem and research object conceptualisation requires instead deeper and more fundamental understandings of ‘critical’ in a more general sense, found instead as elements or aspects of literacy competences in critical literacy and critical information literacy concepts. By necessity, the connotation of ‘critical’ in this sense is also generic in character, pointing to critical literacy attitudes and competences without concern for content, context and modality/technology. But compared to the generic library instruction checklists for information literacy competences critiqued above, these connotations target levels and issues that are abstract enough to not in the same way be troubled by the more articulate context-bound and thereby non-transferrable specifications of skills that tend to be listed in these other examples (nonetheless, these definitions do not embrace all aspects of interest here, which is why they are elaborated with the chosen theories in the concluding section of chapter 4).

The critical literacy and critical information literacy concepts are less common, but far from unknown, in LIS. Both concepts co-exist and show clear traces of inspiration from the theories of critical pedagogy originally advanced by the Brazilian pedagogue, theoretician and socialist Paolo Freire (Elmborg, 2006, p. 193; Simmons, 2005, p. 299). In *Pedagogy of the Oppressed* (2000/1972), Freire defines the purpose of education as the transformation of students from passive receivers of ‘knowledge’ through academic products and practices that enact the dominant ideologies of the surrounding society into active agents with critical consciousnesses, capable of asking questions and bending their own learning towards issues that matter to them and their situations. When students become aware of themselves and their situations in this way, they also become equipped with tools for conscious action towards liberation and social equality (Elmborg, 2006, p. 193; Freire, 2000/1972).

The ideas of Freire are adapted to LIS concerns as “critical literacy” or “critical information literacy”, both with shared focus on a set of core critical competences that range from distanced and reflective stances to empowered actions. Firstly, there is in these definitions a sort of baseline acknowledgement that all information and knowledge production occurs within and needs to be understood as shaped by ideological, historical, and cultural frameworks. Secondly, they also often encourage critical scrutiny of not only immaterial but also material (for example, technology and infrastructure) contexts and consequences of information production and use. Thirdly, although slightly less common, there are also normative goals to empower users to not only recognise and question such aspects in relation to information
production and use, but to also actively reinterpret and reshape the information systems and resources in adaptation to their own needs and interests.

Although I avoid the term ‘critical information literacy’ because of the common and data-excluding immaterial connotations of the ‘information’ concept and thereby favour ‘critical literacy’ as a more useful content- and technology overriding term, I draw inspiration from elaborations of both concepts here below. From my view, this represents an evident follow-through of the initial problem of representation ‘staging’ of visualisation tools as documents and representational artefacts to be able to analyse and understand what and how such problems of representation become enacted in user interactions with social visualisation tools as information resources.

The most common aspect of critical (information) literacy formulates and propagates a generic critical stance or understanding of problems of representation relating to information resources and systems and users’ subsequent distanced attitudes and positioning towards them. In advocating the transformation of library instruction and information literacy programs on such grounds, for example, Elmborg concludes that “ultimately, critical information literacy involves developing a critical consciousness about information, learning to ask questions about the library’s ... role in structuring and presenting a single, knowable reality” (2006, p. 198). The library and information practices and constructs that Elmborg sees as most urgently deserving of such critical approaches are precisely those described in the problem of representation section above, with particular emphasis on classification (in Elmborg’s terminology described as systems embodying the “grammar of information”).

Critical literacy concerns of this type are quite abstract, and encourage the formulation and asking of questions intended to lead to a metaknowledge of socio-cultural, historical, and ideological processes of information and knowledge construction and justification (Kapitzke, 2003a, p. 46). Warnick (2002, p. 6), e.g., describes critical literacy as the importance of being able to create and uphold a necessary distance between user or reader and text so that the former can view the latter with a critical understanding as part of a larger social and textual context. Bruce (2000) claims that users need to be able to “read against” texts in order to understand their political, social, and historical dimensions manifested as parts of discursive genres. And Andersen (2006) describes the importance of users’ critical awareness of the social organisation and structures of society since these influence and become reproduced in documents. Genre theory is often suggested as a tool for conceptual and theoretical development of critical (information) literacy (Andersen, 2006; Simmons, 2005; Sundin & Francke, 2009) and the motivations for this not
only echo but are also starting to explicitly merge with sociocultural theories (c.f., Bawarshi & Reiff, 2010).

When translated to more concrete user activities, critical (information) literacy recommendations often also come close to core concerns in the information policy subject in LIS (c.f. e.g., Pawley, 2003). The overlaps are particularly prominent in Simmons’ description of critical information literacy as highlighting questions about information: “‘Who owns and sells knowledge?’ ‘Who has access to information?’ and ‘What counts as information (or knowledge)?’ … ‘Whose voices get published?’ – or more importantly – ‘Whose voices do not get published?’” (Simmons, 2005, p. 300). This strand of critical literacy calls into question “assumptions about information” to support examination and questioning of its social, economic, and political contexts for production and use. It points to choices made by actors with goals, interests and agendas, and to the marginalisation and exclusion of other actors (Simmons, 2005, p. 299). Shapiro and Hughes (1996) describe similar skills that have to do with critical assessments of technological infrastructures and their effects and consequences within the frame of social, cultural, economical, and philosophical contexts. And Andersen (2006, pp. 222, 226) describes in the same vein information literacy as equal to a sort of socio-political (critical) genre skill implying competences to “read society” via its textually and genre mediated structures. The information seeker therefore needs to be able to critically scrutinize, analyse, understand, and choose among the various document genres, discourses, and social spheres from which the documents originate, and see through for whom, and for what purposes, they have been created.

Finally, some of the most revolutionary aspects of critical literacy are presented by Cushla Kapitzke who advances the ‘dismantling’ goals of revealing document ideologies more as a goal in itself in the senses discussed above, to a mere step on the way to real and productive empowerment of users. The main objective for problematising and contextualising the different versions and constructions of knowledge and truth as represented in documents is thereby tied to the empowerment of users to be able to transform dominant texts (Kapitzke, 2003a, p. 49; 2003b, p. 61). This, then, can take the form of negotiating interpretations and uses by counter-interpretations – “reading against” or “dialectical reading” (Bruce, 1997; 2000) – as well as acquiring the necessary skills for challenging and transforming dominant discourses and documents (Kapitzke, 2003b) and producing alternative “genres” (c.f., Bawarshi & Reiff, 2010, ch. 11).

Together, these conceptions of critical literacy can be seen to respond to the ‘problem of representation’ research tradition in LIS. The aim is to make aware of potential bias and restrictions and to reveal the artifice in what may have become
natural and taken for granted. They also go one step further to aim at user empowerment by positioning users vis-à-vis documents and enable them to not only see through, but also reshape in their own interests or challenge or replace dominant accounts by new and alternative ones. Nonetheless, in relation to the interests pursued here, these critical literacy understandings remain too removed from situated interactions and enactments of meaning. This is why I also propose to develop it here through advances in alternative traditions that rather prefer to speak of literacies in the plural.

3.3.2 From Critical Literacy to Critical Literacies

In order to bring the above described critical literacy connotations down to situated practices of interaction and enactment I turn to the pluralistic conceptions of ‘literacies’ advanced in several traditions. The pedagogically based so-called “new literacy studies” (NLS) (Buschman, 2009; Street, 2003) e.g., assert as key concept that the activities of literacy – i.e. reading and writing – are never self-contained and performed ‘for their own sakes’, but always embedded in larger social practices which give them their form and meaning (Buschman, 2009, p. 98).

The increasing utilisation of ethnographic methods in NLS has made visible the heterogeneity of the localised and micro level. Information activities and practices are seen as situated and as giving rise to different and often multiple co-existing literacies in different situations (Street, 2003). The meanings of documents, the effects of structuring devices, and what people think, ‘know’, experience, and do cannot be anticipated or understood out of context. No value judgement of ‘right’ and ‘wrong’ is forced upon the users from the outside – the logics and rationales that provide meanings for actions are sought and found in the practices and locales where they occur and the goal is thus to understand the users’ own understanding of their activities. “Literacies” in this sense can be said to denote a multiplicity of socially and culturally varying ways of knowing, reasoning, interpreting and communicating that are situated in various practices (c.f. e.g., Säljö, 2005, pp. 221–223).

This conception has informed also numerous LIS critiques and elaborations of the information literacy concept at least since the 1990’s (c.f., Buschman, 2009, p. 101, passim). Above all, it is a basic grounding in social constructionist epistemologies that unite LIS researchers from theoretical traditions ranging from phenomenography and discourse analysis to sociotechnical and sociocultural perspectives in focussing on literacies in the plural in this sense (e.g., Limberg et al., 2012; Lloyd, 2007; 2010; Lundh, 2011; Tuominen et al., 2005). To read, create, and
evaluate texts and meanings are thus seen to occur within the frame of shared activities and represent basic assumptions that meanings and knowledge are situated, i.e., they arise in interactions between people, tools and artefacts, within social and cultural contexts (Sundin & Francke, 2009; Tuominen et al., 2005, p. 339). Different communities can therefore also give rise to different types of literacies that either coincide with, or deviate from, the established and authorised norm; they depend on historically and contextually defined social values and technologies; and the production of knowledge is shaped by the tools used (Marcum, 2002, p. 14; Street, 2003; Webber & Johnston, 2000).

From the pluralistic perspective, knowledge does not “exist” in texts, documents or databases, but arises as a situated co-creation of meanings that transgress individual minds and bodies to involve other people and technological artefacts (Kapitzke, 2003a, p. 48). Tuominen et al. (2005), for example, describe information literacies from a sociotechnical perspective as emergent, local practices in social communities where technological tools and artefacts are awarded decisive roles. Information literacies, in their view, are ways of knowing and acting which individuals share and learn together with others, mediated through the use of tools – discursive as well as material-technological, in everyday and work related practices. For literacies research, the authors call not least for better understandings of the nature and functions of technological artefacts in information activities and practices. Literacies, technological artefacts, and social practices shape, form and give meaning to each other (Bruce, 1997; Schroeder, 2001).

Both the critical literacy and the literacies conceptualisations and research traditions constitute common and central tracks (one “critical”, one “literacies”) in what is most often clumped together in a broad categorisation of information literacy research, but as seen here, they spring from separate traditions and have not been fully integrated in our field. Outside of LIS, however, and according to Street (2003), the explicit combination of a similar critical approach with pluralistic situated conceptions of literacies represents the “best of NLS”. In conclusion, one can claim that sociotechnical, sociocultural and discourse oriented developments of information literacy clearly move in this direction and operate on both crucial levels here: on the one hand with focus on the constraints, embodiment and reproduction of cultural values and knowledge through representational acts and artefacts, and on the other hand with focus on situated, local activities and constructions of meaning and knowledge (c.f. also Sundin & Johannisson, 2005b).
3.4 CONCLUSIONS

To summarise, the discussion on critical (information) literacy and literacies ties into the research problem at the heart of this dissertation in some specific ways. Whereas there are plenty of studies in LIS on information organisation – not least classification systems – from critical perspectives, they overwhelmingly represent historical or out-of-use approaches that aim to distinguish the societal-level discourses and knowledge views that have informed (and thwarted) their development but there are few examples that study, from similar critical understandings, how such embedded and embodied views and values become enacted in use. By combining “critical literacy” with “literacies” into “critical literacies” in this way, I gain a conceptual tool for analysing ways in which problems of representation – the ‘narratives of knowledge, power, budget, goals, skills et cetera’ imbued in representational artefacts become (re-)constructed in situated user interactions. This, however, constitutes a so far both theoretically and empirically underdeveloped approach that I elaborate in the following with a focus on the mediating roles of artefacts with the help of concepts and perspectives from sociocultural and socio-technical traditions, a combination made possible by their shared social constructionist roots.
PART II

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DESIGN AND DESCRIPTION
OF THE STUDY
In this chapter I theorise and operationalise the aim of the study – to analyse mutual enactments of critical literacies and social visualisation tools as information resources – through metatheoretical to analytical levels in two main steps.

First, in section 4.1, I describe how the specific constructionist orientation of this study which not only includes but specifically focuses on physical-material tools as mediational means of knowing and acting has led to a combination of more specific theories and concepts concerning ‘tools’ in a sociocultural perspective and ‘inscriptions’ in the sociotechnical tradition of science and technology studies (S&TS). After this, I describe in more detail how the central concept of materiality is to be understood and used here. The section ends with an explanation of how the overall approach of the study might be described in terms of a ‘sociology of visualisation tools’. The approach is thereby in line with what has been described as a sociology of documents or sociology of visuality in which focus is on understanding what meanings representational artefacts take on in different contexts of use and what knowledges, situations and practices they also in those processes contribute to construct, uphold or challenge.

Secondly, in section 4.2, a set of more specific theoretical concepts are selected and presented as basis for a more focused analytical framework taking hold of ideas connected with the three concepts externalisation, mobilisation, and appropriation.
In the concluding section 4.3, the research aim is operationalised through the formulation of three more concrete research questions based on the analytical framework and the ways in which the theories contribute to a (re)conceptualisation of critical literacies as local enactments of meaning, both shaped by and shaping the visualisation tools as information resources, are explained.

4.1 CONSTRUCTIONIST VIEWS AND AIMS

Social constructionism (‘constructionism’ in the following), maybe because of its relatively recent arrival in the history of ideas, is frequently described in terms of what it is not, such as anti-essentialist, anti-dualist and anti-referentialist. The anti-essentialist stance emphasises that there is no one true essence inherent in humans and objects that give them meaning and determine their values, uses and development. Meanings are not discovered but created, and in this sense, anti-essentialism is also a powerful opponent to deterministic explanations. The anti-dualist position refutes the deep-rooted Western notion of an internal-external (mind-world) separation, closely associated also with the anti-referentialist opposition to beliefs that representations can either correctly or incorrectly reflect an independent, objectively existing reality (e.g., Frohmann, 2004; Sundin & Johannisson, 2005a, pp. 29–30).

What constructionist viewpoints do, instead, is place focus outside of humans, emphasising interactions and relations between individuals, communities, tools, and institutions. All definitions, conceptualisations and choices in this study thus far, from research problem description to research object conceptualisation and positioning stem from such a basic constructionist position. However, there are also considerable differences between constructionist approaches and in the first section of this chapter, 4.1, I describe where, among these, this study can be positioned. This positioning relies on three choices in particular: 1) the focus on physical-material tools as mediational means for knowing and acting; 2) a broad understanding of the materiality of such tools; and 3) the main aim to analyse particular enactments of situated and mutually shaping practices and tools (critical literacies and social visualisation tools).

4.1.1 Sociocultural Tools and Sociotechnical Inscriptions

A common trait in constructionist conceptions of representational artefacts taken hold of in this study is the understanding that to engage in representation-use is, firstly, a form of tool-use; secondly, a necessity for both individual and collective
meaning making; and thirdly, to be involved in historically contingent and intra-subjectively constructed practices of communication. The tool most often acknowledged is language, but early and influential theories including also physical-material representational artefacts are found in, e.g., the anthropologist, communications theorist and systems theorist Gregory Bateson (1979), the philosopher Marx Wartofsky (1979), and the psychologist James J. Gibson (1986/1979). All of them also eradicate subject-object dichotomies by dissolving the border between a human and her tool in acts of use (c.f. also Hayles, 1999; Sundin & Johannisson, 2005a). This study aligns with this tradition of thought, although mainly as presented in more contemporary and specific strands within what might broadly be described in terms of the sociocultural perspective and science and technology studies (S&TS). Both these traditions are commonly applied in LIS research although not always in the ways proposed here, and rarely in combination.

The whole S&TS field has been described as especially important for LIS in having made the social construction of knowledge available for empirical study with focus on activities, practices and the role of artefacts such as documents and information systems in these processes (Van House, 2004, p. 11). Recent S&TS applications in LIS include studies on open access and scholarly publishing (Francke, 2008), collaborative platforms in LIS (Ponti, 2010), and digital library design and use (Bishop, Van House, & Buttenfield, eds., 2003). The sociocultural perspective, on the other hand, seems to have enjoyed a more specific increase of interest over the last few years, in particular in Nordic and Australian contexts, for LIS research on information practices in general (Sundin & Johannisson, 2005a; Wilson, 2008) and for theoretical and empirical development of the information literacy field in particular (Hedman & Lundh, eds., 2009; Limberg et al., 2012; Lindberg & Lundh, eds., 2012; Lloyd, 2006; 2007).

For my own study here, I mainly rely on Roger Säljö’s elaborations of the sociocultural perspective on tools and Bruno Latour’s S&TS related conceptions of inscriptions. The theoretical discussion is extended at times with the above mentioned Gibson and Wartofsky, as well as anthropologist Edwin Hutchins (1995) – all of whom have also been explicitly invoked by Säljö for staking out his version of the sociocultural perspective – along with some additional S&TS researchers writing with or in the vicinity of Latour and conceptions of inscriptions. Terminologically, this means that all of the so far introduced concepts (sociocultural) ‘tools’, ‘inscriptions’, ‘representational artefacts’ and ‘documents’ are used to refer to the social visualisation tool research objects at hand, but they also signal different emphases on either a conceptual LIS positioning (as documents in terms of representational artefacts) or a theoretical-analytical operationalisation (as tools and inscriptions).
My reason for choosing to work with these theories in general and Säljö’s and Latour’s versions in particular are that both are rooted in the basic understanding that tools and practices shape each other which makes them well suited for analysing the mutual enactments of critical literacies and social visualisation tools. A further important feature is that they include both material and immaterial aspects in the conception of all sorts of representational artefacts as meditational means through which humans act, perceive, and construct themselves, social realities and situated knowledges in shared communicative practices – and thus also key for analyses thereof. This is all in line with the conceptualisation and positioning of visualisation tools as LIS research objects in Part I: all are concerned with the simultaneously repeated and dynamic processes through which representations in the form of documents (Levy), tools (Säljö), and inscriptions (Latour) “enter into human activities and organize knowledge, shape perception and structure future action” (Ivarsson, 2004, p. 26; c.f. also Van House, 2004, p. 13).

The agreements aside, however, there is of course a reason for calling on both traditions here, and that has to do with their different attentions to aspects relating to power. The sub-branch of S&TS to which inscription theories belong (laboratory studies and actor-network theory, ANT) describes inscriptions as powerful co-actors (actants) in micro level epistemic and power related conflicts, but it is also commonly critiqued for (consciously) disregarding macro level aspects such as cultures, institutions and structures (Sismondo, 2004; Van House, 2004, pp. 17, 20; Williams & Edge, 1996). The sociocultural perspective, on the other hand, even though sometimes mistakenly assumed to disassociate from power issues (de Abreu, 1999) can be said to bridge the common conflict between micro level and macro level explanations by drawing together individual actions, tools, institutions and social practices in an account of mutually shaping relations (c.f., Säljö, 2005, pp. 48–49). In other words, knowledge, practices and tools are seen as mutually shaped in situated acts whereby certain knowledge becomes institutionalised, normative, incorporated in new tools, mediated in use, and thereupon rebuilt in new tools (c.f., Säljö, 2000, pp. 30, 80–82).

In order to cover a spectrum that is as broad as possible relating to critical literacies and social visualisation tools, I have therefore opted to supplement the broader sociocultural perspective with the more elaborated actor and power related perspectives on tool-mediation in inscription theories. When previously addressed, more elaborate attention to power issues in similar ways clearly adds to the explanatory reach of sociocultural research (e.g., de Abreu, 1999; Sundin, 2003).

Before explicating, in section 4.2, the more specific theories and concepts in these traditions that constitute the analytical framework for the empirical data,
however, I momentarily broaden the discussion to describe two further choices with bearing on both theoretical and empirical focus. These choices concern the understanding of materiality and the aim of my overall constructionist approach in terms of a ‘sociology of visualisation tools’.

4.1.2 Materiality

The most straightforward and common connotation of materiality has to do with palpable qualities and effects, equal to documents having physical matter (Bleich, 2001, p. 121) and intimately bound to surrounding physical conditions and infrastructures. In this sense, we can speak of the materiality of certain types of documents as hinders for reading, and as inspiring the development of new strategies and practices to overcome such limitations (c.f., Dolatkhah, 2011). Such notions of materiality can and have been extended to digital (non-physical) documents as well, by directing attention to how certain digital features not only emulate physical-matter characteristics but also just as effectively support or inhibit various ways of interaction (c.f. section 3.1.2; Alexandersson et al., 2007; Francke, 2008, p. 111). On a more general level, one also speaks of materiality in a sort of socio-material sense by pointing to relations and effects between documents and their social surroundings, such as the way budget, expertise and project goals affect both quantitative and qualitative aspects of documents (c.f., Buckland & Ramos, 2010) or how seemingly trivial cash receipts enable and underscore central financial and judicial arrangements such as tax deductions and evidence in court (c.f., Brown & Duguid, 1996; Levy, 2003, ch. 1).

Here, I include these more literal-physical takes on materiality but also advance my understanding and use of the concept to a more fundamental level. Digital, paper based, and oral representations alike are from this extended perspective also seen to ‘have materiality’ in the sense that they ‘come into being’ as “coherent units of meaning” (c.f., Windfeld Lund, 2010) through practices that rely on representational structures. In this sense, materiality also includes equivalents to the meaning of representation as defined here: it denotes how, for purposes of communication, also intangible entities such as ideas, events and relations need to be given form within existing realms of conventional and well-articulated verbal as well as non-verbal representation schemes or symbol structures, and how those entities will also thereby inevitably be affected and shaped by the possibilities and constraints of those structures (c.f., Buckland, 1991; Levy, 2003, p. 35). Materiality in this sense denotes the opposite of the so-called conduit or transmission metaphor (c.f., 3.1.2): documents (as representational artefacts) are not neutral ‘vessels’
transporting epistemic content without changing it from a person A to a person B (c.f., Brown & Duguid, 1996; Säljö, 2005, p. 55) – on the contrary, representation and meaning are inseparable and mutually shaping. For this study, the last aspect of materiality denoting the mutual shaping of ‘form’ and ‘content’ even in digital media is the most central. To distinguish between the different connotations of materiality as presented here, however, I clarify in the following, when deemed helpful, by describing ‘palpable’ representational artefacts as ‘physical-material’ (whereas the representations in focus here can be said to be of an ‘immaterial-material’ character).

Needless to say, materiality in this sense is highly abstract and elusive and consequently, the question concerning if and how such materiality is or can be ‘visible’ to users is also subject of much theorising. Such theories are also particularly interesting to consider in relation to documents of social visualisation tool types, as many explicitly mention one or more combinations of high-tech/automation, numerical data, and visual representation as cases in the extreme. At the one end, there are arguments suggesting that the materiality of documents becomes invisible, transparent, in instantiations of high-tech data visualisation types; at the other end, there are notions that high-tech and new media features on the contrary highlight their own artificial and constructed nature.

In an ethnographic study of narratives surrounding the production of MRI (medical resonance images), Joyce (2005) finds these particular types of data visualisations to be constructed as true and unmediated sources of knowledge. The effect is accomplished by narratives that reflect and reinforce popular assumptions about images and machines: “embedded in ideologies that equate visual representation with the real and mechanical reproduction with objectivity” (p. 457). The narratives are further strengthened by their ability to support economic and political interests of strong actors in the arenas under study. Beaulieu (2002), in a similar context of functional imagers and brain scans describes a slightly more complex ‘love-hate’ relationship between scientists and their objects (the visual representations). The relation is explained in terms of technological, methodological and institutional elements and the contradictory status of images as having low scientific status yet high public appeal and authority. Campbell (2007, p. 379), in a similar approach, describes how certain prevailing western models of knowledge (not least empiricist epistemologies) have privileged a naturalistic understanding of vision underscoring the reception of all sorts of imagery. In particular, he finds news photographs to constitute examples of constructions that obscure their own production and are frequently interpreted as ‘true’, ‘real’, and ‘objective’.
However, whilst recognising the tendencies described above, a number of researchers also identify opposites to ‘transparency’ discourses and enactments. Bolter and Grusin (1999), e.g., argue that all the while technology (in particular, media) development is largely fuelled by the desire to achieve ‘immediacy’, i.e., the impression of increasingly accurate and unmediated representations of ‘reality’, countertendencies termed ‘hypermediacy’ arise, in that the technological sophistication necessary for immediacy by its sheer newness and often obtrusive physical-materiality will contradictorily also draw attention to its own artificiality. Likewise, Hayles (1993; 1999) coined the term ‘technotext’ to denote a document (in her case, a literary text) that directs attention to both its constructed nature and the relationships between its production and reception. In staking out pedagogical implications of these ideas, Voithofer (2005) suggests conscious design of ‘research technotexts’ that make the problems of representation visible through incorporating the multiple stages in documents’ (here, research articles) production and allowing for multiple discourses.

This discussion on materiality is, thus, essentially a theoretical reformulation of the “problem of representation” research problem described in the introduction. However and also as initially declared, my interest in the mutual shaping of visualisation tools and critical literacies needs to lead further to situated interactions and enactments of meanings. When all of the above is drawn together for this focus, the particular constructionist approach advanced here might best be conceived in terms of a sort of ‘sociology of visualisation tools’.

4.1.3 A ‘Sociology of Visualisation Tools’

Constructionist approaches, as mentioned, vary significantly concerning their views on reality but from a sociocultural perspective, the question of “reality” and what we can know about it is not deemed particularly interesting or relevant: even if a sort of objective reality independent of social relations exists, it is thought inaccessible for us to ‘know’ and study as such (Sundin & Johannisson, 2005a; Säljö, 2005, p. 55). This stance, however, is not the same as relativism, the consequence of which would be to discard ‘real world problems’ whether physical or ethical as constructs open to different interpretations and thereby absolving researchers and the public of responsibility for them. In effect, many constructionist approaches take different types of stances.

At the very heart of the matter, “the point” of constructionism has been described as demonstrating that things can or could be different (c.f., Hacking, 1999, p. 5). It aims to show that what might be taken for granted or accepted as
true, natural and objective is in fact historically and socially contingent constructions, neither natural nor arbitrary. Implicit in a constructionist stance, thus, is a sort of critical, deconstructing, or liberating agenda; to “probe the determinism or inevitability of social arrangements” and recognise them as constructions, “albeit often unnoticed ones, which we mistake for facts fixed and independent of human decisions” (Rosenberg, 1995, p. 101). Hacking (1999, pp. 6–7, 19–21) continues to describe six different, although sometimes overlapping, grades of commitment to claims that an ‘entity X’ is socially constructed, ranging from historical to revolutionary positions. In the middle he places the “unmasking” and “reformist” commitments. Unmasking constructionism aims to undermine ideas by revealing the functions they serve, thus stripping them of false appeal and authority. Reformist constructionism holds that while ‘X’ is a negative thing, modifications might at least ameliorate the situation.

One of the points of this study is likewise to denaturalise, to reveal some of the artifice and positivist cloak that shrouds and shapes visualisation tools in academic discourse as automated and objective generators of new knowledge and truths (see section 2.1). But I do not stop at the “it could have been otherwise” or “unmasking approach” to engage in what Campbell describes as “iconoclastic critique”, focused on exposing representations as “dangerously false” (Campbell, 2007, p. 379, through Mitchell). Instead, I rather aspire towards a broader exploration in line with previous work described in terms of a sociology of documents (c.f., Brown & Duguid, 1996; Levy, 2001; 2003; Windfeld Lund, 2010; c.f. also descriptions of a ‘sociology of images’ or ‘sociology of visuality’ in e.g., Burri, 2012; Campbell, 2007; Joyce, 2005).

In my aim towards a sort of ‘sociology of visualisation tools’, thus, the point of interest shifts from prior critical analyses in the problems of representation tradition (c.f., section 3.2) towards rather asking what the social visualisation tools studied here are made to mean and do. In going beyond the connotation of being given physical form, representation and materiality are understood as ‘occurring’ not once, at some idealised initial point of creation, but as continual enactments at every site and time of user interaction. This includes of course the time a document is first created by an ‘originator’ but more importantly also all other subsequent uses and enactments; documents acquire meanings in each situated act of communicative interaction. This understanding of materiality draws attention, as described also by Bleich in relation to language, to the historical uniqueness of social, situated aspects of use to the extent that representational artefacts “cannot be considered in isolation from living situations” (Bleich, 2001, p. 120).
Whereas the overall discussion here in section 4.1 stakes out the metatheoretical and epistemological grounds for the aim of this study, the following section presents the more specific theories and concepts that make up the analytical framework for analysing the empirical data.

### 4.2 ANALYTICAL FRAMEWORK

To analyse the mutual enactments of critical literacies and social visualisation tools, I have selected theories and concepts that can be used to both explain and problematise various aspects of interaction between humans and simultaneously material-immaterial representational artefacts. Broadly speaking, I base my analytical framework on sociocultural and science and technology studies (S&TS) theories on tools and inscriptions. The material-immaterial conflation is crucial (see above), but also makes the sociocultural tool-category extremely broad, covering all artefacts that extend human capabilities and it is helpful therefore to find some other way of distinguishing between, e.g., a shovel and a diagram. The philosopher Marx Wartofsky’s (1979) hierarchical classification of artefacts provides such a distinction (c.f. also Ivarsson, 2004; Säljö, 2005) by virtue of focussing on the functions and meanings of artefacts in use.

In my interpretation of both Wartofsky’s own writings (Wartofsky, 1979, ch. 11, pp. 188–210) and Ivarsson’s (2004) and Säljö’s (2005, pp. 96–100) reinterpretations of the same, primary artefacts are tools used as extensions of the human body in the production of goods and performance of tasks, such as axes, trucks, and many uses of computers. Secondary artefacts function as a sort of meta-genre for the primary artefacts; they instruct and preserve knowledge of how to use the primary artefacts, such as books, reports, and manuals. This class of artefacts is also explicitly referred to as representations (of actions and of practices). Tertiary artefacts, finally, are tools that are further removed, abstracted, from direct production and that rather concern how we can depict, analyse, and understand the world, as in aesthetic objects, computer games, and scientific theories. They do not directly interfere with the physical world, but can be used as basis for subsequent actions of that type. Tertiary artefacts, Säljö writes, are especially interesting for studies on learning and knowledge formation since they are increasingly central in our societies yet require many and extensive forms of knowledge (Säljö, 2005, p. 99).

But as Säljö also makes clear, Wartofsky’s classification does not state fixed ontological features: one and the same object can travel between categories depending on its use (Säljö, 2005, pp. 96–100; c.f. also Latour & Woolgar, 1986/1979, p.
89). For example, a map used for way finding functions as a primary artefact; whereas if used as historic or pedagogic example of cartography or map reading, it functions as a secondary artefact. I deduce from these examples also that a map used for visualising and analysing data (as in one of the visualisation tool cases here) might also be able to function as a tertiary artefact. It might be possible then, that the uses of the visualisation tools studied here can be seen to span all three uses and thereby be variously categorised as primary, secondary, or tertiary artefacts; an understanding that also seems to agree well with descriptions and understandings of inscriptions (e.g., Latour & Woolgar, 1986/1979, p. 245; Latour, 1987).

In the following sections, a set of theoretical elaborations related to tools and inscriptions in these sociocultural and sociotechnical traditions are presented as basis for the analytical framework with focus on three concepts in particular: externalisation, mobilisation and appropriation. Each concept, as mentioned, is used to explain and/or problematise aspects of human-tool interactions with bearing on meaning making, knowledge formation and associated activities and practices. With this focus, the theoretical framework helps me to spell out, from the above articulated metatheoretical base, how critical literacies are to be understood in the following and why they are interesting to study. Another outcome from the overall approach in this dissertation is thus the introduction and development of a partly new set of concepts for the analysis and understanding of critical literacies as situated activities not merely responding to, but also shaping, the meanings of representational artefacts (as here: social visualisation tools).

### 4.2.1 Externalisation

Säljö’s discussions on externalisation of skills and knowledge into tools together with a few nearby theories are particularly interesting for conceptual elaboration and analysis of critical literacies since they describe tool-mediated human knowing and acting in terms of complex gain-cost relationships (e.g., Säljö, 2000, pp. 80–82; 2005, pp. 36–37, 169–70, 178, 186–92).

In simplified terms, externalisation occurs in two main ways. The first is through historic accumulation through which new knowledge is continuously added to old knowledge in repeated constructions of ‘improved’ artefacts; what Säljö calls sociogenesis (2005, pp. 101–103) and which leads Hutchins to describe artefacts as “material residuums of generations of knowledge and practices” (Hutchins, 1995, pp. 96–97). The other is through more specific deliberate or haphazard acts of superimposition of representational structures within a single framework which yields not only a set of correspondences but also leads to unexpected discoveries and
knowledge (Hutchins, 1995, pp. 102, 111). In either case, the processes result in there being “more knowledge” in representational artefacts than originally and intentionally “put into them” at any one specific point in time (ibid.). Visualisation tools can readily be seen to draw on both slowly accumulated knowledge which has given us modern day geographical and temporal representations, digitised and animated by advanced computer technology, as well as visually represented superimpositions of correspondingly referenced data sets, satellite imagery, and preferential additions or removals of other data layers.

On the overwhelmingly positive side, externalisation and the qualities that go with it means that humans’ abilities to think, perceive and act are extended and amplified beyond biological constraints (Säljö, 2000, p. 17). Our tools help us so that we do not have to learn and remember everything from scratch on our own and are able to perform challenging tasks with more ease and efficiency – like visualise and analyse large data sets. They also help depersonalise knowledge and make it available in different ways with different consequences for how work tasks and shared practices can be organised and carried out. Through physical-material (or repeatable, c.f. section 3.1.3) characteristics, externalisation allows knowledge to stretch across time, space and individual minds, what Hutchins (1995) describes in terms of distributed cognition; Säljö (2009) as social memory; and Strum and Latour (1999) as enabling large-scale societies.

Problems or caveats relating to the above primarily describe how documents are never ‘neutral’ and ‘true’ but built on discursive distinctions, ethics, values, classifications and the like (e.g., Säljö, 2005, pp. 44), similar to the problems of representation recognitions in critical classification studies in LIS (c.f. section 3.2.1). Tools are also marked by constraints and bias associated with the practices and knowledges from and for which they were previously given meaning and used (c.f., Hutchins, 1995; Levy, 2001; 2003; Latour, 1986, p. 17; Säljö, 2000, ch. 6; 2005, p. 52; Van House, 2004, p. 15; and section 3.1.3). Tools will thereby also mediate into new artefacts and activities such constraints and bias: they exert disciplinary power over the ways users reason, think, act, and solve problems; support certain ways of thinking and acting and hide or suppress others as “the choice of representations limit the inferences that make sense” (Hutchins, 1995, p. 82).

This disciplining or ‘cultural hijacking’ (c.f., Säljö, 2005, p. 44) of the human mind by representational artefacts, however, occurs largely unnoticed for several reasons. One is explained in terms of how, when new tools and inscriptions build upon and merge with previous ones, they become increasingly complex, abstract and technologically advanced which makes it exceedingly difficult to ‘see through them’ and grasp how they function and what types of knowledge they are built
upon (Säljö, 2000, pp. 76–82; 2005, ch. 6, pp. 189–90). Other reasons have to do with similar processes although of a sort that is not necessarily embodied in physical-material technological artefacts. In professional and similar communities, the construction of locally shared meanings of representations that are not readily apparent or available to outsiders constitute examples of such processes sometimes described in terms of a complex and gradually acquired professional vision (Goodwin, 1994; c.f. also Säljö, 2005, p. 145). As a result, users have to learn through gradual socialisation what things to ‘see’ and what they ‘mean’. And to the extent that this type of knowledge might often be tacit rather than articulated and externalised, it might not always be a sort of knowledge that the practitioners themselves are well aware of, let alone then able to remain critical towards.

In similar ways and on a social level, black-boxing, or naturalisation, occurs through the formation of interpretative communities; collective agreements on ‘proper’ representational modes and ‘right’ uses and meanings of tools in different practices. Tools and practices thereby become institutionalised (Latour & Woolgar, 1986/1979, pp. 242–243; Säljö, 2005, pp. 56–57; 148) in conformance with canons of representation (Wartofsky, 1979, pp. 180–181). In this way, tools become taken for granted and start to appear natural and true, rather than constructed and cultural (c.f., Bowker & Star, 1999; Latour & Woolgar, 1986/1979, p. 69). Black-boxed inscriptions thus, in Latour and Woolgar’s (1986/1979, p. 259) account, are those that have been rendered distinct from the circumstances of their production; to revisit Campbell (2007), we might also say that they are artefacts that hide their own materiality and constructed nature.

Following these theories, the user of a visualisation tool might be understood as being socialised into ‘knowledges’ concerning what types of data that are ‘important’, what modes of visual representation that are ‘right’, and how they should be interpreted; a socialisation that would make it difficult, not least, to exercise and uphold a critical distance towards the tool.

4.2.2 Mobilisation

Whereas the previous section describes comparatively anonymous social processes in which representational artefacts become perceived as true and objective rather than cultural and constructed, the concept of mobilisation points to how human and organisational actors can also work towards similar effects through intentional acts in order to further their own interests.

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22 This effect can also be the result of more conscious activities by actors (see section 4.2.2).
Latour, particularly in his early writings, looks to high-stake and antagonistic arenas such as the worlds of scientific researchers populated with actors with vested interests who fight to win arguments and dominate certain subjects through the mobilisation of inscriptions (Latour, 1986; Latour & Woolgar, 1986/1979; Sismondo, 2004; Van House, 2004, p. 14). The main aim of these activities is to construct order out of chaos, and produce harder and harder facts (e.g., Latour & Woolgar, 1986/1979, pp. 235–258). For the purposes of mobilisation, Latour mentions nine particularly decisive inscription characteristics: 1) they are mobile (easily transported); 2) they are immutable when they move; 3) they are flat which means they are easy to master; 4) their scales can be modified without changing their meanings or functions; 5) they can be reproduced and spread at little cost; 6) they can be reshuffled and recombined; 7) they can be superimposed to produce structures, patterns, theories, and abstractions; 8) they can be made part of written text (which means that the text is not simply illustrated but effectively carries all there is to see in what it writes about), and; 9) their two-dimensional character allows them to merge with geometry and as a result, we can work on paper with tools, marks and symbols, but still manipulate three-dimensional objects “out there”. Of these, the last two are the most important, with point nine described as the second-degree advantage or surplus-value (Latour, 1986, pp. 21–22).

Mobilisation, firstly, requires the more or less purposeful manipulation (intervention, tinkering, or enclosure) to make inscriptions do what one wants them to do. The construction of inscriptions and facts is not a straightforward, objective, one-outcome process (Latour & Woolgar, 1986/1979, pp. 246–247). Hands-on adjustments are necessary to find exactly the ‘right’ amount of information needed to make desired results visible, such as the technologists’ choices of ‘slice thickness’ in magnetic resonance imaging (MRI) examinations (Joyce, 2005, p. 447). But while selective enclosure makes some patterns visible, it simultaneously hides others, and is costly also in the sense that the results are highly unstable and rarely successful (Latour & Woolgar, 1986/1979, p. 246; Sismondo, 2004; c.f. also Joyce, 2005). By themselves, then, Latour says, inscriptions come at the “cost” of simplifying the unruly nature or social world into smaller and more manageable “items of knowledge” and as they are continuously merged or superimposed, the process escalates into a “cascade of ever simplified inscriptions” (Latour, 1986, p. 17). The longer this chain, the further removed are also the inscriptions from what they are intended to represent – as are the eyes and minds of their readers.

To construct hard facts and persuade others, it is necessary to hide the act of persuasion itself; to make the constructed appear unconstructed. ‘Facticity’ and objectivity is achieved through eradicating traces of inscription construction and
subjectivity, for example through repeated superimpositions (c.f. 4.2.1). In reversing this logic, counter-claims are of course likewise most effective when managing to draw the attention back to these very same aspects (Latour & Woolgar, 1986/1979, pp. 76, 84, 240).

For all these efforts and activities, laboratories are crucial and central power hubs because they contain the *inscription devices*, defined as any item of apparatus able to transform pieces of matter into inscriptions directly usable in an argument (Latour & Woolgar, 1986/1979, p. 51). In a sense, therefore, it is also as much through exclusive rights of access to laboratories or similar localities for inscription devices that, according to Latour, scientists, engineers and politicians hold privileged power positions (Latour, 1986, p. 21; c.f. also Strum & Latour, 1999, p. 29; Sismondo, 2004).

Viewing visualisation tools in the light of the above, it becomes possible to also see them as tools potentially and more intentionally wielded by actors to further their own political and power related interests. It also raises an interesting question concerning what happens in the current transition of data and visualisation tools (understood as inscription devices) from the exclusive control of states, companies and communities of ‘professionals’ into the public realm.

4.2.3 Appropriation

Finally, through certain aspects of the concept of *appropriation* in the sociocultural perspective and an outlook to the somewhat related concept of *affordances*, focus is also more directly placed on aspects of shared agency and co-construction of meaning in situated human-tool interactions.

In the sociocultural perspective, appropriation describes the process of learning to use tools for different practices, to apply and deal with them in relevant ways in different situations (Säljö, 2000, pp. 35–36; 2005, pp. 31, ch. 2, 70ff.). In one sense, this of course relates to the sort of socialisation and black-boxing processes described in section 4.2.1 through which humans may come to take cultural constructions for granted as the only, true and natural ways to depict, understand and act. But these ideas are only one aspect of the larger meaning of appropriation, and here, I place focus on the other aspect in which dynamics, tensions, human-tool co-constructions and situated enactments take precedence. Even under the influence of dominant institutionalised or canonical frameworks, thus, the sociocultural perspective does not hold that ‘meanings’ are static and universal: the relation between humans’ thinking and representational artefacts is instead to be considered dynamic and negotiable.
In the sociocultural perspective, interactions with mediating artefacts also involves an interplay between a fixated meaning and a situated interpretation of it; a combination of stability and flexibility that is a basic requirement in any symbolic system (Säljö, 2005, p. 53). In these situated interactions, the artefacts are not passive but hint, point, guide and suggest in activities where we create meaning and understanding, but are always open for different interpretations (Säljö, 2005, p. 53–55). This dynamic and situated relationship explains why interpretations differ between individuals, times, and contexts.

The origin of similar understandings of situated co-constructions as emphasised here can be traced to the psychologist James J. Gibson’s ecological psychology and his famous twin concepts of affordances and abilities (e.g., Gibson, 1986/1979). To Gibson, affordances are opportunities for actions; they are what the environment “offers the animal, what it provides or furnishes, either for good or for ill”, and they “have to be measured relative to the animal” (Gibson, 1986/1979, pp. 137–139). He uses, for example, the familiar examples of a chair and a mailbox to demonstrate the situated nature of interactions between agents and systems (applicable, then, also to information systems). To a grown person, a chair affords sitting; it is ‘sit-able’, but the relational understanding also emphasises that for an infant, this affordance and sit-ability relation cannot exist. Greeno describes the nature of this relationship as “codefining” and “straightforward”:

An affordance relates attributes of something in the environment to an interactive activity by an agent who has some ability, and an ability relates attributes of an agent to an interactive activity with something in the environment that has some affordance. The relativity of affordances and abilities is fundamental. (Greeno, 1994, p. 338)

To Gibson, moreover, the perception of affordances is culturally shaped; i.e., the affordance of sit-ability is only possible in a culture where a chair would be recognised as a tool for sitting. In my uses of the concept of affordance, thus, I refer to Gibson’s original writings and my uses of it should not be confused with the way it has been transformed and given completely different meanings by researchers of usability and human-computer interaction (HCI), as either merely technical or merely perceptual properties. It can also be noted that this is a shift that many within the HCI and usability fields seem to consider to have been detrimental to research and development and there was not least in the 1990’s and 2000’s a rather heated public discussion (c.f. e.g., Torenvliet, 2003) and the earlier apologetic article in 1999 by Donald A. Norman, the supposedly responsible person for these ‘new’ connotations of affordance.
In the concluding section of this chapter, I demonstrate how I use the theoretical framework presented here to operationalise the research aim.

4.3 CONCLUSIONS: RESEARCH QUESTIONS AND ANALYTICAL TOOL

The previously presented critical literacy definitions in chapter 3 describe a research topic and field that this study intends to contribute to, but from the ethnographically and sociologically inspired focus here, these definitions are, in part, too abstract and owe too much to dualistic conceptions of human-tool relations. They range from prescribing that users a) assume a distanced intellectual position towards values, ideologies and epistemologies imbued in and mediated by representational artefacts (documents), to b) ask more concrete (information) political questions concerning who has the means and skills to access, produce and interpret (and who has not) and how and with what consequences they exercise those powers, to c) become more actively involved and empowered through renegotiating existing documents or even producing completely new and alternative ones in line with individual and local interests. More or less explicitly, thus, they imply that ‘critical literacy’ connotes some sort of ‘end-point’, ‘information recipient’ response to other sorts of ‘creation-point’ macro or micro level constraints and bias induced in, conveyed by or otherwise affecting the form and content of representational artefacts – or the ability to reverse, but only to yet again reproduce, this hierarchical sender-receiver relationship. In other words, they are based on the here previously critiqued conduit or transmission understanding of information as an independent entity that is packaged ‘in’ documents and travels unaffected between ‘senders’ and ‘receivers’.

The previously described shift of emphasis in this study towards a focus on situated and locally enacted “critical literacies” in the plural means, in comparison, two particularly important things: firstly, that I look for the participants’ own meanings and enactments of ‘critical literacies’, here defined as critically informed and locally justified approaches to or uses of the tools, and secondly, that I understand critical literacies and social visualisation tools as mutually shaping. That is to say, critical literacies are from this view not seen as end-point responses but as ongoing constructions of both tools and activities which makes it impossible to draw a line between the visualisation tools and the study participants’ critical literacies. Nonetheless, it is probably more than likely that the sort of sender-receiver relationships described in prior critical literacy definitions will in different ways be reflected in the study participants’ own enacted critical literacies, simply because these
definitions are, of course, in line with dominant and institutionalised understandings of critical literacy in our culture.

My overarching aim to analyse the mutual enactments of critical literacies and social visualisation tools as information resources can now be operationalised through three more specific research questions. I make an analytical point here of dividing up what are in fact overlapping and tightly intertwined aspects of the central concepts in the sociocultural and S&TS traditions that I have presented in the theoretical framework. I make this choice in order to adapt and elaborate on the existing critical literacy definitions from the point of view of these theories and metatheoretical views. This is mainly accomplished through the focus presented in the two first questions which essentially present theoretical reformulations of prior critical literacy definitions with the addition of the here applied situated perspective on literacies in the plural. The aspects covered through these two questions, however, are not by themselves capable to include certain additional and crucial aspects of human-tool interaction central to in particular the sociocultural perspective. For this reason, I also present a third question which addresses such aspects not similarly acknowledged in previous definitions. The questions are formulated as:

— **In what ways do the participants approach and use the tools as cultural and material artefacts?**

— **In what ways do the participants approach and use the tools as mediators of political interests and power relations?**

— **What other critical approaches and uses emerge in the interactions between the participants and the tools?**

Through the first question, ‘**In what ways do the participants approach and use the tools as cultural and material artefacts?**’, I primarily relate to theories on externalisation and nearby concepts. To look for critical literacies through this theoretical focus means that I look for the participants’ enactments of the tools as constructed and cultural, rather than taking them for granted and treating them as true, objective, unbiased and unproblematic. In a different way, the question can also be said to direct attention to whatever aspects and meanings of materiality (in a broad sense) that the participants can be seen to enact. More specifically, focus is here directed both towards more concrete issues such as mistakes and financial constraints perceived to affect the tools, as well as towards identifications of more abstract bias and constraints such as actor interests and ideologies. This focus adapts and elaborates on concerns expressed in critical literacy definitions that propagate
users’ (intellectual) distanced positioning in relation to documents to ‘read against’ and ‘see through’ artifice and bias, as adapted through the theoretical framework here. Potential aspects of critical literacies made visible through this focus would, in a sense, also place those critical literacies enactments in resonance with Hutchins’ ‘unmasking’ constructionism, which finds critical value in revealing hidden constructions and false objectivity.

The second question, ‘In what ways do the participants approach and use the tools as mediators of political interests and power relations?’ connects in particular with the theories on inscriptions and mobilisation. From these theoretical views, the analysis of critical literacies actually addresses two sides of the same coin. Firstly, the question directs attention to ways in which the participants ascribe more specific meanings to the tools as used by other actors to further their political and power related interests. This focus thereby adapts and elaborates on critical literacy definitions with similar distanced, unmasking recommendations as in the prior research question, although based in more of an information political and power interest in questions concerning who has the means and skills to produce and use documents as well as how, why and with what consequences they exercise those capabilities.

Importantly, though, the theoretical perspectives applied here means that the focus of this analysis does not make claims to reveal any actual actor intent – what I analyse is instead the aspects and meanings of politics, interests, and power relations that the study participants in various ways ascribe to the tools. And secondly, the focus of this question also draws to attention the potential ways in which the participants themselves actively engage with the tools to make them serve their own interests and values. Although mirroring the first focus, then, this latter ‘turn’ also points to a reversal of agency in a crucial way to relate with the definitions of critical literacy that propagate individuals’ empowerment by actively challenging, changing or replacing the (perceived) institutionalised and hegemonic norms, values and interests mediated through various documents.

The third question, finally, ‘What other critical approaches and uses emerge in the interactions between the participants and the tools?’; is intended to connect with those aspects of the sociocultural perspective on tool-mediation that the two first (and prior critical literacy definitions-based) questions could not incorporate, namely situated enactments in which meanings are co-constructed in human-tool interactions; appropriations. Even though this question does not directly have a counterpart in previous critical literacy definitions, the central ideas are in many ways recognisable in the emerging traditions of new literacy studies (NLS; c.f. section 3.3.2) and draws attention to how humans not merely passively ‘absorb’, accept and reproduce what the norm says about uses and interpretations, but that
they also engage in continuous dynamic reinterpretation and reshaping. In these actions, I have chosen to place focus on how local contexts/practices and various affordances of the visualisation tools contribute to enactments of meaning. Through this focus, this last question is intended, thus, to present a more complete sociocultural elaboration of how critical literacies can be understood and analysed, and to broaden the theoretical repertoire through which the empirical material can be analysed for critical approaches to and uses of the tools as information resources.

These three research questions thereby represent three different analytical entry points and foci from which the same collection of empirical material is analysed. Accordingly, the results emanating from each question are presented in one primary analysis chapter each (chapters 6, 7 and 8 respectively). And as mentioned, these findings are also in conclusion brought together in the ninth and final chapter in which the overall research aim is discussed. Before the presentation of analyses in Part III of the dissertation, however, the cases and methods chosen for producing and analysing empirical data are presented in the following chapter.
5

METHODS AND MATERIAL

In this study I apply a combination of methods intended to produce data in cooperation with the study participants. The basic approach is ethnographic, which means that I strive to stay as close as possible to situated user-tool interactions and related local meanings of these activities (c.f., Bishop, Van House, & Buttenfield, 2003, p. 6; Brewer, 2000, p. 10). The critical elements in the research aim and theoretical approach, however, also mean that I fluctuate between closeness and distance and assume a more active role in my interaction with the study participants than a traditional naturalistic study might imply. The combination is reminiscent of what has been described as a critical ethnography approach (Alvesson & Sköldberg, 1994, p. 215).

The methods used are interviews and observations, and, in an area of overlap between the two, an approach inspired by contextual inquiry (Beyer & Holtzblatt, 1998; Holtzblatt & Beyer, 2011). In this chapter, I first introduce the two cases under study and why and how they were chosen and set up. After this, I continue to describe in more detail the data production methods and the practicalities of central steps involved in these processes. In the concluding section, I present an example of application of the theoretical framework for data analysis.
5.1 **THE TWO CASES**

In the first section of this chapter, 5.1, I describe the processes of selecting and setting up the two case studies, followed by more detailed accounts of the tools, participants and settings in each case, and conclude with a brief comment on ethical considerations pertaining to the studies.

5.1.1 **Selecting Cases**

While I definitely saw a worthwhile objective for LIS research to investigate ways in which users critically approach and use such fairly novel types of information resources as visualisation tools, which differ in so many respects from the sort of information resources assumed in information and critical literacy definitions, it was difficult to imagine what might come of such a study and therefore what would be best to focus on, empirically. Because I was unable to find previous research comprising both critical literacies and visualisation tools, a comparatively open and exploratory approach appeared most appropriate.

From the related research that I came across, however (see primarily section 1.2), two aspects stood out as particularly interesting: 1) whenever social data (data on human beings and their doings) are involved, researchers appeared to express many more concerns and worries about the tools’ meanings, uses, and consequences; and 2) in lack of equivalents to authors and written text/propositional statements (i.e., prior, accompanying interpretations), the structuring devices in visualisation tools seemed practically all-dominant and equivalent with the names, meanings and uses of the tools. Both of these aspects were deemed significant to consider in this study with specific interest in critical literacies, and so I decided to focus on two social visualisation tools with different (primary) structuring devices. I also wanted the tools and the cases to be as public as possible, to avoid complications related to private business market competition and company secrecy.

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23 In the types of visualisation tools that I study here, there are usually more than one structuring device at work, but as a rule, one of these is made to dominate the tool to the extent previously described, i.e., made to determine the name and main meanings and uses of the tool as, e.g., a geographic information system used for geospatial analyses even though the tool might contain and visualise other data variables as well, not least, of course, temporal indicators.
As a result, the following decisions became more straightforward. Given everything else that seemed new with my study, it seemed logical to include a tool based on the unquestionably dominant structuring device today: geographical representation (geographic information systems; GIS). For the public character, a state or municipal case would obviously make a good candidate, and for the sake of convenience and budget, the choice finally landed on the city of Gothenburg: my own hometown and also, incidentally, at the time described as one of the leading GIS using cities in Europe. Through a series of subsequent choices, Case 1, hereafter referred to as Geo, came to centre on Gothenburg city’s Traffic and Public Transport Authority, an agency with responsibility among other things for improving traffic and transport infrastructure and conditions, and reduce the number of accidents, wounded, and killed in city traffic. The visualisation tool used in this work is the proprietary system MapInfo (see below). Included in this Geo case are also employees from a couple of other departments and organisations involved in related work and connected to the same or similar visualisations in MapInfo.

Once I had selected the Geo case and learnt more about the case setting, the tool, and the practices in which it was involved, I went on to a more focused search for a complementary case with a tool based on a different structuring device. Next to “place”, “time” is also a common structuring device in visualisation tools, but it was difficult to find anything more than sporadic and amateur uses of visualisation tools of other types than GIS. After some time, however, I learned about a tool in which temporal indicators were used as structuring devices for visual representations of changes in large data sets. The tool and its uses fulfilled my selection criteria concerning social data, public character, and a primary structuring device other than geographic/map based. This meant that Case 2, hereafter referred to as Trends, came to centre on the Stockholm based Gapminder foundation and their freely available visualisation tool Trendalyzer. Since the foundation itself has few employees, this case as well was extended to include additional tool users from two external and free-standing organisations. In the contexts of these settings, the Trendalyzer tool is mainly used for analysing and spreading knowledge about the state and development of the countries of the world in areas such as health, life expectancy, education and economy.

5.1.2 Setting up the Cases

Access to each data setting (case) was initiated by sending e-mails to the main responsible person for each system (see Appendices A and B). In the Geo case, this first contact led to an introductory meeting with the head of Gothenburg city’s IT
department at which time I was given a thorough introduction to the MapInfo system, its technological characteristics, the structure of the city’s organisation, and the many different work tasks in which MapInfo with sub-systems was used. I also received a list of suggestions of city departments deemed interesting – and possible24 – for me to study. After the meeting I reviewed the list and read the publicly available information online about the departments but still found it difficult to attempt to evaluate likely research outcomes for different choices. Instead, I decided to select between a) one big department with many possible different uses of MapInfo, or b) a more specific area/topic for which different city departments as well as sub-contractors and external free-standing organisations came together in exchange and cooperation around similar data and MapInfo uses. As the theories used here describe that tools cannot be separated from use-practices, I decided on the ‘b’ option in order to keep focus on as similar practices as possible, and the Traffic and Public Transport Authority in Gothenburg city seemed to correspond well with all the criteria and objectives described here. This first contact and case study decision was then followed up by another e-mail contact, telephone conversation and informal information and presentation meeting with the IT and MapInfo manager at the Traffic and Public Transport Authority, from whom I received another list of possible candidates in-house as well as in other departments, contractors and companies for my subsequent field visits, observations and interviews.

In the second case, Trends, centred on the Gapminder foundation, the process of gaining access and setting up the case was the same as in Geo, with the exception that the first lengthy informal discussion concerning my research interests and needs and their ability to respond to these occurred over the telephone. I then received the same help as in the first case in being granted access and participation by the main responsible person. The major difference here was that the system was both developed and used by a very small group of people so I did not have to choose between several possible settings, uses or study participants; the three people working at the Gapminder foundation also worked with Trendalyzer and all agreed to participate in the study. I did however receive suggestions of external users of the specific Trendalyzer tool, located at two other organisations (see below). The manner of establishing contact with tool users at these locations was essentially the same as previously in my contacts with the Traffic and Public Transport Authority and Gapminder.

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24 Some of the city’s departments were impractical or inaccessible due to high security protection policies that would have severely restricted empirical access and written report.
The processes of gaining access to the empirical and distributed case sites thus from start to finish continually followed this snowball routine of e-mail and telephone contact, followed by informal meetings and discussions. At the end of each contact, I had received subsequent recommendations for additional suitable sites and study participants and I was able to proceed and establish personal contact with each potential study participant. The process was much simplified because of the help I got from my initial contacts to guarantee overall cooperation, grant me access, and inform and prepare potential study participants in advance of my upcoming contacts.

At the close of this whole process I was able to include eleven study participants: six persons distributed across five sites in Geo, and five persons from three sites in Trends. No person that I contacted declined participation in the study, but a planned twelfth study participant (in Geo) became unavailable for a prolonged time period and eventually had to be passed over due to time constraints.

Whereas the setting up of the case studies extended over a long period of time, the more focused data production parts of the case studies — the interviews, observations and contextual inquiries (see below) — were carried out between June and August of 2007 for Geo and between July and September of that same year for Trends (c.f. also Appendix E).

5.1.3 Case 1: Geo

The first case, Geo, is situated at the Traffic and Public Transport Authority (Trafikkontoret) in Gothenburg, Sweden, a city of some 550,000 inhabitants. Maps, whether in analogue or digital forms, have been central for analysing, planning and deciding on maintenance and security in the city for a very long time but nowadays central operations are conducted through specific GIS technology in the form of the proprietary MapInfo from ESRI (the Environmental Systems Research Institute, Inc.). At the time of the case study, Gothenburg city was described as one of the leading GIS using cities in Europe, with a centralised GIS system extending to practically every city department, company and authority, as well as in minor extents to citizens and area businesses. Gothenburg city’s MapInfo system is built around an extensive relational database, with a variety of associated tools and applications and virtually all city data are meant to go into the database, from which everything should be transferable to all other programs. At the time of the case study, in 2007, Gothenburg city had about 800 MapInfo users within the firewalls, and it was used for a variety of purposes, from planning for critical water levels in
the city, to finding out who is the responsible agency or department when a tree has fallen somewhere and for scheduling the emptying of public trash cans.

The Traffic and Public Transport Authority (TPTA) at the centre of the Geo case is a contracting agency, which means that it is small and mostly concentrates on planning and strategies in various forms. It was therefore necessary to include participants from sub-contracting city companies, central city service departments with which the agency had contacts, as well as an external private firm, as employees in these are routinely involved in identifying, analysing, planning for, performing, and otherwise working with many of the traffic security enhancing and infrastructure maintenance measures central to the Traffic and Public Transport Authority’s work with MapInfo. Below, I briefly present the study participants (two men and four women) included in the Geo case; their main relations to the MapInfo tool as administrator, developer, and/or user (bracketed terms indicate comparatively infrequent/shallow relations); and their experience with working with the tool.

— Administrator, Developer, (User). IT and MapInfo manager at the TPTA. Mainly works with MapInfo to develop and administer the tool for the organisation’s work tasks. Also works with producing, requesting and processing data sets for the system. Performs, to a minor extent, analyses of data for traffic enhancement measures and similar tasks. Has worked with GIS systems, MapInfo, and traffic related work tasks for more than twenty years.

— Developer, Administrator, User. IT and MapInfo manager at a sub-contracting city company that develops GIS solutions and makes GIS-based analyses but also performs traffic enhancement measures on the basis thereof or on commission from the TPTA and other sites. Has worked several years with MapInfo and related work tasks, and with GIS systems in general for fifteen years.

— User. Traffic security coordinator at TPTA. Works with MapInfo (and some other systems) for strategic analyses of data on traffic accidents for improvement of traffic security. Has worked with MapInfo and these work tasks for two years.

— User. Chief of unit at customer service for TPTA and one other city department. The unit has main responsibility for handling the communication between the citizens of Gothenburg and these two city departments. Citizens can, for example, phone in and inform or complain about things that are broken or malfunctioning, such as holes in the
street, broken lights and run-down street signs or to ask questions about traffic, parking and the like. Has worked with these tasks and MapInfo for one year.

— User. Head of communications at the TPTA with main responsibility for both external and internal information issues, such as sending information to the media and publishing information – both map based and in other forms – for the public on the city’s website. Has worked with this for eight years.

— User. Consultant and project manager for a traffic analysis group at a private technical consultancy company. Performs GIS and MapInfo analyses of traffic data on specific assignments from the TPTA. These assignments are a longstanding arrangement between TPTA and this company and they cover both minor analyses and large projects. The participant has worked with these tasks for six years, and has over twenty years of general experience with GIS systems.

The relationships between these study participants, their organisational belongings, and their relations to the MapInfo tool are also schematically illustrated in a figure in Appendix C.

Two representative examples of MapInfo visualisations used in the various Geo sites are provided below in Figures 5.1 and 5.2. The images show visualisations of traffic accident data between 2000 and 2007 for the same area in Gothenburg (a major intersection) in both the so-called ‘base-map mode’ (Figure 5.1) and with an orthographic photo overlay (Figure 5.2). The base-map mode illustrated by Figure 5.1 is highly stylised, merely depicting basic geographical features and infrastructural elements such as built areas, open/park areas, water ways, roads, major buildings and blocks of houses. The data points are colour coded and symbolically shaped with associated legends incorporated in the left lower corner of both images. The colours and shapes indicate the severity of the injury (yellow = light injury; red = severe injury; and black = fatal); whether the data comes from a police report or not; and if the accident involved vehicles and other persons or not. It is also possible to click on singular dots to open up scanned police and hospital reports from which the data on geographical location, type of accident and injury, and type of vehicle have been collected and input.
Figure 5.1. MapInfo visualisation (screen shot). An example of visualisation of data on traffic accidents in Gothenburg city between 2000 and 2007 in base-map mode.

On top of this basic map, it is possible for users to add or remove layer after layer of visually represented data; what the participants call “switching on” or “off” or “lighting up” or “down” layers and objects. It is possible to perform searches “on the side” of the MapInfo application, to, for example, work with and analyse the underlying data in other applications like Excel. And as illustrated in Figure 5.2 below, an overlay of an orthographic photo (an aerial photo that has been adjusted to scale) of the area can be added on top of the base map. This still allows for a highly detailed zooming in on the area from above, with representations of data and other objects also still visible in layers on top of this imagery.
Figure 5.2. MapInfo visualisation (screen shot). An example of visualisation of data on traffic accidents in Gothenburg city between 2000 and 2007 with an orthographic photo overlay.

The data that are selected, input, and analysed as MapInfo visualisations in the Geo case were, at the time of the study, primarily collected from the reports routinely produced by the police at or after an accident and by hospitals as part of care-giving and administrative routines. From the rather extensive information potential provided by these forms, only some data were selected and input in MapInfo for the Geo uses studied here.

5.1.4 Case 2: Trends

The second case is centred on the Swedish Stockholm based Gapminder foundation, an organisation formed out of a previous cooperation between a small group of people working on the development of a visualisation tool called Trendalyzer and their funding partners Sida (Swedish International Development Cooperation Agency), UNDP (United Nations Development Program), and the Division of Global Health at the Swedish Medical University Karolinska Institutet (IHCAR). Trendalyzer is a program for dynamic visualisation of nation-level social data focussing
on the development over time for various indicators such as health and economy in the countries of the world. The tool visualises a comparatively high number of data points and variables through a combination of colours, sizes, movements and exchangeable values for the X and Y axes.

The originator of Trendalyzer is Hans Rosling, professor of global health at Karolinska Institutet. From his ideas the Trendalyzer application was developed and shortly after, in 2007 and just months before my first contacts with and visits to Gapminder, Trendalyzer was acquired by Google, Inc. Today, Google continues the development of the program\textsuperscript{25}, and the Gapminder foundation continues to work with Trendalyzer as analytical tool and information and pedagogic resource.

The foundation has two main goals, as publicly stated. The first is about making the world’s data fun, interesting and available to everyone. For this goal, they use Trendalyzer to produce stand-alone visualisations of specific data sets like the “Gapminder world” (Gapminder, n.d.) presented in Figure 5.3 below, and which is freely available online. They also use Trendalyzer visualisations in lectures and presentations on world development in various areas, either performed live or as freely available videos online (so called Gapcasts). The other goal is to work for public availability of data resources held by nations, institutions and organisations – work which is also to a certain extent connected to the Trendalyzer tool as will be shown in the data analyses.

At the time of the study, the Gapminder foundation consisted of no more than three employees (and only two on full time), who all agreed to participate in the study. To extend the number of participants in this case as well, I received suggestions of a couple of additional users of Trendalyzer at external organisations, and so there came to be five participants (two women and three men) in Trends: three from the Gapminder foundation and two from the external and free-standing organisations Sida and UNDP:

\begin{itemize}
\item User, Developer, (Administrator). Many years’ work with Trendalyzer. Employee at Gapminder since four months with main responsibility for producing and presenting visualisations. Also involved in development of the tool and to minor extents in data collection and preparation. Previously worked with the Gapminder foundation for two years on a sort of freelance basis using Trendalyzer as a tool for presentations, preceded by two additional years of cooperation with Gapminder and work with
\end{itemize}

\textsuperscript{25} As Google’s “Motion Chart”, see Google (n.d.).
the tool during employment as UNDP officer (see description of participant 2 below).

— User. Worked with the tool for little over a year. Employee at UNDP’s (the United Nations Development Programme) Stockholm based sub-office whose many missions include informing at all levels and sectors of society about the UN’s Millennium Development Goals (c.f. section 6.2.1); maintaining good contacts between the UN, the Swedish government and other relevant organisations; and mobilising resources for continued development work. Uses only a couple of set and ready Trendalyzer visualisations in lectures and presentations relating to the office’s goals (i.e., does not input and analyse data by him/herself).

— User, (Developer). Many years’ work with the tool. Employee at Sida, the Swedish International Development Cooperation Agency; a government organisation under the Swedish Foreign Ministry that administers about half of Sweden’s budget for development aid (Sida, n.d.). Uses the tool to plan, perform, and follow up on Sida’s activities on national and regional levels. Has also been involved as advisor in the early development of Trendalyzer as Sida was one of the primary funders for the development of the tool.

— Administrator, (Developer, User). One year’s work with the tool. Employee at the Gapminder foundation for mainly administrative and maintenance related tool tasks concerning collection and preparation of data sets and the creation of visualisations on the basis of these data. To a lesser extent involved in tool development and sometimes also a user of the tool for presenting and lecturing on the visualisations.

— User, Developer, (Administrator). Many years’ work with the tool; continuously involved in its development and a frequent user for analyses of data sets and presentations of visualisations. To a lesser extent involved in more routine current administration and maintenance of the tool and data sets.

As for the Geo case, the relationships between these study participants, their organisational belongings, and their relations to the Trendalyzer tool are schematically illustrated in a figure in Appendix D.

In Trendalyzer visualisations, an unusually high number of variables can be displayed simultaneously, as demonstrated in Figure 5.3 below. The image shows a frozen screen shot from a dynamic visualisation with predefined data and sets of variables called Gapminder World. In one “go”, the Gapminder World visualisation
can show a) two indicators (one on each of the X and Y axes, as here: life expectancy and income per person); b) the countries of the world indicated by the bubbles; c) the population size of the countries indicated by the size of bubbles; d) the regions of the world that the countries belong to indicated by the colour of the bubbles; and e) the development over time for the selected variables.

In traditional diagrams, a time axis of some sort is usually employed to visualise changing values over time through a static representation, but in Trendalyzer, change over time is principally represented by movement. Three different animation features represent change over time in ways that are not easily reproduced in this print publication, but described in words, they take place through: 1) the movement of the bubbles; 2) the ticking of years in the background; and 3) by the gliding progression of a marker on a time bar below the main ‘bubble chart’. Since they are different representations of the same temporal aspect they are of course synchronised with each other.

*Figure 5.3.* Trendalyzer visualisation (screen shot). An example of visualisation of data on the development of, and relations between, income per person and life expectancy from 1800 to 2006 for the countries of the world in Gapminder World (Gapminder, n.d.).
Each bubble in the Gapminder World visualisation can be clicked (or simply hovered by the mouse indicator) for more detailed information about the name of the country, its size and population. In some visualisations, clicking a country can also split the bubble into smaller bubbles so that different regions in that country also become visualised and placed along the various indicators on each axis. As a result, differences in income, health and education between regions within one country are made visible. As in the Geo case, it is possible to “light up” or “down” certain indicators at will, so that, e.g., no indication of population size is represented (all bubbles are then represented with equal size), or so that only Asian countries are selected to appear in the visualisation. The indicators on each axis (e.g., income per capita, primary education, or number of computer and Internet users) can be changed by selecting among extensive options in accompanying lists. It is also possible to “put a trace” on a specific country so that a dotted line remains for analysis after a time series has been played, as illustrated by Figure 5.4 below.

![Trendalyzer visualisation](image)

**Figure 5.4.** Trendalyzer visualisation (screen shot). An example of visualisation of data on the development of, and relations between, income per person and life expectancy from 1800 to 2006 for the countries of the world with a specific “trace” on Sweden in Gapminder World (Gapminder, n.d.).

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The sets of global, longitudinal (long, replicated, time series) data used for Trendalyzer animations are difficult to get hold of and, at the time, predominantly retrieved from Pennsylvania University’s Penn World Table (c.f., Heston, Summers, & Aten, 2006), the World Bank and some other places. The accessibility of data sets of this type varies, with Pennsylvania University providing their datasets for free, whereas the World Bank upholds proprietary interests and charge for access to, and use of, their data. These large data sets are themselves the results of a combination of data sets from numerous other sources. In Penn World Table, e.g., some of the data have been collected from the World Bank Development Indicators and the United Nations Development Centre, but also from national accounts, and the World Bank relies on so many data sources for their compilation that a list of selected data contributors specifically names 33 partners for their 2008 publication (the World Bank, 2008, p. xii).

5.1.5 Ethical Considerations

None of the cases or individual study participants requested or required the establishment of formal legal research contracts for ethics or access. The general guidelines for research ethics in the arts, humanities and social sciences as laid forth by the Swedish Research Council (Vetenskapsrådet, 1990)\(^{26}\) thus sufficed to set the parameters for the study. The four main requirements of information, informed consent, confidentiality, and right of use, along with additional recommendations were used to formalise a standard document that informed each participant about necessary conditions. The document stated my name and institutional affiliation, information about who is funding the research; contact information; purpose of the study; the participants’ roles in the project; and what conditions apply to their participation. The participants were also offered the possibility to read and review interview transcripts, but only to correct apparent misinterpretations or indicate sensitive information. They were also offered copies of subsequent publications (see Appendix F: Consent Form).

The cases chosen, however, are small with few participants and easily recognizable because of the specific characteristics of the tools and data that they use. This means that I am not able to assure complete anonymity on an individual level. All data, however, are kept strictly confidential, and in written report I strive to maintain

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\(^{26}\) There have, of course, been more recent versions of ethical guidelines from the Swedish Research Council since 1990, but this version was the current one at the time of the preparation of the study.
as high degrees of individual anonymity as possible. All personal information and details have been marked in the transcripts and presented in writing in such a way that it should not be possible to identify individuals on the basis of empirical quotes, at least not by outsiders, but ideally not by their colleagues either. On the most basic level, this means that all instances of personal and similar names or markers have been excluded to the greatest extent possible. In addition, I have chosen not to refer to individual transcript IDs (c.f., Appendix E) when citing the participants, in order to minimise the possibility that several quotes attributable to one and the same ID might aggregate into an identification of the individual. I use instead a successive, running numbering system for quotes from each case included in the text (as: Geo, 1; Trends, 1; Trends, 2), and keep an unpublished list in which each uniquely numbered and case-associated quote is linked to the proper transcript ID and corresponding line numbers.

5.2 DATA PRODUCTION

In this section, the focused critical ethnography inspired methodology and the observation, interview, and contextual inquiry methods chosen for data production are described. Commonly, the more focused empirical parts of research are talked about in terms of ‘data collection’ but in consistence with the study’s constructionist epistemology and to underline the situated researcher-participant collaborative character of the methods applied and data generated thereby I choose instead to speak in terms of ‘data production’. For the same reasons, I choose the term ‘study participant’ rather than ‘study object’ and similar labels.

5.2.1 Focused Critical Ethnography

For ethnographically inspired studies such as this one it is a problem when research localities are geographically and organisationally scattered – as is also the case here. However, contemporary changes in work practices and organisational structures, as well as general cut-downs in research funding (restricting the time spent in the field) have also brought about adaptations of ethnographic methods. Knoblauch (2005), for example, presents a “focused ethnography” framework, and Wulff (2002) introduces a similar “yo-yo fieldwork” approach. These adjusted methods are characterised by relatively short-term field visits, compensated for by more extensive and intensive data production strategies and analyses than traditionally prescribed. I have followed general recommendations in these to compensate for the
relatively short time spent “on sites” in each case, and adapted my studies by using a combination of methods that all generate comparatively rich data. The methods applied are observations (including studies of documents and technology), interviews and contextual inquiry (see below). The observations were used for my own background understanding of the tools and contexts under study (see further below) and not subjected to theoretically guided analyses with direct bearing on research questions and aim.

Once on site, the researcher’s relationship to the setting can be of two types, according to Lofland and Lofland (1984, pp. 15–17). The first; to problematise, ask questions, and apply critical or defamiliarising perspectives requires a certain distance. The second; to understand, answer questions, and make sense, requires closeness. For the research aim and questions pursued here, I came to strive for a combination of, and fluctuation between, both stances. This methodological strategy lies close to what has been called abduction (Alvesson & Sköldberg, 1994), and refers to the researcher’s repeated oscillating movements between empirical groundedness and the theoretical apparatus. From this perspective, the comparatively short ‘field visits’ may actually have supported the analytical distance between me as a researcher and the study participants and their activities (c.f., Fangen, 2005, p. 119).

This overall focused critical ethnography inspired methodology came to mean at least two particularly important things for data production and analysis. Firstly, that I strive for a first person perspective on the participants’ activities. In their interactions with the tools, it is not interesting to look for “right” or “wrong” ways to act, i.e., to ask if they are ‘critically literate’ or not according to some predefined checklist, but to look for the specific logic, rationale or meaning that – from the participants’ own perspectives – might explain what critical literacies mean to them in their interactions with the tools, and help us understand their own understandings. Secondly, it also means that I add a critical distance or lens on these activities and local meanings through the theoretically informed research questions and subsequent analysis which, to a considerable extent, delimit what aspects of participant-tool interactions that are deemed interesting to look for, and why. With the help of the analytical framework, then, the analysis also attempts to explain the participants’ critical literacies in the light of these more elaborate theories and concepts.

The critically ethnography approach, in other words, makes it possible to discuss the local meanings of critical literacies enacted by the study participants in terms of their consistencies with or departures from supposedly critically relevant aspects of human-tool interaction in general as described by the theories on tools and inscriptions. On an aggregated level, this will also enable the theoretically informed discussion of research results in relation to the overall research aim
concerning the mutual enactments of the participants’ critical literacies and the visualisation tools as information resources, presented in the ninth and final chapter.

Before this, however, the following sections of this chapter present the specifics surrounding each data production method, the preparation of the empirical material, and the application of the analytical tool for data analysis.

5.2.2 Observations

In a general ethnographic fieldwork sense one might say that the whole range of site visits, informal meetings, and technology and document studies has provided important information for my understanding of the settings, the visualisation tools and (some of) the work tasks for which these tools were used. This information made possible the background descriptions of each case (sections 5.1.3 and 5.1.4), and has also supported my contextualisation, analysis and presentation of empirical data more generally. These sorts of observations were important, in other words, because a first requirement even for a critical ethnography inspired study is of course to be able to describe and understand the units of analysis “in context” – most importantly how, when and why the tools and participants interact in the different sites. To achieve this sort of understanding I relied, thus, on informal observations involving also meetings and casual conversations along with studies of the visualisation tools themselves and various documents describing the tools’ technology and functions in general.

Since the study participants were spread out over so many different organisations, the process of setting up the case studies was very time consuming. One benefit, at least, was that the approximately 50–60 hours spent on first and follow-up contacts, meetings, conversations, demonstrations, and visits also represent occasions of such informal observations during which I took extensive notes. I alternated between making notes while observing and writing down notes from memory afterwards, depending on whether I deemed that simultaneous note-taking might in some ways be a hinder or not (c.f., Lofland & Lofland, 1984, pp. 63–64). These notes, however, since not agreed upon with the participants beforehand, has only been used for my own recollections of tool and site specifics and for background description of the cases here. Site visits, meetings, conversations and notes of this type were fairly similar in extent and scope between the cases, but my own access to and studies of the visualisation tools and documents pertaining to them were very different.

In the Trends case, I was given access to extensive parts of the documented history of the development of the Trendalyzer visualisation tool and the forming of
the Gapminder foundation. It comprised most of the organisation’s documents created and collected over a period of seven years, collected in seven binders, with hundreds of pages in each. The material comprised project and budget reports, funding and patent applications, e-mail correspondence, newspaper clips and articles, research reports, conference proceedings, software plans and tests, evaluations et cetera. The documents can be divided into six rough categories dealing with the following topics: 1) design of application interface (graphic/dynamic representations); 2) technical aspects (of software, program, code); 3) data access and management; 4) policy, aims and goals (for both Trendalyzer and the Gapminder foundation); 5) organisational form, structure and history; and 6) environmental scanning/research. Furthermore, many Trendalyzer visualisations, including Gapminder World, were freely available on the Internet throughout the entire research project.

In the Geo case there was unfortunately, but understandably, no available equivalent to the above described Trends documentation since they use a set and ready commercial application of external origin. I was, however, able to access and study somewhat similar documents available on official websites that describe, e.g., the organisation, aim, and work tasks for the different departments and organisations included in the case, as well as certain texts and reports concerning the MapInfo visualisation tool available via the tool owner, ESRI. ESRI’s documentation for the MapInfo application includes somewhat similar technology and design descriptions as well as company history and aims, press coverage, conference proceedings and the like (c.f., ESRI, 2012) as found in the Trends case documentation. However, since ESRI is not part of my Geo case localities, the documents are still empirically different and not possible to include in the analysis as ethnographic artefacts. Another difference compared to the Trends case is that I did not have access to the MapInfo tool and visualisations used by the study participants outside the case sites; merely to a small number of much simplified visualisations of traffic accidents and the like that were publicly available on the Internet.

5.2.3 Interviews

In total, eleven semi-structured interviews (six in Geo, and five in Trends) were performed (for participant descriptions, see sections 5.1.3 and 5.1.4 and appendices C and D). These interviews are best described as “guided conversations” (Lofland & Lofland, 1984, p. 59), allowing for a large amount of flexibility and opportunities for the participants to speak freely in their own words about the set of issues and concerns that I was interested in. In developing the interview guide (Appendix
G) I followed recommendations from Lofland & Lofland (1984) on data logging and preparation of the interview instrument, as well as Kvale’s more general recommendations (Kvale, 1996, pp. 83–159). It meant that I began by writing down questions in relation to my main area of interest (“puzzlement”) based on my common-sense understanding of the research problem. During an extended time period of case site visits and meetings, the guide was continuously re-worked and adjusted as new questions and angles came to appear. After a period of such fluctuation in each case, the questions were sorted and structured in roughly ordered sections. During the whole time of preparing for and conducting the interviews, though, the interview guide was treated as a flexible instrument, adjusted and adapted to my own learning process as well as to the characteristics of each case and participant in a cumulative, rather than symmetrical, fashion (c.f., Kvale, 1996, p. 100, “getting wiser”).

My prime “puzzlement” in this sense of course concerns the research aim to analyse the mutual enactments of critical literacies and social visualisation tools as information resources. But as an overall aim, this is (at least) one step removed from empirical data and primary analyses which is why it was operationalised through three more specific research questions concerning in what ways the participants approach and use the tools as cultural and material artefacts; as mediators of politics and power; as well as other potential expressions of critical approaches and uses that emerge in participant-tool interactions. Even so, these questions are mainly intended to guide subsequent analyses and the interview questions are instead formulated in as concrete and non-theoretical manners as possible.

The interview guide can be described as divided into sections. The first six questions primarily ask “how”, “when” and “why” the participants use the tools. They seek to encourage descriptions and recollections of examples of use as well as possibilities for me to ask for practical demonstrations (which also, importantly, opened up for the contextual inquiry parts of data production; see next section). The questions focus on general areas that had seemed to be associated with all sorts of critical approaches and uses in both previous research (see Part I) and in the observation parts of this study (see above) such as also specific issues connected with the data sets or the tools’ structuring devices (primarily, then, place and time). These questions were hoped to produce data suitable to analyse in relation to in particular the first and last of the three research questions. The last three questions in the interview sheet (questions 7–9), on the other hand, are more abstract in character and call for opinions and thoughts on issues that I had hoped would provide data suitable for analysing the second research question concerning perceived political and power related aspects. In retrospect I conclude that this set
of questions was misguided and did not yield particularly useful answers but more of speculations and forced guesswork of little value to, and therefore subsequently excluded from, the analysis. Political and power related aspects of the participants’ interactions with the tools appeared instead without me explicitly asking for them throughout the discussions relating to virtually all other (and prior) questions.

Most questions in the interview guide contain bracketed alternative wordings to allow for easy rephrasing or clarification if some things seemed unclear, or followed by a list of “probes” used to ask for things not mentioned spontaneously but that I wanted, if possible, to know more about (cf., Lofland & Lofland, 1984, pp. 56–57). For each interview, a fresh guide was printed and filled out during the session. Each copy contains a face sheet and a post-interview comment sheet. The face sheet records standardised information such as the participant’s name and occupation/position, and the time, place and date of the interview. The post-interview comment sheet was used to write down my own reflections and thoughts on difficulties or theoretical, analytical and methodological ideas and insights directly after the interview, to be considered for subsequent interviews and analyses of data (c.f., Lofland & Lofland, 1984, pp. 57–58).

To the greatest extent possible, I tried to schedule interviews “on site” at each participant’s work place or other habitual site of interaction with the tool. At least one person frequently worked from home and while travelling and I therefore interviewed this person in his/her home in front of the participant’s own laptop. This ‘on site approach’ was important both to enable the interview sessions to extend in line with field work inspired observations (c.f., Fangen, 2005, p. 195) but also to open up for the contextual inquiry parts of data production (see next section). Two participants, however, found it more convenient to meet me at my office, but the other nine interviews were thus performed on site.

A digital voice recorder was used for interview uptakes, in combination with sporadic note-taking, so as to keep as much focus as possible on the study participant and follow-up questions while still allowing for a certain degree of simultaneous annotation (c.f., Lofland & Lofland, 1984, pp. 60–61). Care was taken to reflect and document further immediately after each interview. The interviews were expected to last about 90 minutes, and on average this was fulfilled (95 minutes per interview). In effect, however, there were major time differences between the first interviews in each case, and the final ones. Some of the early interviews took over two hours and later ones around one hour. In part, this is probably an effect of my strategy to start with the most centrally placed persons in each case, who therefore also had the most to say about the tool and its uses, as well as my own need to ask more general questions for my own understanding at the beginning of each case.
contact. In part, it might also, hopefully, indicate a sort of saturation at the end of each data production phase.

5.2.4 Contextual Inquiry

The contextual inquiry inspired parts of data production merge segments in the interviews described above with a particular observational method in which practical activities or demonstrations of participant-tool interactions are in focus. Contextual inquiry (CI) was originally developed by Karen Holtzblatt within the Human-Computer Interaction (HCI) field of system design (Beyer & Holtzblatt, 1998) and is a specific field interviewing method designed as an alternative to studies that decontextualise users from the natural settings in which they use certain tools and perform certain actions such as daily work practices or leisure time information seeking. The basic idea is that contextual inquiry provides an avenue for studying and understanding tacit knowledge embedded in largely habitual routines and activities that study participants are either unaware of, or for other reasons have difficulties expressing in words. It is a qualitative, field based, bottom-up method often used in user centred and participatory design (c.f., Beyer & Holtzblatt, 1998, p. 37; Holtzblatt & Beyer, 2011) but also for many other purposes such as studying Internet search behaviours (e.g., Anschuetz & Rosenbaum, 2003).

For similar reasons and in similar ways that more traditional ethnographic fieldwork has been adapted into smaller and more focused versions (c.f., Knoblauch, 2005; Wulff, 2002), contextual inquiry has also been adjusted into a condensed version (condensed contextual inquiry, CCI) (Anschuetz & Rosenbaum, 2003; Beyer et al., 2002; Kantner, Hinderer Sova, & Rosenbaum, 2003; Potts & Bartocci, 2009; Rosenthal, 2007). The differences, however, are small and mainly mean disregarding most of what has to do with the larger contextual design framework with which traditional contextual inquiry is commonly associated (c.f., Beyer & Holtzblatt, 1998; Holtzblatt & Beyer, 2011), alongside the obvious measures to downsize the data production phases by spending less time with fewer participants – even four to six participants can be sufficient for some purposes, according to these condensed contextual inquiry proponents.

A typical contextual inquiry session is recommended to last between two to three hours, and builds upon four principles: 1) context (go to the actual workplace and watch participants do their own work); 2) partnership (talk to them about their work and engage them in uncovering unarticulated aspects of work); 3) interpretation (develop a shared understanding of the observations in conclusion); and 4) focus (direct the inquiry from a clear understanding of your own purpose). Of this
entire session, the interview makes up the smallest part, with the most time spent on the partnership and interpretation parts (Beyer & Holtzblatt, 1998, pp. 37–38).

The way the interview sessions were set up in this study already fulfilled the first and fourth contextual inquiry criteria (see above). The third criterion was skipped altogether since it is a feature more suited for the design purposes of developing or improving a system based on user input. My partly critical and distanced approach does not in the same way aim at a consensual understanding and interpretation between me and the participants, at least not one that is easily attainable on site. ‘Partnership’ and ‘context’ are thus the key criteria focused on here, and with the context part already taken care of through the setting up of interviews, it is the partnership aspect that required further, deliberate and clear shifts within the ongoing interview sessions and which will be described here below.

My own adjustments of the contextual inquiry method meant largely reversing the suggested order and spending relatively more time on interviews than on observations, although the precise relations shifted from session to session following the contextual interview (the most common form of contextual inquiry) steps: 1) the conventional interview, 2) the shift or transition, and 3) the contextual interview proper (Beyer & Holtzblatt, 1998, pp. 64–66). During the conventional interview (1), I followed the semi-structured interview guide (Appendix G), and when it seemed interesting and possible, I asked the participant (2) to demonstrate what he/she was talking about. This pattern could be repeated as interstitched passages throughout the interview or saved to the end. Upon each transition I (3) shifted from the role of ‘interviewer’ to ‘partner’. I watched and listened and tried to learn from and better understand the participant and his/her interactions with the tool by asking what they were doing, what it meant to them, and why they did it in those ways. In most cases, the difference between what the participants were able to formulate and express in the interview, compared to what they were able to express when showing me how they worked with the tool and explaining as they went along, was considerable.

The partnership model is partly intended to avoid power-tilts in either researcher or participant direction (traditional interviews grant control to the researcher; traditional apprenticeships or observations to the participant). This instead presents a middle way, in which both are participants with relevant and useful knowledge that can reveal valuable insights to both. The focus aspect is what sets necessary delimitations in these encounters, and I maintained focus by readdressing concrete rather than abstract issues. Usually, it required very little from my part, like merely pointing and asking “What is that?”, and “Why did you do that?”, to
get the participant talking without apparent holdback or hesitation and often with considerable excitement about particular features and what they meant to him/her.

Since the contextual inquiries and interviews overlap in this way, the audio recording ran throughout the whole session and it was later transcribed as one document (see below). When helpful, I also let the study participants illustrate what they were talking about by writing and sketching in my notebook as they explained aspects of their work practices or the tools to me. Besides the rich data produced, these contextual inquiry instances that merge segments from interviews and observations also had other positive side-effects, not least in providing opportunities to test and check my own, unfolding, interpretations of meanings and activities with the study participants, and to compare the accounts and descriptions they had offered in the prior interview sessions with what I observed them doing (c.f., Fangen, 2005, pp. 188–191).

5.3 DATA PREPARATION AND ANALYSIS

The ethnographically inspired methodology has meant that the analysis of data has stretched out into a more or less constant activity permeating the whole research process including the cumulative structuring and restructuring of questions in the interview guide, the observational notes and the post-interview reflections. But naturally, the preparations and analyses of empirical data were also characterised by a number of more formally distinct and high intensity stages such as sound file transcription; sorting and coding the material; and sifting, thematising and interpreting the transcripts with the help of the analytical tool, research questions and previous research. Below follows some comments on each of these stages.

5.3.1 Transcription of Sound Files

The process of transcription is often valued as an opportunity to get truly and intimately acquainted with the empirical material and as the first “real” start of the analysis but in order to save time I only transcribed three interviews and enlisted help for the rest. It was therefore necessary to take extra care to develop a detailed plan and list of rules and codes to ensure the highest possible degrees of interpretative and formatting consistency between me and the transcriber. To achieve this, a sample passage from an interview was transcribed by both me and the other transcriber in accordance with this first transcription manual. We then compared and discussed the two transcripts, and where there were differences, I explained
how and why I would like subsequent transcripts to be performed. The transcription manual (Appendix I) was thereafter further developed into a detailed style sheet to also avoid corruption and optimise the orthography to ‘code-and-retrieval’ possibilities when uploaded and managed in the software later used for data analysis (see next section).

For the transcription of sound files, a simplified version of Jefferson’s transcription notation system (Jefferson, 1984) was used. Excluded features are mainly of the advanced linguistic sort, such as: prosody indicators (rising or falling pitch); quicker or slower speech than usual; lowered voice; as well as a number of standardised orthographies for paralinguistic behaviour and sounds. The modified transcript legend with comments is included in Appendix H. To minimise the risk of misinterpretations, the transcription of the sound files retained the Swedish language and all my subsequent analyses were thus performed on transcripts of participants’ original wordings. The quotes from the empirical material that are included in this dissertation have been translated after the analyses, upon decision of inclusion in the main text. These quotes are also the only parts of this text that have been checked by a bilingual professional to enhance the dual purposes of consistency of meaning whilst also retaining the more informal style of colloquial speech.

5.3.2 Sorting and Coding Transcriptions

The collected empirical material was organised in a list of transcriptions so that each interview (including contextual inquiry sessions) was assigned a unique code in a list with information about date, length, time and sound file ID for each. A rough categorised description of each participant represents their relation to the visualisation tool in question (as developer, administrator, or user in any combination). Any extra documents and material obtained in relation to each session were also noted in this list (see Appendix E).

Once transcribed, the interview sound files were analysed for relevant themes. The process of analysis thus started with coding of the transcripts to identify passages that could be understood as expressing some sort of theme or aspect with any sort of possible relevance to the research questions, and such passages were thereafter labelled with as much detailed, descriptive and transparent wordings as possible. For this coding, the CAQDAS (computer assisted qualitative data analysis) package ATLAS.ti was used.

Obviously, the “codable” instances of text in ATLAS.ti constitute simplifications; they are restricted to comparatively easily defined and delineated instances of expressions of themes in the transcripts. And as should be expected, this is an effect
of coding of qualitative data that has generated much criticism, in particular in relation to technical CAQDAS solutions that some fear lead researchers to homogenise and routinise reductionist analyses of decontextualised coded passages that upon retrieval in the CAQDAS are separated from their relevant contexts, and perhaps also one-sidedly encourage grounded theory methods of analysis (e.g., Coffey, Holbrook, & Atkinson, 1996). Overly rigid adherence to clearly definable expressions suitable for coding in this manner thus risks overlooking relevant expressions that are more difficult to define and delineate, such as things not said (i.e., that are missing in the texts), or interpretations that require a great deal of inference (e.g. ‘reading between the lines’ and picking up on paralinguistic behaviour such as hesitation, agitation etc.).

Two things in particular can help counteract problems of the type described here. Firstly, the empirical material has been produced in cooperation between me and the participants, and it is small enough for me to be able to satisfactorily remember and retain an overall grip on each session and related transcript fairly well, thereby reducing problems of decontextualisation. Secondly, the detailed notations in the transcripts include nonverbal activities such as humming, pauses, interruptions, emphases of words, sighing et cetera that may convey feelings related to the topic under discussion. Furthermore, in acknowledging the fuzziness and complexity of data (parts of) individual passages can and have also been coded several times with multiple labels.

After the first coding process, the labels and coded passages were worked through iteratively, alternating between further subdivisions and mergers that ultimately included subcategories into a hierarchy of broader, more overarching themes. This process of reduction was halted when the overarching labels could not merge further without risk of hiding significant distinctive qualities. During this reduction, the overarching codes used for labelling also moved from mainly descriptive to mainly analytic (i.e., theoretically informed). This also means that the grouping of coded passages by theoretically related labels holds variations on each analytic theme as more descriptive sub-labels. These variations were examined not only within each case, but also between the cases, in those instances where identical or similar descriptive labels had emerged.

5.3.3 Analysing Data: Enactments of Meaning

In the conceptualisation of visualisation tools as a specific category of sociocultural tools – as repeatable representational artefacts; as documents – I retain the notion that these tools, just like language, are interesting to study because when used they
contribute to shape their users’ perceptions, form their identities, and construct their understanding of social realities. But compared to an exclusive focus on linguistic expressions, it also adds to the empirical and analytical possibilities and responsibilities in including also communicative acts expressed by means other than words and technological artefacts as constitutive of, and mediating, meanings. Analytically relevant enactments of meaning can thereby take the form, for example, not only of a study participant’s explicitly verbally and retrospectively (in interviews) declared refusal or hesitation to share data and visualisations with others, but also as a non-verbalised but embodied activity of, for example, setting up a technological feature such as a password mechanism which might communicate a similar meaning in the context of activity.

To broaden the analysis towards enactments of meaning in not least Gibson’s (1986/1979) sense of affordances and abilities, I also draw inspiration from ethnography and work place studies on how to reach non-verbal, paralinguistic aspects of user-tool interactions. In lack of video recordings or still images, the transcription notation has been a valuable tool for getting at such instances. Work place studies, not least, make use of elaborate transcription notation with inspiration from conversation analysis with its focus on sequential organisation of “action in interaction” but also broaden this scope to include studies of interactions between humans and technology as well.

This transfer is made possible by viewing communicative acts as social actions accomplished in and through interaction not only in person-to-person exchanges of linguistic utterances but also through different forms of visual and material conducts such as hand gestures or shutting a door. Human-technology interactions can thereby be understood and analysed in similar ways; as, e.g., reading similar meaning into a person’s frustrated repeated hammering in of the same computer command without apparent effect, as into the person’s verbal expression of frustration with the software or hardware (c.f. e.g., Heath & Luff, 2000, pp. 24–26).

As recognised by Heath and Luff (2000), physical tools and artefacts play an important role in the “practical accomplishments” of social activities. Naturally, though, the analysis of such interactions presents several exceptions to what is unique about spoken conversation; an artefact, for instance, does not speak with emotion, interrupt another person’s talk, or express itself with body gestures. A human, however, does, and humans constitute at least half of the units of analysis in such studies, which is what makes this type of analysis possible. In some respects, I would argue that it is not very far-fetched to compare humans’ interactions with documents (repeatable representational artefacts) to “conversation”. There is, in accordance with the theoretical perspectives applied here, a sort of “give and take”
between the two; both contribute in the interaction forming a joint enterprise between the disciplinary effects of externalised inscriptions, and situated interpretations of meaning (c.f. section 4.2.3). There might not be a proper turn-taking as in spoken conversation, but there is still a significant amount of exchange and mutual dependency involved.

In instances where the study participants also provide concrete demonstrations of how they use the tool, by pointing at the screen, clicking on display options, and commenting on what they do and how they react and respond to the visualisations, then the extra keys for picking up on how things are said, or how the interaction occurs, therefore become much more interesting. A sigh or a timed pause of 12 seconds, for instance, may have a lot of information to convey in such instances. The notations thus make visible non-verbal aspects of user-tool interactions, for example by revealing hesitance, hand gestures pointing out or mimicking significant aspects of the visualisations, and even onomatopoeics.

The detailed notation of the transcripts was retained throughout the analysis of the material, but as it is also in general perceived as difficult to read by those who are unacquainted, I have removed much of this notation from the quotes included in the following analysis chapters. Only in the third analysis (chapter 8), where focus is explicitly placed on situated interactions and enactments of meaning, are more of the original notations included (although still only those aspects deemed helpful for interpreting the interaction).

5.4 CONCLUSIONS: APPLICATION OF THE ANALYTICAL TOOL

To conclude this second part of the dissertation on theory and methods, the ways in which all of this comes together for data analysis is illustrated in Table 5.1 below. To provide some idea of how I worked with this broad approach for analysis of the empirical material, the table includes examples of what I have perceived of as significant enactments of meanings in relation to the formulation of research questions.
Table 5.1

Examples of Application of the Analytical Framework

<table>
<thead>
<tr>
<th>Research Question</th>
<th>Enactments</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ1: approaches to and uses of the tools as cultural and material artefacts</td>
<td>Expressing concern that quantitative political goals determine the focus of the visualisations and their users</td>
<td>Denotes awareness of external conditions that influence tool interactions and constructions of meaning</td>
</tr>
<tr>
<td>RQ2: approaches to and uses of the tools as mediators of political interests and power relations</td>
<td>Offering a visualisation to get another organisation to open up their previously non-public data sets</td>
<td>Denotes political use (mobilisation) of the tool to serve own interests.</td>
</tr>
</tbody>
</table>

Whereas the examples in this table are only able to point to the more literal and “codable” analyses of data, the example below illustrates the more comprehensive approach required to understand enactments of meanings as situated interactions; as relations between affordances and abilities:

You can see pretty clearly when it’s round the bend. It’s easier to see here than in an Excel file when you’ve made a mistake because then as a rule you get completely unreasonable answers and you see here that it goes “swoosh” ((waves hands downwards in front of the screen)) and it jumps down there, like: “What was that?”, kind of. And then you see, “Well, that must have been something wrong or something”.

The quote shows how it is possible to read meaning into something not directly verbalised and explained, but rather enacted, by one of the study participants, who here reacts to something in particular during contextual inquiry; a sudden, drastic movement of a bubble in a Trendalyzer chart (“what was that”) which this person also apparently reads specific meaning into (“that must have been something wrong or something”). These aspects of participant-tool interactions might not have been as prominent in a less detailed transcription of mere words adapted to written language conventions.

With this, the second part of the dissertation is concluded, and the following chapters present the analyses guided by the research questions and illustrated with empirical examples.
PART III

~

ANALYSIS AND RESULTS
6

THE RIGHT (VISUALISATION) TOOL
FOR THE JOB?

This chapter presents findings from the analysis guided by the first research question: *In what ways do the participants approach and use the tools as cultural, material artefacts?* The question primarily represents a pluralistic situated literacies adaptation of critical literacy definitions that propagate critical distance, reading against, and seeing through artifice and bias in documents. Through the analysis, two polarised approaches and uses relating to the visualisation tools as cultural, material artefacts stand out and stretch from seemingly non-critical to a variety of critical enactments. These findings, that from some perspectives would appear contradictory, are here interpreted as indicative of the force and proliferation of popular narratives of data and visualisations, and of the study participants as actors with both abilities and incentives to switch back and forth between several different ways of talking about the tools.

The first set of approaches and uses, described in section 6.1, is then best described as characterised by an apparent *absence* of critical literacies. The section contains accounts in which the participants describe the visualisation tools as *powerful and intuitive* (section 6.1.1) *providers of answers* (6.1.2) in seemingly non-critical enactments of the tools as objective sources of knowledge ideally fitted to their information needs and work tasks. The second section (6.2) presents, in contrast, a variety of enactments of meanings that *do* constitute examples of critical approaches
to and uses of the tools as cultural, material artefacts. More specifically, the analysis demonstrates that the participants also recognise a number of data and tool-associated problems in the form of errors and bias (6.2.1) and of somewhat costly yet necessary trade-offs between providing ‘the whole picture’ and selective foci (6.2.2). These perceived problems are further construed by the participants as requiring distanced approaches and appropriate (counter-)actions based on a priori acquired knowledge and therefore also give rise to a number of concerns regarding other users and uses of the tools, since not everyone is an expert (6.2.3).

6.1 REFLECTIONS OF POPULAR NARRATIVES

The first set of approaches to and uses of the tools to emerge in the analysis, thus, are not critically informed at all in the way defined here, and I have chosen instead to describe these enactments of meanings as reflections of popular narratives. By this, I mean that although the study participants are generally well acquainted with the data sets, tools and relevant contexts of production and use and know from experience a number of tool-associated errors and bias (as will be described in section 6.2 and the two following chapters 7 and 8), they nevertheless also frequently describe the tools and their uses of them in non-critical manners as powerful and intuitive sources of knowledge that provide answers ideally fitted to their information needs and work tasks.

These meanings are primarily ascribed to the visualisation tools in two ways. The first is through comparisons with more traditional statistical tools for analysing and presenting data in contrast to which the tools are described as far superior in handling large and complex data sets; in making their meanings almost intuitively available; and for making the ‘whole picture’ understandable at once (presented in section 6.1.1). The other is through emphasising a combination of the tools’ perceived capabilities to include large quantities of data (much potential information) and their interaction possibilities (high flexibility) as key for their abilities to provide tailor-made answers to on-the-spot and individual information needs (presented in 6.1.2).

6.1.1 Powerful and Intuitive

The most frequent and prominent of what are here described as reflections of popular narratives combine to enact the visualisation tools as simultaneously powerful and intuitive machines that reveal the meanings of large, complex and often
heterogeneous sets of data. These meanings are ascribed to the tools in a number of ways and combinations: by emphasising the sheer quantities of data that the tools are capable of processing and visualising; by pointing out their abilities to make these data almost intuitively understandable (cognitively available); and by comparing and contrasting with the alternative data analysis and presentation tools of paper, statistics and PowerPoint presentations: “it’s an easy way to get a quick overview, rather than looking through, you know, loads of diagrams in front of me” (Geo, 1); “You can express how a country is doing instead of just saying a number: ‘This country has so and so much GNP [gross national product] and so and so high child mortality’ ... then it becomes such a clear outline somehow ... You can see how a country has changed over time” (Trends, 1).

That the visualisation tools have made the data sets in each case easily understandable and cognitively available appears, in the accounts of the participants, as quite a remarkable feat. They all return repeatedly to comparisons with the more traditional paper-based or at least static (non-dynamic) statistical analyses and data representations described as tedious, boring, ineffective, difficult to interpret and understand and with limited capabilities of both inputting and representing high quantities of data: “instead of looking at statistics that are columns where you add PowerPoint after PowerPoint and you see a development, maybe, certainly– but it’s pretty boring and static” (Trends, 2).

One participant explains that overcoming these barriers is key: “to be able to have an incredibly large amount of data- because that’s what it’s about”, and continues to illustrate the superiority of the Trendalyzer tool to answer to these needs by mentally calculating an example intended to illustrate the amount of information concentrated in and conveyed by an average visualisation. The example is a fictive (but representative) visualisation containing data for two hundred countries and two hundred indicators over a time span of fifty years: “and then we’re up to one, two, three (...) two million cells in an Excel sheet, sort of. And that makes it incredibly complicated ... And it gets big as hell, and completely impossible to see, and you can’t even enter two million cells in an ordinary line chart, sort of” (Trends, 3). But the really extraordinary accomplishment rests not with this quantitative capacity alone, but in the ability of the tool to render all these data and their relations intelligible all at once: “that it’s easy to understand. I mean it’s a way of actually understanding what it’s showing” (ibid.).

More precise descriptions of how or why the tool in each case can perform and combine these powerful and ‘easy to read’ outputs seem, however, difficult for the participants to formulate in words. They prefer instead to speak in terms of (the positive) effects: “you can catch so many complicated things at once– a lot of
indicators, I mean” (Trends, 4); “that it’s actually possible to compare with other countries, and development over time at the same time” (Trends, 5). It is, thus, in vague but predominantly holistic terms that they express that the visualisation tools help them “see”, “understand”, “get an overview” of a situation or an “outcome”, how one country or two hundred countries are “doing”:

It’s easier. If you’ve done an analysis, then it’s easier to see on a map what the outcome was– geographically [rather] than getting it in a column chart straight up and down on a piece of paper /.../ If you have a lot of data to run, then the map is the best; if it’s just a little data you can look at a piece of paper and see a column chart, how it turned out. You can do that quickly, and then it can be more of a hassle to start the map /.../ But still in most cases I think the map is superior, you can get an overview in different ways of an analysis. (Geo, 2)

Both Trendalyzer and MapInfo, thus, are described and praised in these ways for their abilities to process, visualise and make understandable large quantities of data in ‘one image’, but there is also a crucial difference between the tools to consider here. Unlike MapInfo as well as more traditional statistical tools, Trendalyzer also incorporates representations of dynamic aspects in the data sets through animation. And it is precisely the lack of such features in GIS in general that leads for example Jessop (2006) to critique map based visualisation tools as less well adapted to the specifics of social data which, he contends, are at their most interesting when viewed in a historical/temporal perspective with focus on change and movement. Also in the material here, the dynamic quality clearly stands out as one of the main perceived advantages of Trendalyzer, although a connection to social data characteristics of the sort described by Jessop is at least not explicit. Instead, the Trends participants mainly emphasise again how the dynamic feature is another – and central – aspect of what makes Trendalyzer both quantitatively powerful and qualitatively available (easy to understand):

That it moves over time; it’s movement, you can see changes which you can’t– Well, of course in a line chart you can see that it’s grown there a bit: “Oh, that’s more than before”, but when you see– … Here, you can see sort of two hundred countries at the same time; how they’ve moved, and you understand it. (Trends, 6)

The animation in Trendalyzer thus emerges as a major component in what makes its visualisations so easy to understand according to the participants. It almost seems as if they experience the movements over time – the animation – in its
most literal sense, as a ‘performance’ and a representation that really in a way brings
the data to life: “And precisely because it’s animation, too /.../ you get to sort of
follow these symbols, then, of countries or regions, or whatever they are, that move
across the diagram. And that makes statistics exciting to look at, from being just
numbers on a piece of paper” (Trends, 7).

The sheer quantities of data possible to input and process in the visualisation
tools emerge thus in the material as one of the main perceived advantages of the
visualisation tools compared with the old and traditional ways of working with
statistical analyses and associated presentations. But whereas theories on inscrip-
tions describe inevitable and even multiplying or cascading costs associated with
materialised representations in terms of increasing simplifications, abstractions, and
decontextualisations of the inscriptions from whatever natural or social realities they
are intended to represent (e.g., Latour, 1986), the participants here often describe
rather opposing views. The tools are apparently felt to significantly increase the
number of data values and relations that are possible to discern: “I think you can
get a lot of information with few questions. I think you can see many correlations
at the same time– in a short time” (Geo, 3).

Information is not thought to be ‘lost’ in the processes of visualisation but the
participants emphasise instead that the tools are not only able to ‘receive’ a lot of
information (data), but that they ‘return’ at least as much in their processed outputs
(visualisations). In other words, there is not much talk about losses or absences but
rather about the opposite, about how much – and meaningful – information that
appears and is made visible through the tools. One of the Trends participants even
remarks and demonstrates that he/she thinks that it is precisely because of the high
quantities of data variables and values in both input and output that Trendalyzer
(“the graph”) is so easy to ‘read’ and understand. With a visualisation displayed on
the computer screen in front of us, the participant turns to the screen to demon-
strate how adding values and variables in the visual representation makes it easier to
read: “If you take this graph and compare it with this one– where all the bubbles
are equally big– then I perceive this one as less easy to read than the one where
you’ve actually taken out a piece of information” (Trends, 8). Almost consistently
and unanimously, the point of reference when describing the tools’ capacities as
information sources in these ways is ‘traditional’ statistical tools and paper/static
representations (“... just because you do have more than just two indicators at once”).

Further, and as foreshadowed by the quote above, another prominent vein in
these non-critical enactments of the visualisation tools as information resources
contains descriptions of the tools as intuitive and closer to ‘reality’ compared with
alternative and potential modalities for representing the same thing. For example,
this Trends participant emphasises positive aspects of intuitive representations in Trendalyzer: “Now it becomes very clear that ... here’s a special observation that—it’s light-blue in contrast to all the others that surround it and it’s much bigger, and it’s also easy to understand that big bubbles are large populations for example” (Trends, 9).

Descriptions of this type bring to attention how the visualisation tools might also be understood as examples of representational artefacts that revert to, or invoke, simpler (less abstract) sets of symbol structures for analysing, interpreting and communicating ‘meanings’ of data. Visualisations by their very nature, of course, rely on pictographic and iconic representation in which the relation between ‘signifier’ and ’signified’ is more direct – based on physical resemblance between the representation and the object to which it refers. The iconic character of visualisations also explain much of the perceived ease and intuitiveness of the geographic representations in MapInfo, as well as hints in the Geo material of a sort of scale of preferences from abstract statistics (difficult and boring) to simplified, stylised maps (comparatively easy and intuitive), to orthographic photos (even easier to find one’s “way in” and closer to ‘reality’ (e.g., Geo, 4).

Language and statistics as alternative modes for representing data and their meanings are more complex and abstract compared to more direct visual modes of pictograms and icons. And unlike statistics and mere numerical representations, the graphic, colourful and animated representation of countries in Trendalyzer is thought to lower the cognitive threshold to make ‘everyone’ understand, even younger people which, the quote implies, are more visually oriented: “That you have this, sort of, slightly animated effect that makes it very easy to relate to, even for the MTV generation” (Trends, 10). But also, because the visualisations appear intuitive and are iconic and visual rather than text based and propositional in character, they are also perceived as difficult to approach in a critical sense. To argue or disagree with something that appears objective, real and makes intuitive sense is not easily done, and the visualisations might therefore be perceived as highly persuasive, merely showing ‘how it is’: “‘Look, this is what the world looks like’, I say when I give a lecture. And then they see it at the same time, and then you understand that, ‘Yes, that’s what it’s like, actually’” (Trends, 11).

By also referring to personal cognitive preferences, a Geo participant describes similar positive aspects of MapInfo’s iconic representational mode and the way it makes the data easy to understand. Even when this person is primarily interested in quantitative information on traffic accidents, which would seem to be as easy or even easier to take out as numerical values only, the map based visualisation remains the preferred modality: “For me, it’s easier to see something like a map, a
A contributing factor to the experienced cognitive facilitation through these representations is further ascribed to the flexibility of choice between a rich variety of iconic representations: “Because I can thematise the map like that. I can ask it to demonstrate with different symbols for different numbers, or different colours, or different sizes” (Geo, 5; c.f. also Geo, 6).

The Trendalyzer visualisation in particular is even described as so easy that it would be almost impossible to not understand the data and their meanings, which is the reason this participant uses it: “because it explains in a relatively easy way something that is pretty difficult. And it almost makes it impossible for someone watching it to not understand these things” (Trends, 12). Some of the ‘pre-loaded’ Trendalyzer visualisations that have been set up to show differences also between and within regions in one and the same country or between countries in a continent (“You can split up Africa and see differences between Mauritius and Sierra Leone; understand that ‘Wow, it’s that big a difference’”) are also particularly and explicitly described as being so easy and intuitive that they are practically self-going and self-explaining: “I use them too sometimes, and just run them, because they’re self-going ... You can almost just read-- click on the bubbles and stand [besides the visualisation] and smile, sort of” (Trends, 13).

For the related non-critical enactments of the visualisation tools as providers of answers, however, somewhat different aspects are invoked as shown below.

6.1.2 Providers of Answers

Besides being described as powerful and intuitive, the visualisation tools in the two cases are also frequently expressed in terms of an almost ideal fit between the participants’ information needs and work tasks and the tools’ affordances as a seemingly unproblematic 1:1-relationship. In these accounts, the tools are not described as offering information of potential value, but as providers of answers and knowledge. What the participants want and need to know, the tools appear to offer. The reasons for this declared ideal conformity are seen here to span all the way from notions that the tools are easy to adapt to their own individual needs, to descriptions that rather suggest the reversed relation; i.e., that the participants adapt their expectations and actions to the possibilities provided by the tools. Somewhere in between these opposite views are also more general descriptions of correspondences between the overall focus of the visualisations and the overall goals of the respective work and organisational characteristics in each case. Thus, to the apparent contentment in Geo, MapInfo visualisations tell a fairly straightforward tale about geographic locations and relations: “You can see how accidents relate to
schools or bus stops or intersections or— … You’re interested in just one place so to speak” (Geo, 7), and the Trends participants seem equally content with Trendalyzer’s primary focus on temporal trends: “You can capture the whole world’s development and change over time. Those two things” (Trends, 14).

The high degrees of perceived consistency between ‘tools and tasks’ on the organisational level in each case are, however, hardly surprising, and most likely effects of a long-term mutual shaping of tools and practices. For the Trends participants, it is a reality that the entire global arena of international (in particular monetary) aid to recipient countries is reliant on data and statistics to determine where, when and how to distribute resources. In sociocultural terms, these practices are institutionalised, and the Trendalyzer tool has been developed within this context or arena, in many respects intended as an (improved) answer to these needs and practices. And in Geo, maps have been used for similar traffic security analysis and enhancement work since long before digital GIS and MapInfo. Some of the old wall-displayed print maps that were used for marking the sites of accidents by hand-insertion of pins might, I was told, remain even today in various hideaways at the Traffic and Public Transport Authority.

The tools can thus be understood as shaped in conformance with work tasks and information needs based in long-standing, well-established practices and cultures. And the questions that the participants pose to the tools are also similarly mediated, shaped and disciplined through their own socialisation into and learning of these cultures and practices, but also through appropriation through tool interactions of these ways of thinking and acting as inscribed – externalised and fixated – in the visualisation tools. Such repetitive and reinforcing relations between representations and thinking and acting are central to sociocultural and sociohistoric theories on learning and artefacts.

What is there, then, to be critical of in this sense? It would obviously be a rare approach indeed to not ask a map to show ‘where’, or a time axis to show something other than ‘change’, but what might appear blatantly obvious at first glance – that, for example, Geo participants use MapInfo to seek answers to: “for example how many accidents there are at a certain time at a certain place” (Geo, 8); “usually, of course ‘Where?’, ‘When?’, ‘Who?’” (Geo, 9), and that Trends participants use Trendalyzer when they want to: “look at a general development on a national level” (Trends, 15), or “explain what– the basic conditions for people to live in this world” (Trends, 16) – can also be problematised from a critical literacies perspective. The problematic aspects, in light of the theoretical framework applied here, have to do with understandings of how representations and inscriptions exert disciplinary effects on thinking and acting (Hutchins, 1995); how human minds
can be ‘culturally hi-jacked’ by socialisation into institutionalised ‘knowledge’ (Säljö, 2005, p. 44); and how inscriptions always involve simplifications with cascading costs of abstraction and black-boxing, naturalisation effects through which the cultural, constructed and material nature of representations become invisible (Bowker & Star, 1999; Latour, 1986). All of this makes it exceedingly difficult to retain critical distance to, for example, what questions that are not asked and what perspectives that are not seen through the choices of structuring devices (c.f., the ‘problems of representation’ discussion in 3.2); the resulting visualisations; and subsequent uses of them.

As an extension of Hutchins’ (1995, p. 82) description of how tools discipline their users because the choice of representations limit the inferences that make sense, we might likewise assume that familiarisation with a tool will also lead to a limitation or disciplining of the sort of questions that make sense. And whereas tool-imposed restrictions to possible inferences is one problematic aspect from a critical perspective, possible restrictions to the formulation of questions in the first place is even more severe. If certain types of questions become naturalised and taken for granted as the right and only way to perform work tasks of analytical character, then the critical dimension in the entire work process can be said to be lost. And if certain types of questions become institutionalised and naturalised, then new information systems and resources are likely to continue to reflect and reinforce this bias in a cyclical reinforcing manner (c.f. also current descriptions of the “geo-everything era”; Johnson et al., 2009).

The material analysed here is not of a size that allows conclusions of a generalised nature, but it does contain examples that show that the participants are at least prone to seek information, ask questions, and even direct their work towards issues that generate clear and distinct patterns in the visualisations, as for example this Geo participant who has been working a lot with a specific category of accidents that is described as a good example since “it’s a bit exciting to look at (…) geographically, because it’s one of those traffic types that doesn’t spread out like stars on a night sky across the city” (Geo, 10).

The “stars on a night sky” metaphor reoccurs several times in the accounts of this participant, and is used to describe visualisations of accidents that do not display a clear geographical pattern but that rather are spread out ‘everywhere’ (c.f. also section 8.2). Accounts of this type in both cases illustrate how issues or topics that render clear patterns – geographically or temporally – are preferred because they are ‘there’; easily distinguished and with agreed upon meanings. As such, there is also a certain influence on what sorts of questions that get asked and what sorts of data the participants come to focus on. Trendalyzer, for example, is described as
being focused on “health indicators, because that’s what you can show in a very easy way. What development is, and what it can mean for people” (Trends, 17). A Geo participant also describes that using MapInfo is very much a quest for distinct patterns, at least if it is a “thorough analytical work”; a quest for patterns by looking for “correlations” in the form of a combination of quantity and location. Meaningful and ‘sought-after patterns’, in other words, are primarily equivalent to accumulations of accidents at a certain place, these are: “things that are common to present” (Geo, 11).

The process becomes repeated and reinforced as most often, the same set of data is analysed in several stages by different persons. What one person first finds interesting in terms of significant patterns is then perhaps ‘filtered’ many more times as described here, at a presentation to and consultation with a whole work team. The participant describes the findings of his/her first analysis to the group by ‘lighting up and down’ “layers and things like that for {the meeting participants}. And then, we decide: ‘Well, that looked interesting, let’s include that and present it in the report’, ‘Let’s include that’, ‘Okay, let’s look into that further’” (Geo, 12).

But the analysis also suggests that there are more pieces in the puzzle that explain the participants’ perceptions of ideal tool-task correspondences, not least the often described flexible characteristics of the tools. This perceived flexibility is described in both cases as reliant on a combination of high data input (much potential information) and high interactivity possibilities (many ‘tailoring’ options). In MapInfo, users can input different data sets and also ‘light up’ or ‘down’ numerous layers that add or remove information from the visualisation: “It’s so clever that I can sort of choose exactly what I want to see you know ... I mean, if you’re interested in accidents– injured people– then you light up that image ... and then these reports just appear (Geo, 13). And in various Trendalyzer visualisations, the participants can similarly choose different data sets and then select from lists of indicators what values to include in the axes. Both tools also allow their users to further customise the graphic layout to suit individual interests and needs, such as choosing between orthographic photos and stylised maps in MapInfo, or the option to put a trace on a specific country or take away visual representation of population size from the bubbles that represent countries. These are also examples of what seems to contribute to the oft-proclaimed consistencies between tools and tasks.

Throughout the material it is also apparent that much of the information processing activities have come to be delegated to the tools. In general, however, this is not thought to be a problem but an advantage, and maybe some explanation to that is to be found in these high interactivity features, often described by participants as granting them extensive control. When asked whether they feel that there
could be too much information in the tools, no one thought so, with reference to interaction affordances felt to allow generous scope to adapt and determine the level of detail and types and amounts of information in visualisations: “No, I don’t think so, since you can zoom in or out as you like, so that’s not a problem really” (Geo, 14), “I can choose that completely on my own, in MapInfo when I’m going to present– I decide that all by myself, how much I want to light up and down” (Geo, 15).

Precisely because the tools process and show data analyses ‘in real time’, in response to ‘cues’ or ‘questions’ and allow for individual selections and choices, their ability to answer to on-the-spot individual local needs becomes perceived as so great. And even though a print publication with statistics and written commentaries might include the same data and results, the visualisation tools are seen to take away the time-consuming and tedious needs to sift through masses of additional material in the quest for just one specific thing – or, of course, the even more challenging tasks of trying to find out about something that was not included in that report in the first place:

As an analytic tool, I think it’s incredibly efficient. If you want to know something about a particular country or if I know that on Tuesday I’ll be asked about Peru or Argentina, then I can go in and look at just those countries: see how they’ve moved during the years, sort of, so that I’ll have a little more stuff to go on. (Trends, 18)

With a slightly different emphasis, these abilities to provide precisely the information or answers that the participants are looking for, also concern the tools’ abilities to scale away data and information that are not deemed interesting on a specific occasion: “precisely since the system– or support system– limits the information to precisely that place [it] makes you sift out the [data] that are not interesting at that time, the ones that are further away from the place you’re looking at” (Geo, 16).

As illustrated here, there are numerous instances when the participants construct the tools in overall positive unproblematic and objective terms. The following section 6.2 provides a first look into the simultaneously existing and equally numerous critically informed approaches and uses that apparently and simultaneously are part of the participants’ views of the tools as information resources.
6.2 EXPERTS’ RESERVATIONS

Despite the seemingly non-critical accounts presented in the previous section, there are among participants in both cases also broad and varied approaches to and uses of the tools, data sets and visualisations as anything but ‘objective’, ‘fact-based’, ‘true’ and ‘easy’ reflections of those aspects of the (social) world that they are intended to represent. The enactments presented here all express variations on the theme of approaching and using the tools as cultural, material artefacts, i.e., as artefacts marked and constrained by the contexts and conditions of their construction.

The participants describe the tools as containing and conveying a number of flaws and errors primarily relating to data access, quality and specificity as well as certain forms of bias mainly associated with statistics in general as well as more specific political and quantitative goals and agendas incorporated in visualisations or guiding their production and analysis (section 6.2.1). There are also a number of other problems primarily associated with the structuring devices’ constraints of focus are ascribed slightly ambiguous meanings as somewhat costly yet necessary trade-offs for the participants to be able to work with and make sense of the abundance of data in their fields of work (6.2.2). And the third strand in this theme includes a significantly varied set of concerns connected to public access to data and tools based on the recognition that not everyone is an expert (6.2.3).

6.2.1 Errors and Bias

The examples in this section present enactments of the tools as afflicted by a number of data, structuring device and use related errors, constraints and bias perceived to have consequences that require various sorts of counterstrategies. In these examples, the participants describe their abilities to identify these various errors and bias as dependent on their a priori acquired knowledge; of having learnt from experience what sorts of errors, bias and similar problems that can be expected and how they can be handled.

In Geo, one of the most concrete problems described in relation to the MapInfo visualisations of traffic accidents has to do with how each data point (each ‘dot’) in the visualisation (often) represents data on accidents from two different sources: one police report and one hospital report, and these are not as specific on geographic location as the Geo participants would want them to be. Inadequate geographical description in the reports, combined with low interest for that level of
geographical specificity on behalf of the external organisation that performs data input often causes misplacements of accident sites in Geo’s visualisations as well as the production of “duplicates”, i.e., one accident appears as two ‘accident dots’ because the data on locations differ between the police and the hospital reports.

From their beforehand knowledge of likely misplacements and duplicates, the participants approach and use the visualisations with corresponding critical distance, and they also compensate by balancing off the known weaknesses in one type of data with known (relative) strengths in the other data. Thus, in cases where the geographic location is clearly duplicated, wrong or inconsistent between reports, the police report data can be used as more reliable on geographic location. Similarly, hospital report data takes precedence as more reliable descriptions of degrees and types of injuries. In Goodwin’s terminology, these approaches to and uses of data and visualisations seem to constitute examples of professional vision (Goodwin, 1994) since there is nothing ‘in’ the visualisations that accentuates these problems or uncertainties, nor ways to handle them. Therefore, the participants have to rely on their previous knowledge of each type of data for detecting the discrepancies and maintaining a critical distance to how much confidence that can be attributed to each data source. This balancing or compensation is also applied when a visualisation lacks data from one of the two sources:

In cases where there aren’t reports from both, if you’re going to look at a small selection and look at individual accidents, then it can be good to know what deficiencies each of them have ... I mean, if I have a stretch of a road where I only have hospital reported accidents, then I can’t pay as much attention to exactly where they are. If I have a stretch where there are only police reported ones, then I can’t pay as much attention to how badly injured they are. (Geo, 17)

The example can thereby be said to illustrate a combination of distanced approach based on a priori knowledge (central to certain critical literacy definitions; e.g., Andersen, 2006; Bruce, 2000) of faults and errors, and of acquired professional vision. The existence and detection of misplacements and duplicates are described as necessary to be learnt beforehand (you have to “know”), and the way to handle them is through adopting a critical stance, a reserved distance that also allows for complementary actions such as knowing what aspects not to “pay as much attention to”.

That a priori knowledge is deemed crucial for critically informed uses of the visualisation tools for data analyses is made explicit in Trends as well. The perceived problems in the data sets that occasion critical approaches and uses are identified
and described here with reference to both first-hand acquired and long-time experience – not seldom also in an empirical sense, from having been ‘in the field’ (“when I was working in Vietnam”). From this sort of acquired, expert knowledge, the Trends participants mention a variety of errors and more or less consciously inserted bias that make it necessary to approach the (tool-mediated) data in certain ways, with a critical distance and with associated appropriate actions; you have to “be aware” and “relate to” “that it can be like that”:

Sometimes there is the occasional country that might want to display a more positive image of their country than what (is actually) the case. And that, that you have to relate to above all and be aware that it can be like that. When I was working in Vietnam we were supposed to take out information about, for example, how many women that died in child labour ... And those numbers differed a lot, depending on where they came from: from the government or if they came from the UN or if they came from (...) Well, if you included certain areas in these statistics or not, so that– They’re definitely not the whole picture, they’re not. (Trends, 19)

Since many of these expert users know much about the data and issues that they’re working with, some of them also describe how they have been thinking about possibilities to add visualisation features to the tools for showing or highlighting such aspects that they feel require particular critical awareness and consideration. As demonstrated in the quote below, the described problem complex itself is a recurrent issue (“we get questions about”) and the participant illustrates with known examples (“if we take maternal mortality in Zimbabwe, for example, then we’re almost just guessing”). Apparently, there have also been discussions among colleagues on how to add and represent this type of critical knowledge into the visualisation (“another thing that we talked about”). As in the previous example, the knowledge described is both generic and specific – knowing that data in general are characterised by varying degrees of uncertainty intervals as well as what countries that have data of particularly poor quality. Both prerequisites for this sort of critical approaches to and uses of data and visualisations, then, fall back on a priori acquired knowledge:

So then you should have a– … when you clicked it [the bubble representing Zimbabwe in the Trendalyzer visualisation], you’d get a spectre, so that somewhere within this it’d be darker in the middle so that you saw: the greatest likelihood is that it’s here, but we know with great likelihood that it’s somewhere here– ((points to a bubble in the visualisation)) You understand? That it floated out, and then you’d
see that when you clicked up Sweden it’d be very small, probably just like ( ), but when you look at, well, if we take Sierra Leone, for example, the uncertainty interval would be bigger. (Trends, 20)

Knowing that the visualisation tools are simultaneously intertwined with a whole complex of data sources, methods and agencies that ‘are’ statistics at the same time as they produce something (the output visualisations) that are not statistics in a strict sense and that cannot be treated as such is another sort of experts’ reservation calling for distanced approaches with references to professionally acquired understanding of shortcomings and limitations in the visualisations and the tools. A Geo participant, for example, describes awareness of how they have made certain choices (“been limiting ourselves”) in what they focus on by excluding certain types of data27 and also that the remaining data sets are neither large nor complete enough to generalise, draw conclusions, and “make it statistically correct”:

And besides, we’ve also been limiting ourselves to looking at those that are moderately or severely injured ... and deceased. You’ll have to say like this, really, that it’s a bit tricky to talk– We’re a bit careful now when we draw conclusions from this– When we speak in statistical terms, because– fortunately, you have to say, there are not enough accidents to be able to draw some– to make it statistically correct. (Geo, 18)

In the broadest sense, the participants also enact critical approaches to the tools that seem based on reservations concerning the use of “statistics” in general. Again, then, these approaches are grounded in a priori knowledge, here of the more generic character concerning general risks: “You should always be careful, I think, about using too much statistics, because there is a risk that we make people think about that only, instead of thinking about the more human sides of a story, but that– We try to work with that as well” (Trends, 21). Increased attention to and interests in data and their possibilities and restrictions as information resources are described as having emerged comparatively recently, even in the international arena, and this development is perceived to be reflected also in the participants’ own more immediate work and in conversations with colleagues: “the discussion surrounding quality in the data: ‘What are real statistics?’, ‘How can we know that this tells the truth?’, has started. I think that discussion has become a bit more visible with us” (Trends, 22). New ways to handle and use data, such as Trendalyzer,

27 The reasons for this are, at least in part, connected by the participants to the guiding influence of the Zero Vision, a Swedish political goal and agenda described in more detail later in this section.
are felt to have contributed to this development by opening up new possibilities and perspectives.

To the sort of experts’ reservations discussed here also belongs knowledge that not all topics can be quantified and measured and thereby visualised in a proper way in the tools. The participant quoted below exemplifies this well in describing a sense of the whole national and international political arena as highly data focussed (“We also have a fact based world”). Some topics and areas in particular, such as environmental politics, are perceived to stand out as traditionally organised around quantitative measurements and subsequent discussions on how to interpret and translate into political action those data and numbers. These political fields and practices are also felt to have led to similarly quantifiable and data-driven agendas (“You’ve set up goals”) which have also spread to other sorts of political discussions and areas. This described development represents an understanding that motivates a critical approach to and use of Trendalyzer in an intellectually distanced and scrutinising way so that not issues of more qualitative character are allowed to become over-simplified into ‘numbers’ or altogether overlooked because they happen to be of a kind that do not easily lend themselves to quantifications of the sort promoted by both the general political climate and the tool’s design:

It’s obvious that [Trendalyzer] is definitely also useful for our understanding of these problems, to the extent that they’re measurable statistically– not all of them are ... All that I mentioned before, with human rights and so on, all areas are not measurable. The environmental area, a lot can be measured in a meaningful way, but certainly not everything in a meaningful way. (Trends, 23)

Accounts of this type represent a sort of critical approach towards both tools in the participants’ enactments of them as to certain extents bound or restricted by quantitatively formulated political goals and agendas. There are a number of these that are mentioned in both cases, but the unquestionably most influential are the Zero Vision in Geo and the United Nations Millennium Development Goals in Trends. The Zero Vision is a document formulating a political goal of zero fatalities and severely injured in traffic, assumed by the Swedish parliament in 1997 (Nollvisionen, 1997) and intended to guide all traffic security enhancement work in Sweden. The overall goal of the Zero Vision has thereafter also been broken down into similarly quantitative milestones on the way – most recently defined as a goal to halve the number of fatalities in traffic between 2007 and 2020 (which means getting the figure of fatalities down to 220) (Vägverket, 2008). The Millennium Development Goals (MDGs), on the other hand, are part of the United
Nations Millennium Declaration (United Nations General Assembly, 2000) and form “a blueprint agreed to by all the world’s countries and all the world’s leading development institutions” to reach a number of quantitative goals by 2015, including halving extreme poverty, stopping the spread of HIV/AIDS and providing universal primary education (United Nations, n.d.). As central as these goals are, then, the participants are also careful to explain that they are aware of their limitations and that they act and position themselves accordingly:

I mean, like the Millennium Declaration– the indicators that they defined for that ... there were also a lot of things that were not selected for inclusion there. For example, there is no indicator that in a good way measures sexual and reproductive health and rights– what we call SRHR– there. I mean, this about women’s rights to their own bodies and that bit is really very neglected … We constantly have to question and think again: “What have we been missing now?”, “What aren’t we measuring now?” (Trends, 24, 25)

Similarly in Geo, the Zero Vision is recurrently mentioned as a yard stick and goal for the operations at the Traffic and Public Transport Authority, but as explained by a participant, this is a goal that in itself might be unnecessarily restricting if allowed to guide their activities altogether. In their work to enhance traffic security, they should be concerned with reducing also the number of injured which includes then also light injuries even though this is not an acknowledged political goal in the same way. The Zero Vision needs then also to be kept at a little distance, to not lose sight of other important aspects of their work: “if you’re going to work strictly in accordance with the Zero Vision’s agenda, then you can leave that [data on light injuries] aside, but we still feel that it’s good for the whole picture” (Geo, 19).

The examples above describe distanced and critical approaches towards the tools as constrained by and reproducing the exclusions of values and topics characteristic of political goals. The recognition and understanding of this is felt to require compensations in the form of ‘reading against’ the visualisations, questioning their limitations, and including those missing aspects in activities and practices in other ways. In theoretical terms, the participants enact these critical approaches from an understanding of the tools as intertwined with political and quantitative goals and measurements that are at risk to discipline – control in a restrictive sense (c.f., Hutchins, 1995, p. 82; Latour, 1986, p. 17; Säljö, 2005, p. 44, c.f. also section 4.2.1) – their thinking and acting if they do not maintain a critical distance to them.

Other examples include reservations about potential disciplinary effects of the tools’ structuring devices in a more general sense, perhaps leading them to settle for
the easiest and most convenient action afforded by the tool, in the Geo case: looking at patterns of geographical distribution only. Reservations of this type can be said to point towards critical understandings of the potential naturalisation processes by which certain modes of representation become taken for granted as the only way of doing things:

I do think there’s room for improvement. Because now it’s very easy to press a button— even I can do that— say: “Show ... accidents”. Well, “pop” it goes, and then there are a lot of dots. Yes. But to know that you can actually click on those dots— so you can open up reports then and see (...) Knowing that you can actually do a search on the material where you can ask questions and seek out— On that I think there’s less knowledge. (Geo, 20)

There are also examples of how the participants in both cases mention that the main structuring device in the other case’s tool is inadequately included or available in ‘their own’ tool. This Geo participant explains for example that: “if you’re going to compare all the age groups with each other, then a majority of fifteen-year-olds are hurt, that’s not interesting to show on a map ... If you want to look at trends or trend curves or things like that, then it’s not as interesting any more” (Geo, 21, 22), and a Trends participant mentions how “there are some things that aren’t well suited to show with [Trendalyzer] ... If you have some indicator that might be interesting from [a] geographical perspective [then] you can’t see from the image how the countries are positioned geographically in relation to each other” (Trends, 26).

Trying to compensate for structuring device and data related restrictions in practical action, however, is difficult. In Geo, for example, the data that they would need in order to be able to focus on light traffic injuries are not readily available today. The police, from whose reports they receive some of their data, are rarely involved in reporting minor accidents, and the hospital reports from which they receive corresponding data are from emergency hospitals only, and they concentrate on comparatively severe injuries. To be able to include also light injuries, they would probably need access to data from journals at local health clinics as well, since they take care of less severe cases. Even this, however, would probably not be enough since many accidents do not end up with a hospital visit at all. To a great extent, then, the participants have to rely on their experience and prior knowledge to keep the awareness of these data restrictions alive and not forget about them. One participant describes this as a matter of “security in the system” and as the “main concern”: “Partly how the information has been filled out. We know that we have a huge number of unrecorded cases, in particular it’s the light injuries, where
we would probably like to know more ... And we’re not likely to get a grip on that, definitely not via the police” (Geo, 23).

A major and nearby problem described by Geo participants are integrity related restrictions to access to data on traffic accidents, a consequence of their position as data re-users. Since the data are not primarily collected by the Traffic and Public Transport Authority for their own explicit purposes, the Swedish law on personal data hinders such re-use: “So they [the hospitals] have more complete information. We have more stripped down information. We don’t have any personal identity numbers, for example. We can see how old they are but nothing more than that” (Geo, 24). In some cases, this restriction to data access becomes more apparent and problematic than usual:

Now it’s pretty much a matter of— What shall I say— Learning to utilise what is actually there ... And as we do that, the questions also come: “Well, how good coverage is it?” I mean, it dawns on you a little bit as you go along. We have a really sensitive issue that we’d like to work with a bit now, it’s about (...) that we’re getting indications from [an organisation] that they think that [a certain category in the population] are (...) sort of, to a greater extent involved in accidents. And if you’re going to target actions, then we have to be able to take out some basic data [that support this]. Okay, how do we do that then, we don’t have access to personal identity numbers ... And then we really only need to know: is there an over-representation? And we can’t take that out ourselves. (Geo, 25)

When it comes to social data, personal integrity and privacy concerns are naturally important aspects to consider. As described in the methods section (chapter 5), the choice of cases here deliberately targeted tools for visualisation of social data for these reasons, but there are also significant differences between the cases in relation to this. In Geo, they rely on micro data, i.e., the data report on individual related accidents, and these are also treated and represented individually in the visualisations. In Trends, on the other hand, they utilise macro data, aggregations of data on countless individuals compiled into overall national or regional numbers (as well as non-individual related data, such as gross national product, or number of hospitals). Nevertheless, I had expected there to be more prominent perceived reasons for critical approaches to and uses of the tools with reference to the social nature of data and the different levels of data granularity in the two cases than actually emerged in data production and analysis. Most of the critical approaches and uses found here concern instead other aspects, such as the recognition of necessary trade-offs described in the following section.
6.2.2 Necessary Trade-Offs

This section presents critical approaches and uses of similar character to the ones described above, but in relation to which the participants also assume a more nuanced stance. While they recognise in one sense a number of more or less costly restrictions and choices in the tools, they also perceive of these in another sense as necessary trade-offs for their ability to efficiently conduct their work tasks, orient themselves amongst, and make sense of the vast quantities of data with which they are surrounded. Expressions of these sorts of distanced experts’ understandings come forth mainly as discussions of costs and gains connected to structuring device aspects of the tools, and they are primarily found in the Trends case material.

Above all, the empirical material illustrates interesting and continuous shifts in how the participants sometimes describe the most important benefits of the tools in terms of their perceived abilities to visualise all data in one or several data sets in comprehensive and meaningful ways (c.f. more specific accounts and discussion on this in section 6.1), and at other times in terms of how the tools allow – sometimes even “force” – them to focus on specific aspects and parts of data. These fluctuations in ascribed meanings also appear to be more context than person dependent since one and the same participant can at different times speak of both qualities as the primary benefit of the tool.

From this perspective, the perceived utility of the tools is thus often described as providing solutions to more general organisational and societal problems of too much information that would have been more difficult to handle without the help of MapInfo and Trendalyzer. All the study participants here work in very information dense organisations with tasks that require the handling and analysis of large amounts of data, and although they are aware that the tools embody a number of trade-offs, they also think that these are necessary to manage the work that they need to do: “We’re surrounded by such huge amounts of statistics. I have so much information that we’re almost drowning in it” (Trends, 27). Both tools are described as answering to challenges of this sort, and again, the understandings seem to imply that the tools are valued as different compared to other tools and modalities for using data as information resources. Trendalyzer, for example, provides shortcut alternatives to extensive written reports; a highly valued feature in a work context where one person can have about thirty different projects in various countries to keep track of at once:
… in Mali, Burkina, Laos, Honduras, Guatemala, Nicaragua, regionally in Africa, and maybe regionally in Central America … People that work here really have a lot of things to keep track of– So that, for me, this is a way to quickly be able to go in: “No, but I have to go to an annual meeting”, and then maybe I don’t have time to go over the three hundred pages of the annual report with a fine-tooth comb, but I can quickly go in and see: “But what’s happened in this country, then?” (Trends, 28)

And MapInfo similarly allows quick and effective ‘filtering out’ of data relating to a specific geographical area only; a welcome way to focus and be efficient in the masses of data: “Above all it’s so easy to find … And then you’re usually only interested [in] a certain place. Then it’s very convenient” (Geo, 26).

In the overwhelming mass of data sets and other information, the way aspects of the structuring devices in each tool are felt to help direct the participants’ focus towards certain aspects in particular is described as a big help and a relief. The focus certainly comes with a cost in terms of downplaying all other possibly interesting aspects and variables that also could have been emphasised in visualisations, but there is considerable agreement that most of the times, focus is what is most needed, rather than more comprehensive and inclusive views. This Trends participant, for example, describes how “being forced” to focus by the Trendalyzer visualisation’s inclusion of a few (but internationally agreed upon prioritised and important) indicators (here in the form of the MDGs, c.f. 6.2.1) is different and an excellent ‘counterbalance’ to how they otherwise work:

I’d say it is that we dare to simplify a bit, without making it banal. That we dare to concentrate on fewer numbers of indicators, and that we force ourselves to choose as well– [The visualisation] forces us to choose what it is we’re actually going to look at. Because sometimes it can require a certain degree of concentration to really see what’s happening … In one way … [it’s] a very good counterbalance to how we work otherwise. Because the reporting is very information dense. I mean, there’s an awful lot to go into when you look [at the] national level, it becomes very– I mean, an entire country can gather enormous amounts of information about what’s going on. You can look at what their foreign debt is, and how many that can read, and how many cars there are, who’s talking on mobile phones– I mean, there are so many things that you can look at– “What’s development?” sort of. So that’s why I think that this is a way to be able to focus and get a quick understanding of what’s actually happening. (Trends, 29)

This understanding also again wipes away the difference between data and reality: by close focus on aspects of the data it becomes possible to see “what’s
actually happening”. By focussing on a few indicators, the visualisations “force” focus and simplify what they are intended to represent. The perceived gain is in line with the construction of “harder facts” according to Latour (1986); it is a way to be able to control and manage and explain the ‘messiness’ of data. Enactments of meanings equivalent to the costs described by Latour (involving abstractions from ‘reality’) can be discerned in the background but also seem to be downplayed in various ways. Firstly, there are the dominant practical arguments that restrictive foci are necessary to at all be able to make use of the vast quantities of data. Although ‘selective enclosures’ in these ways show some things at the expense of others (c.f., Joyce, 2005; Latour & Woolgar, 1986/1979), they are justified on these grounds by the participants.28 Secondly, the costs of simplification also seem to be deemphasised by constructions of the tools as inactive conduits in an objective sense; more as placing a magnifying glass on aspects of the world as directly conveyed by data, than as culturally, materially, and practically constrained artefacts.

From an opposing perspective, the incorporation of the Millennium Development Goals in visualisations is at other times also constructed as providing a focus on a more overarching level, stopping people from becoming lost in the numbers themselves without reflecting on what those numbers ‘should’ (be made to) relate to:

Previously, we used to come to these annual run-throughs, and we sat and looked at endless PowerPoint presentations with enormous amounts of information which meant that there was never a focussed discussion about one single thing— but everyone was sitting and fiddling with— and said: “Well, but here we can see a small change: zero point two up, zero point three down”. There never was a focus on what it was really about: to reduce poverty and increase health for poor people. (Trends, 30)

Accounts of this sort demonstrate understandings that sometimes the whole picture is important, sometimes focus and details are important. Both are also associated with ‘costs’ in one sense or another, but as long as one knows the topic and area – as they as experts do – then both overviews and strict foci are allowed and seen as good things, it merely depends on what they need to know: “because usually it’s a simplification we need rather than more details– so for us, [the Trendalyzer visualisation] was very good, actually” (Trends, 31).

28 From another perspective, selective enclosure also describes tinkering and manipulation in order to ‘make inscriptions do and show’ what one wants them to do and show, and can thereby be understood as more deliberate mobilisations for certain purposes, but these aspects of critical literacies are discussed in the following chapter 7.
The shift between overviews and selective enclosures; between getting at the ‘whole picture’ or a specific set of variables and measurements is, as mentioned, recurrent throughout the material. But interestingly, both of these seemingly opposing affordances are – most often – constructed in a positive sense as enabling focus on ‘what is really important’ by still providing intermediate and easily understandable representations of meaning that do not become overly data-centric or quantitatively overwhelming.

The many accounts describing this also show the participants’ general awareness of the trade-offs that characterise their work with the tools, and their crucial yet delicate nature: “I mean, sometimes simplification can be a bit dangerous … you just look at these, you know, very vertically, you sort of just look straight down at one thing and then you miss the whole picture like that. So it’s a balancing act kind of the whole time” (Trends, 32).

The ‘balancing acts’ performed by participants in their tool-interactions also represent critical approaches and uses that the participants explain or associate with their experience and knowledge as professionals and experts – an acquired status that, for obvious reasons, is not shared by the public in general. This understanding thereby also fuels a set of concerns relating to public access to the tools, data and visualisations in question, although with very different connotations both within and between the two cases.

6.2.3 Not Everyone Is an Expert

The Geo and Trends participants display considerable variation in their acquaintances with the tools, how long they have worked with them, and whether they work with all aspects from data to tool development or merely with analysing data and presenting visualisations (c.f., chapter 5 and Appendices C and D). Nonetheless, they can all be described as professional users since they use the tools in their work and since they are comparatively well acquainted with the topics, data, and visualisations in each case. And as demonstrated in the two prior sections, the participants also place considerable weight on the importance of their professional and a priori knowledge for their abilities to identify and handle perceived errors, bias and trade-offs in their interactions with the tools. As an extension of this view, the importance ascribed to prior knowledge is seen to permeate also the participants’ views on (potential) public access to the tools and data. Since ‘outsiders’ and the general public are not experts in a comparable sense, they are also felt to lack necessary sorts of knowledge and experience; a recognition that forms the basis for a number of perceived public access problems and barriers. But although based in a
common understanding, the concerns themselves have strikingly different connotations to the participants, leading to a variety of approaches to and uses of the tools: from restricting public access, to targeted actions to encourage and increase the same.

In Geo, very little of their extensive collections of in-house data are available for free public use on the Internet, and the interest among participants for opening up their data resources through MapInfo visualisations is also notably low. When asked to reflect upon possible benefits or drawbacks of opening up at least certain data sets through MapInfo applications for public use, two main and opposing attitudes and expectations emerged. The first approach represents understandings that public access to data and visualisations is a ‘non-issue’, something that no one is thought to be interested in or benefit from; in the other approach, the public is thought to be interested in getting such access, but with different associated views on whether this should be accommodated or not.

Many of the Geo participants seemed to lean more towards seeing the possibility of public availability of the city’s data resources on the Internet through MapInfo visualisations as a non-issue that was neither in the interest of the public in general nor of individual citizens. For some, this viewpoint was apparently a thought-through position in a realm of possible information related measures, given the work tasks and the data that they have at their disposal: “We’ve not had the ambition ... to spread the information to the public. Which we very well could have done, but in order to do something we have to have a will and a belief that this is useful for the citizens” (Geo, 27). In this view, public availability is simply not deemed to be useful or interesting to the public, and no other hinders to public accessibility are mentioned. For others, such possibilities of public access have – apparently – not even been considered:

(Participant): Well, I really don’t know ... maybe if ... we have a map on the web, [the public can] go in and see traffic issues, what types of problems do we have today ... run down trees, signs, big holes in the street– We might be able to publish that.  
(Interviewer): Is that something you think about?  
(Participant): No! ((laughs)) (Geo, 28)

The other main distinguishable approach in Geo, as mentioned, represents understandings that the public is likely to be interested in access to their various data and visualisations, but with different takes on whether this would be desirable to act upon or not. On the most pragmatic level, these notions associated with public access revolve around whether it would diminish or increase their work load. Some lean towards the view that public access would reduce the number of questions
as it would empower the public to find their own answers: “Many questions are sort of only about ‘Where can I find that?’, or ‘What does it look like there?’, or ‘Where can you do this or that?’ And those types of questions the public could seek answers to themselves, I think” (Geo, 29). Others assume in a more negative sense that public availability would increase their work load; and others still see both as possible outcomes:

We can get less questions to our traffic customer support for example, which costs money, so you know– You can find different motives for– If we inform properly about parking spaces, then maybe we won’t get so many questions about parking spaces /.../ Although at the same time if you have a lot on the Internet you get a lot of questions about– if it’s common. So it’s a bit difficult to know which is– (Geo, 30; c.f. also Geo, 31)

The Geo participants that assume the existence of a public interest in their data and visualisations mention, not least, that they know that specific types of information that is already available on the Internet, in particular relating to parking in the city, are in high demand from citizens. Some data on that have also been made available with apparently satisfactory outcomes so far (c.f., Geo, 32; Geo, 32, 33). Notably, though, these examples almost exclusively mention uses of MapInfo as a tool for geographical orientation and for localising specific places and objects in the city – i.e., these accounts can be said to relate to primary artefact uses of MapInfo as a comparatively conventional map, and not to more advanced uses of analysing data as a ground for interpretations of their meanings and related interpretations of appropriate responses.

But there are also expressions of reluctance towards public access that have to do with fears that the public might misinterpret the information since – as ‘non-experts’ – they do not know everything they would need to know in order to handle errors or make the right interpretations. The arguments found here can be described as a sort of ‘benevolent guardian’ stance intended to protect the public; the data are simply not thought to be ‘good enough’ for making them freely available online: “It’s important that those [data] that are the most public are correct, as correct as possible, because when you get a bit further away, then it’s more difficult to interpret the errors” (Geo, 34).

The terminology used in the quote above is particularly interesting since it describes a perception of critical literacies in terms of closeness and distance, reminiscent of critical literacy recommendations to read against and stay at a distance (c.f., Andersen, 2006; Bruce, 2000; section 3.3.1) – although here, closeness is what
is described as necessary for appropriate critical approaches and uses. This view reinforces the participants’ appreciation of the importance of first-hand knowledge gained through experience and of professional vision (see also sections 6.2.1 and 6.2.2) to be able to act ‘critically’. The view is also in distinct opposition to both the above mentioned critical literacy definitions and theories on black-boxing, naturalisation and institutionalisation processes – all of which connect ‘critical’ with ‘distance’. Becoming overly familiar is here instead thought likely to hide an artefact’s mediated and material nature and make it appear natural, objective and true (c.f. sections 4.1.2 and 4.2.1). ‘Critical’ here, then, takes on seemingly different connotations in the theoretical framework and in the empirical material.

Most commonly, the ‘benevolent guardian’ arguments are associated with perceived ‘less-than-optimal’ data updates which means that the data might not always incorporate, for example, the latest changes in traffic regulations:

... you have to make sure it’s updated. It can never be incorrect if it is to be available to the public. We can sit here and be aware that it’s not certain that it’s updated, something may have happened since the last turn. But if you publish it online it really has to correspond with the truth. (Geo, 35)

These careful and protective stances are of course also parts of the basic responsibilities of public authorities, and mistakes of this type are simply described as unthinkable; they can never take the risk of providing incorrect information. If a dataset is to be released and made available in MapInfo “it can never be incorrect” because the public is thought to lack something that the internal users at Geo have, and that is crucial for the ‘correct’ uses of, or approaches to, these data; namely a critical understanding of the nature of potential flaws and errors (“we can sit here and be aware that it’s not certain it’s updated, something may have happened since the last turn”). Likewise, the previously mentioned effect of unspecific georeferencing which can make one accident appear as two in the visualisation is another such hinder: “Of course you could maybe just publish that, sort of, that year’s reported accidents, then, neutrally ... But then you also have to have a pretty good system so there are no duplicates and things like that” (Geo, 36).

Some of the experts clearly feel that they ‘know’ what the data mean and/or how they should be used and in that process become both protective and possessive of them, which sometimes applies to in-house colleagues as well:

There can be some executive officers that don’t want to give away their data because they’re afraid that they will be misinterpreted. You want to be able to explain orally
to the one that receives the data—Not give out information without sending along that this you have to be very careful with because it’s—But at the same time it’s difficult to have that ambition to always be able to talk to the one that takes part of the information. We have for example traffic data where certain information is available but where the executive officer is pretty restrictive about giving it up like that. But we are working on it. (Geo, 37)

The combination of social data and geographical representation also underpins certain fears that the public’s lack of expertise and first-hand knowledge will lead to misinterpretations that cause not only practical mistakes but also psychological worries or fears:

Yes, yes, we’re working on that, that we shall publish some more. But I don’t know if we should have any geographical data really ... I mean, we are more than happy to answer the question how many bicycle accidents there are on [Z-street]. But from that to say that, “Okay, there are twenty-five injured cyclists” say that “It’s the most dangerous place.” We have to have something to put that in relation to, and we haven’t really produced that measurement yet. So therefore we’re a bit cautious ... We can say that it perhaps— “This is the street where most accidents occur—” ((laughs)) [but] is it the most dangerous? (Geo, 38)

Closely aligned with this view on problems with public access are also concerns that unscrupulous news media will knowingly misconstrue the meanings of data and visualisations in order to create sensational and selling headlines:

I could worry a bit concerning this that ((makes the sound of an explosion)) kind of exaggerates— and then you make a big thing like that. A single stroke that isn’t very relevant. And then I’m back in this, kind of, that— these— really popular with these “Ten most dangerous places” that we ((makes the sound of a struggle)) keep away from us. (Geo, 39)

Turning to the Trends case, it becomes obvious that they too perceive many and similar barriers to public access to data and visualisations. It also becomes obvious, however, that the meanings of and attitudes towards those barriers are very different between the two cases. Whereas for the Geo participants, there are few incentives and little interest to strive towards public access to and use of data and tools, the Trends participants consider the overcoming of barriers to broad uses of Trendalyzer as an explicit and central goal for public good and political reasons of democratic participation (presented in sections 7.3.3 and 7.3.4).
On the most concrete level of barriers to public access and use, the Trends participants count a number of problems related to language and alphabetical incompatibilities as well as a complex and demanding structure for inputting and running data in the Trendalyzer application for visualisations (Trends, 33, 34). Despite their explicit goal to get more people involved in data analysis, for example, the Gapminder foundation did not have a version of the application itself available for download or use online at the time of the study and this was “not because we like to keep it secret or not allow people”, but simply because they had not been able to work out a version that was user friendly enough for outsiders²⁹ (Trends, 35).

For the central goal of increasing access to and involvement in data analysis and interpretation, thus, user friendly improvements on two levels become intertwined. Trendalyzer is primarily intended to turn data into more easily available information resources, but to achieve that, the tool itself needs also to be (more) user friendly: “[It’s sort of about] making the entrance easier for viewers” (Trends, 36). And it is precisely such features of easy access and ease of use that explain many of those instances when one of the ready-made Trendalyzer visualisations (charts ‘pre-loaded’ with data and equipped with certain sets of indicators) has been chosen as basis for analyses and discussions and introduced to new users: “It [Trendalyzer] was also something that we got them to use there in Honduras. Just because it was so easy to get access to, and, well, use it online and things like that” (Trends, 37).

Numerous more complex problems connected to non-experts’ uses of Trendalyzer are, however, also featured in the Trends material. The more challenging barriers to be overcome are not of technological character, but ascribed to the mindsets of ‘the public’ and ‘non-experts’. The ways in which the participants approach and use Trendalyzer to overcome these illustrate that the problems for non-experts’ uses of the tool are perceived to be about data and visualisations as something altogether foreign or unknown; that people in general have very different levels of ambition and commitment and therefore will accept different thresholds to use or get started with Trendalyzer visualisations; and that the lack of accompanying interpretations that ‘tell’ users how to interpret the patterns in visualisations might be intimidating.

Firstly, then, to sort of promote Trendalyzer and get people acquainted with it, the Gapminder foundation has started to cut down on what they perceive to be too time-consuming live lectures to instead work more intensely with recording

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²⁹ As previously mentioned (section 5.1.4), the original Trendalyzer application has been re-worked into such a public tool following Google’s acquisition of it, and is currently available for download under the name of Google’s Motion Chart (Google, n.d).
video lectures for the Internet ("Gap casts", in their words). The idea is both to inform about whatever topic that is treated in each so called “Gap cast”, but also to increase the general level of awareness and sense of comfort with data and the Trendalyzer tool to lower the threshold for personal use: “We’re still only two, three people [that use it at Gapminder] so it becomes sort of a bottleneck here, if we’re the only ones using the tool. We think that more people should use the tool, or that more people have to see us use the tool, or both” (Trends, 38).

In addition to demonstrations through lectures and Gapcasts, possibilities to accommodate the tool to different levels of commitment among ‘ordinary’ potential users is a related concern. The live and video commented presentations of Trendalyzer visualisations take care of users on “level one, where you want to lean back and see it being presented” (Trends, 39). The slightly more engaged users can use the ‘pre-loaded’ visualisations with specific sets of data and indicators that can be played to run over a predetermined time period, but without accompanying commentaries (like the Gapminder World Chart). And the third, most advanced, level involves “to use it as I do now: to look at it, make your own graphs and present— ... analyse yourself” (ibid.). This highest degree of user involvement with the tool is described as requiring both interest, topical knowledge and technology know-how (“you have to be a bit interested, sort of, and know what to click on and look at”; Trends, 40). This level of use is therefore not anticipated to attract hoards of people who will “download [data] and put them into their own computer, and completely make their own graphs”, but reaching at least a sufficient number of such users appears crucial for the democratising ideas (c.f. section 7.3.3 and 7.3.4) behind the tool: “That’s where the multiplication effect comes in, I think, when we have that” (ibid.). The actions described here, then, are all measures thought appropriate for making the tool available to the broad public; for different purposes, users and levels of use.

The most difficult and challenging barrier to public access and use, however, seems to be ascribed to the openness of the visualisations as information resources; that it is never ‘known’ from the beginning what a visualisation will come to show and how the patters ‘should’ be interpreted and understood. The participant quoted below, for example, has given numerous presentations with Trendalyzer, many of them in schools, and tried to convince teachers to start using the tool themselves, but experienced resistance or reluctance for these reasons:

And in the beginning I felt it was a bit hard-going so then I thought that they needed a guide ... So then we did a technical guide, but that was not what they needed at all, because any teacher can handle that, clicking on the play button and pull the...
lever up and down … Well then, maybe they need background facts. Sort of that they needed a conception of the world, what you’re going to say when you show the bubbles. And then I wrote a book … it’s like a textbook to the bubble graphs … Then I notice that people are coming up: “Yes, I’ve used that in school and it’s been very effective”, or “I’ve read that in your book, then we’ve used these (…)” (Trends, 41)

To not in advance be able to be sure of what ‘stories’ that will ‘emerge’ in a specific visualisation becomes perceived as a major obstacle and cause of uncertainty and unease for non-experts – and for apparently good reasons. The a priori knowledge described necessary to be able to make ‘the right’ or substantiated interpretations include not only subject and topical knowledge but also knowledge of data and statistics in general. It is not enough, for example, to simply ‘read’ a visualisation without taking into consideration potential changes in the underlying data sets during the time period observed:

If you’re not familiar with the subject it’s a bit scary to show statistics on it because it might show something completely different, then maybe you’ll say like this: ‘Look how long they live in China’, “Yes, that’s because they’ve given up their neighbouring countries’ or something like that.” (Trends, 42)

The likelihood of misinterpretations is, however, mostly perceived by the Trends participants as a natural step in every process when a ‘new’ type of information resource is introduced, and fears concerning public access to data are described as both exaggerated and unfounded. Public access, whatever it leads to, is here seen as a good in itself (see chapter 7) but they also recognise that Trendalyzer and similar visualisation tools and data are challenging for non-experts that do not have access to the sorts of experience and knowledge that they themselves have accumulated. By not providing answers or interpretations, the visualisations admittedly raise questions that for example teachers are seen to have found intimidating and difficult to relate to:

If you show the advances of Chile for example– … because Chile is the country that’s had– well– probably the fastest progress in terms of improving child health, kind of. And that’s of course a difficult thing for us democrats to realise that the two most successful countries in fighting child mortality have been Cuba and Chile– that’s sort of Castro and Pinochet … And if you show that in a school class you have to have the answers and things like that: “Ok, so it’s communism we should have?” … “A military junta we should have?” … Then you’re gonna try to deal with that somehow, and then you have to have the factual background: what was it that Chile
did that worked out well, sort of? … So you have to be able to deal with and answer those types of questions– and I think that is (...) The statistics in themselves do not give that type of explanations, and I think some people are a bit afraid of that: they feel that they have to problematise and give the full picture always. (Trends, 43)

The openness of output, that virtually anything can appear in a visualisation without explanation, seems in fact to influence certain tool interactions within the Trends case as well, in descriptions of how sometimes sticking to ‘known’ and ‘rehearsed’ pre-loaded visualisations that have been “learnt” are preferred: “Well, I’ve learnt one of these presentations, so that’s the one I use the most” (Trends, 44). There really seems to be considerable perceived difference between knowing beforehand various bias, deficiencies and weaknesses in data, and meeting them straight on with no prior knowledge as a data visualisation. As one participant describes, another but related effect connected with the visualisations are that they may also be difficult to at all question and take a critical stance towards for non-experts: “I can sometimes get the feeling that no one questions what I’m saying, because I’ve shown such overpowering statistics ... ‘Is there anyone that has any questions?', and then it’s completely silent because they (...) How are you supposed to question that, sort of?” (Trends, 45)

Overall, the accounts described here combine to construct the data and visualisations as highly challenging information resources for the public in general due to their combination of objectively alluring and persuasive characteristics with non-propositional, non-textual natures – both of which are felt to need, or at least significantly benefit from, a priori knowledge and acquired professional vision to master in appropriate ways.

6.3 CONCLUSIONS

The results of the analysis presented in this chapter illustrate above all the simultaneous existence of a rich variety of both critical literacies and non-critical enactments of the visualisation tools among the participants in each case study. It demonstrates that the participants as experts in their areas and as well acquainted with their respective data, tools and visualisations have both possibilities and incentives to speak about the tools in unproblematic terms as objective providers of knowledge on some occasions, only to resort in others to more critically informed ways of talking and acting. The co-existence of both constitutes further testament to the previously observed pervasiveness of ‘public images’ of data and (digital)
visual representation as expressed, for example, in academic definitions of 
visualisation (c.f., section 2.1) and more general and popular narratives and 
epistemologies on high-tech and visual representations (Campbell, 2007; Joyce, 
2005). Other reasons for talking about and constructing the tools in non-critical 
terms despite their simultaneous wide critical understandings might also be 
understood in ways similar to the “dual registers” of medical scientists described by 
Beaulieu (2002, p. 75) who, aware of both the lower status of visual knowledge and 
its public appeal were found to switch between discourses to “have it both ways”.

These diverse approaches to and uses of the visualisation tools also construct 
them as information resources in very different ways. Through the non-critical 
enactments as powerful and intuitive providers of answers, the tools are constructed 
with the help of epistemologies and beliefs associated with information and 
cognition such as the transmission metaphor; fact-based views on data; understand-
standings of technology as neutral and objective; and of visual representations as 
‘real’ and intuitively and cognitively available. These enactments show no traces of 
the materialities of the visualisation tools as representational artefacts and they are 
rather constructed as effective but inactive conduits that reveal ‘the meanings’ of 
data which are equalled to the ways things ‘are’. Through these accounts, the many 
steps involved, the many sites of production, the many times at which budget and 
politics, actor interests, project aims and goals, technological restrictions and inter-
face designs et cetera have affected the production of data sets and become imbued 
in the tools and their visualisations, are wiped away. The effect is to construct the 
visualisation tools as automated generators of new knowledge and as immaterial 
and unmediated reflections of reality; they appear black-boxed, naturalised, taken 
for granted and perhaps even naturalised (c.f., section 4.2.1).

The other set of critical approaches to and uses of the tools presents in 
contrast a great number of problems related to materiality, most primarily associ-
ated with errors in the data; bias in structuring devices; and costly yet necessary 
trade-offs between providing ‘the whole picture’ and selective enclosures. Both the 
identification of these problems and the perceived appropriate ways to handle them 
are connected by the participants to first-hand experience and acquired knowledge, 
and this understanding then also leads to approaches to and uses of the tools as 
difficult and problematic for non-expert users. The examples represent critical 
literacies through which the visualisation tools are constructed as detached informa-
tion resources; free-standing objects with fixed meanings that require a priori know-
ledge of subjects and data (or statistics). Their materialities and cultural and con-
structed natures are hereby emphasised, but only at the point of a prior ‘construction’ when certain types of political interests and errors are ‘put into’ the
data sets and visualisations and thereafter transmitted by the visualisation tools as inactive or objective transport devices carrying content from one point to another. At the point of ‘unpacking’ in these views, users need a priori acquired knowledge to deal with this in critically informed manners.
In this chapter, findings from the analysis guided by the second research question, *In what ways do the participants approach and use the tools as mediators of political and power related interests?*, are presented. The question represents a pluralistic situated literacies adaptation of what has previously been defined in information policy inspired versions of critical literacy definitions. These definitions place focus on the formulation and asking of critical questions concerning who has access to produce and consume information; who owns and controls information; as well as how and with what consequences those capabilities are exercised. Other aspects of these definitions emphasise also powers and skills to transform dominant accounts or produce alternatives to work in favour of other interests.

The first set of examples presented here (section 7.1) illustrates how the participants perceive the visualisation tools as both afflicted by and restricted in their potentials as information resources by uncooperative or even immoral restrictions to data access imposed and enforced by primary data holders. In this sense, both the tools and the participants themselves are constructed as ‘victims’ of other actors’ power and political related interests and actions. The image conveyed places both the tools and the participants in the middle of a political conflict enacted around data access with perceived far-reaching consequences for public good governance, and for democratic participation and transparency. In the two following sections,
the analysis illustrates on the other hand almost a reversed set of critical approaches and uses by which the tools are constructed as both passively mediating, and actively mobilised by the participants for, allocation and control of various sorts of resources such as money and personnel (7.2) and knowledge (7.3). In the examples of active mobilisation, the participants are seen to transform themselves and the tools from ‘victims’ or ‘recipients’ to active actors that strive to enforce their own (work related) power and political interests through tool-mediation.

This particular political and power related theme in focus here also came to bring forth more pronounced differences between the two cases compared to the analysis presented in the previous chapter 6. To make the presentation as clear as possible, it is throughout this chapter consistently divided into separate sections for results from each case.

7.1 DATA ACCESS CONFLICTS

This first theme presented in this chapter, described as data access conflicts, is grounded in the similar situation in both cases as reliant (although not exclusively in Geo) on what have here been described as second-hand data on both the level of the ‘objects’ of visualisations (the various data sets upon which analyses are performed) as well as on the ‘tool-level’ of structuring devices (in Geo as various forms of map data and in Trends as indicators for development and political goals). In other words, much of the data on which both cases rely have not been produced within each ‘case setting’ or with consideration to the intended purposes and uses in these cases. This situation is of course associated with a number of concrete practical problems (c.f., chapter 5 and section 6.1.2) but also, as shown here, perceived as laden with conflicts of interest of political and power related nature. These perceived conflicts concern restrictions to data access from primary data holders with associated limitations for re-use, hindering both optimal uses of the tools as such as well as the analysis of specific data.

The participants’ critical approaches and uses relating to this perceived data access conflict theme are seen to construct the data and visualisation tools in question in various ways as public good resources afflicted and hindered by primary data holders’ passively or actively imposed restrictions on data access. Associated with this understanding are also identifications of a number of negative consequences for the functions and uses of the tools as information resources. In Geo, the consequences primarily mentioned or implied are that the problems of data access hinder developments of uses and functions of the tool and the production and application
of public good knowledge (section 7.1.1) and in Trends that they hinder transparent governance and democratic, public participation in data analyses (7.1.2).

The whole issue of data access related conflicts, however, is of course incredibly complex and likely to be grounded in many more interests, beliefs and actions than come across in the examples here. For example, that public access to data is intimately connected to notions of democratic transparency through allowing critical scrutiny of the very bases upon which decisions are made and research and development conducted is now fairly well-established and increasingly embraced on both national and international levels of nations and research organisations (c.f., Buckland, 2011; Cabinet Office, 2012; PARSE.Insight, 2010; Schmidt & Peters, 2008; c.f. also section 3.2.2). It does not, however, seem far-fetched to consider also that transparency and critical scrutiny are certainly welcomed as democratic improvements by some actors, whereas others will just as certainly hold opposing views. In the analysis presented in this first section (7.1), these sorts of aspects are not particularly prominent, but in the two following sections (7.2 and 7.3) a number of critical approaches to and uses of the tools bring forth examples of such understandings.

7.1.1 Map and Traffic Accident Data (Geo)

As demonstrated in the first chapter of this dissertation, geographic information systems (GIS) and technologies in particular have become successfully commercialised and commonplace devices and by association, so have the structuring devices needed for their functioning. To use or purchase map data, however, can be very costly (c.f., Dodge & Perkins, 2009) and this is noticeable also in the Geo case: “The main problem may be expensive map data” (Geo, 40). In fact, economic restrictions to access emerge as one the most serious perceived obstacles for future developments and uses of MapInfo as information resource on a broad scale in the Geo related context: “it’s that map data wouldn’t be so expensive– because it’s pretty expensive to purchase for those who need it. I mean, license fees and things like that for map data” (Geo, 41). This situation is further described as something of a shift in progress: “because the accessibility to data [of other types than map data] increases all the time, and, in general, that it’s easier to get hold of, when it’s just to download from the Internet and things like that” (Geo, 42). From a Geo perspective on this development, then, the main problem with ‘data’ is that they still require the acquisition of expensive structuring devices – primarily in the form of map data and possibly satellite/orthographic image overlays – for their useful handling and analysis.
The map data needed in Geo are controlled by another department within Gothenburg city that has responsibility for the entire collection of maps and aerial photos over the city. Since the implementation of the centrally acquired GIS system MapInfo, all other city departments and companies now need to have access to these maps in order to organise, structure, and work with their particular data: “We have our own layers on top that are unique for our operations. [But] you have to have some type of background map to place this on top of to be able to orient yourself; to be able to get our wires and other (traffic devices) in place” (Geo, 43).

What they describe is a monopoly situation felt to unjustly privilege the agency with control over these maps and whose profit interests are in the way of other interests of other agencies in the city and also of the general good and benefit of the city as a whole:

{Agency X} has a monopoly position since they have all the maps there with them. It’s probably always been like that, it’s old tradition. They received an assignment from the city council [to] take care of primary maps … they charge us other holding companies and administrative authorities for access to these maps, we can’t get them in any other way except through them … So it’s a little– unfortunate that it’s become like that. That they can charge for something that should be natural for all within the city of Gothenburg to get for free. [That’s another] thing that inhibits the development … It becomes rather obligatory with map data. It’s sad it’s like that, and it’s like that in all of Sweden … [You] can buy a cool, cheap system, but you can’t fill it with useful– So that’s just the way it is I guess. (Geo, 44)

The ways in which they reason about this can be seen to lift their perceptions of map data to the level of infrastructure for public good effects. In fact, the occasions of expressed sympathy in the empirical material towards costly access to data of either sort are strikingly rare. Although the participants know that it is costly, demanding and incredibly important to produce and manage in particular map data of high quality (i.e., with high precision and continuously updated) they simultaneously lean towards the opinion that the public good effects of being able to analyse and make use of vast data resources in the ways enabled by MapInfo outweigh opposing protective and financial reasons and arguments for restricted access. The only participant here that explicitly voices an ambiguous stance in this perceived conflict illustrates the point particularly well, stating on the one hand that: “I know what an incredible cost it means to produce it [map data] and keep it up to date”, yet continues in the same breath to describe how the whole issue might benefit from being looked upon in a different light, as a long-term investment for
public good: “maybe it’s like that, that they actually should invest a bit more money in things that might not go directly to having to purchase the products, but— maybe it would also be more easily available like that” (Geo, 45).

The problems of data access in Geo also relate to data on the level of objects of analysis. For their uses of MapInfo, it is particularly important with highly specific representations of geographic location of traffic accidents for their ability to perform meaningful analyses. A major problem then is that the participants experience a troublesome mismatch between the needs and interests of their own operations and the needs and interests of those responsible for managing and uploading data for those MapInfo visualisations: “if you only work with statistics— on a higher level then it doesn’t matter with these details but— we want to be able to use it for— or— look at small places as well” (Geo, 46). A recent example involved a bus route afflicted by a number of accidents precisely where the bus exited from a slip road onto a larger road, but where the map based representations of these accidents were found to be off mark (and in different directions) by a couple of hundred meters: “and then you don’t see that problem and can’t use it maybe to— motivate that you have to do something about that intersection” (Geo, 47).

For the Traffic and Public Transport Authority’s needs, then, more specific georeferencing of accident locations with the help of GPS technology would be the preferred solution. However, they also explain that their concerns are difficult if not impossible to introduce on par with the primary objectives of established police and paramedics routines and policies for on-site procedures. In part, the participants are sympathetic to this situation: it is, of course, more important for paramedics to quickly get an injured person to hospital than to record the exact location. On the other hand, there is also the feeling that there might be a fairly simple way to improve the quality of their work with the data if, for example, the police could use GPS devices and, at the simple press of a button, automatically record an exact position. This is perceived to be worth striving towards since after all, their work with analyses intended to reduce the number of accidents in the first place is also highly valid and important. For this reason, Geo participants and their colleagues have tried to negotiate greater awareness of, and adaptation to, their needs in future data production and management practices by reporting back on errors, and by numerous visits to and meetings with the other agencies and people working with the data. So far, however, they describe those negotiations as largely unsuccessful which they think have to do with the other actors’ perceptions of financial and practical costs associated with suggested changes as well as a more general lack of awareness and interest in their needs (Geo, 48; Geo, 49).
7.1.2 Nation-Level Social Data (Trends)

In Trends as well as in Geo, perceived overly rigid restrictions to data access and re-use by primary data holders are felt to introduce barriers that not only strike unevenly and particularly hard against financially weak or otherwise politically marginalised actors, but that also work in direct counterproductive ways. When what has been deemed to be interesting data are too costly to access and use, then data that would have public good effects (and therefore should be of a public good character) will have to be left aside due to the all too high costs involved in their use. The study participants in Trends express a whole range of problems connected with getting access to the data sets they need, and one of the most prominent causes of frustration in this sense is the reluctance from original data holders to open up and share their resources for free: “that makes it a huge problem, that it’s so difficult to get hold of statistics” (Trends, 46).

Major actors are felt to unjustly control and monopolise data that are not ‘theirs’ to begin with. The sort of government and public sector data used for the Trendalyzer visualisations discussed here ought to be public and freely available according to the Trends participants, not least since those data are produced with public fund resources (“tax payers’ money”): “[Those public data bases] were difficult enough to get to. Incredibly and shamefully difficult to get to them. They already belong to the tax payers, but that was on an organisational level. That has been very difficult the whole way” (Trends, 47).

The difficulties of access to data, however, also spur significant frustration voiced in terms of more ideological understandings of data as belonging to that group of public good resources that are or should be exempt from intellectual property rights claims for utilitarian, democratic and creative re-use reasons. Implicitly as well as explicitly there are examples of views of these government and public sector data that reflect the age-old conflict between ‘public domain’ or ‘raw material’ and works or products that are the results of intellectual (or considerable physical) labour and thereby legally possible to own and trade (c.f. e.g., Boyle, 1996; Hemmungs Wirtén, 2004):

... and that’s completely unreasonable; that data cost money. It’s one thing if I make a product; if I make a book– print a book– then you can charge for the print of course, naturally, that’s– and the analysis that I’m doing– naturally you should pay for that. But when you still have data there at the same time– It’s not like the World Bank has walked about counting, you know, but they’ve received this somehow–
Collected and processed and charging money for—That’s how I feel—Or, unreasonable, well, it’s stupid, you know, it becomes so counterproductive, because if you’d had a fantastic product but no one used it because it costs money—And you don’t get in—You get some tiny little percent of what it costs to produce it anyway, so it’s not very economical anyway to charge a small percent and not get any users to it. (Trends, 48)

Besides hindering access and use in the first place, these perceived monopolising, overprotective and even unjust data control measures by major international organisations are also seen to cause several other unfortunate consequences, such as not being able to re-publish the full data sets together with visualisations. This is considered a serious problem with far-reaching consequences as the restrictions prohibiting full disclosure of the complete underlying data sets linked to or juxtaposed with visualisations make it impossible for external users to independently check the bases for these visualisations. The problems of data access are then costly also because they continue well into secondary re-use issues once the data have been acquired for one type of use. Restrictive ownership claims hinder the re-publishing or otherwise public availability making of those data or products thereof (the visualisations): “Yes, well, that’s always been the problem. If we want to show it on our website then there are a lot of data that—Above all the World Bank is the biggest problem. They charge for their data and that means that we can’t put it on the [Internet]” (Trends, 49).

Whereas the general feeling in Trends seems to be that things are at least starting to improve—the United Nations and the OECD (Organisation for Economic Co-operation and Development) have, for example, made a lot of their data freely available, as have a number of national statistical agencies around the world—the situation is still felt to be far from satisfactory: “the thing is … it should be clear, there shouldn’t be a question mark. When I have [the number] one, you’re supposed to be able to click and open up a source and link to data and so on” (Trends, 50). Virtually all government and public sector (social) data on aggregated level (i.e., not micro level data that are integrity sensitive) must, in the accounts of the Trends participants, be available for critical scrutiny and verification; they should be “freely available—easily available—and easy to understand what they are, and easy for the users to look at and understand what they’re saying, pretty much, and then download the data themselves so you can look at them for yourself” (Trends, 51).

In this whole situation deemed seriously amiss, Trendalyzer is constructed not merely as an information resource afflicted and restricted by ignorant, reluctant, or straight-out profit-seeking and self-interested data holders; just as in Geo, it is also
constructed as a ‘public good’ alternative that approaches the status of infrastructure. The state-support for the development of Trendalyzer, for example, is legitimised in accounts precisely by the tool’s “global public good” character and effects, meant to be “completely free and open for everyone to use”. The investment is felt to be well motivated not merely with reference to singular instances of generated output (specific data visualisations), but more so in terms of long term infrastructure investments with benefits that are accessible and sustainable beyond local concerns and single instances of use:

… the potential gain in using something like this … intended to be completely free and open for everyone to use and things like that– There’s a lot of talk about this “global public good” … if you compare with … what we give in aid to individual governments or to other forms of support … then this is very little money, and it can, sort of, potentially have a very big effect. (Trends, 52)

The material from the Trends case also illustrates a number of tool-mediated counter-actions aimed to change the perceived current data access power imbalance. These range from constructing and promoting the Trendalyzer tool as a means to increase public interest in and awareness of data, to using the tool more directly against other actors as leverage in negotiations to make data sets public and as advocacy support in demonstrating what data that are missing or of unsatisfactory quality.

As seen in the analyses of both cases, the issue of (second-hand) data access and control is a highly contested one in relation to which the participants construct themselves and the tools in terms of victims of other actors’ actions. The analysis of the material also illustrates, however, numerous examples of how the participants themselves also actively mobilised the data and tools in order to control and allocate various sorts of resources, presented in the two following sections.

### 7.2 Tool-Mediated Allocation and Control of Resources

The examples in the previous section demonstrate enactments of the tools as infrastructure and public goods, unfavourably restricted or even unjustly counteracted by primary data holders that are either unable or unwilling to cooperate towards improved data access. In these accounts, the visualisation tools and the participants are also, by and large, constructed as victims of other actors’ power and political related interests and actions. In the analysis presented here emerge, however,
examples of the participants’ own tool-mediated power and political related interests to change or even reverse relations concerning access and control of various resources (including, in some instances, even data). The participants mobilise in these examples data and tools in activities intended to further their own (work task related) interests and purposes interpreted here in terms of allocation and control of resources. The resources in question are both of the sort that the participants have at their disposal (time, money, personnel) and of the sort that they wish to attain (certain data sets; primarily in Trends). Related approaches to and uses of the tools as mediating the allocation and control of knowledge is presented separately in the following section 7.3.

More specifically, then, both MapInfo and Trendalyzer are here seen to be used in rather straightforward but also deeply politicised ways by the study participants to initiate and influence actions and perceptions of other actors in order to attain ‘real world’ effects. They use the tools (at least in part) to arrive at and carry out decisions that have to do with where, when and how to invest resources in the form of time, money and personnel. Activities of that sort are at the heart of work tasks and operations in both cases: the primary work task in Geo concerns measures to improve traffic security, and important work tasks in Trends concern financial and other support to and work with numerous countries on a global level. To the Trends case in particular can also be added targeted actions aimed to make previously inaccessible data sets available to the public. Although these types of actions represent goals that are naturally pursued within each case with a vast number of means in a variety of ways, focus remains here in this analysis on those actions that in some way or other can be identified as (visualisation) tool-mediated and enacted.

Critically informed approaches to and uses of the tools in this theme include not only intellectually distanced approaches but also active counteractions in the form of tool-mediated attempts to negotiate and exert opposing political pressure and advocacy and they are described here as constructing the tools as information resources with the powers to effect (identify and bring about; primarily in Geo) and/or affect (enforce and influence; primarily in Trends) actions on behalf of other actors in each case’s respective arena and field of work.

7.2.1 Effecting Action (Geo)

The control and allocation of resources enacted and mediated in Geo through MapInfo can be said to overwhelmingly (although by no means exclusively) concern what I have chosen to describe as ‘effecting action’ on behalf of other actors.
This denotes that MapInfo is predominantly used to identify and localise problems; to connect those problems with responsible agencies, people and measures; and to bring about subsequent actions in response, whether it concerns hauling away a fallen tree or achieving agreement to invest in specific traffic security enhancement measures at specific places. These types of approaches to and uses of MapInfo are hardly surprising but rather in high compliance with a long history of using maps as political tools and control mechanisms. Apart from describing physical terrain, landmarks and other objects of interest (geographical and topological features), maps have for almost as long also been used to negotiate and settle (as well as challenge) agreements on political entities, administrative domains and other sorts of geographically defined and represented resources, not least through marking out territorial borders (e.g., Latour, 1986; Merriam, 1996).

For the focus of this study, it is perhaps even more interesting to reflect on how uses of MapInfo presented here, to identify and settle responsibilities and bring about actions in response, places it along the base levels of Wartofsky’s (1979) tool-categorisation, as secondary and sometimes even primary artefact. Through these uses, in other words, MapInfo is constructed as a tool with comparatively direct bearing on the ‘real world’ and actual activities; used to perform fairly straightforward work tasks such as identifying a geographic location and sending the ‘right’ person out to fix a problem on that site, or to decide where and how to allocate financial resources within a restricted budget with numerous competitors.

Obvious examples of primary artefact uses of MapInfo are the descriptions of occasions when the participants use it to orient themselves geographically in the city when communicating with colleagues or the public or to solve a problem that has appeared in their own work during the day. On these occasions, MapInfo is used more or less as a traditional map, as a positioning tool that helps localise precise areas or objects in the city (and that also reveals more specific information about these places). This use seems most common in communications with citizens that phone in to report damages or problems: “The first [question I ask] is really where this street is located and then, depending on what the problem is then, where is the lamp or the well on this street, and then you find it so you can localise the exact place” (Geo, 50; c.f. also Geo, 51, 52).

In these types of interactions, the tool is used to accomplish a gradual zooming in on a specific location; it helps establish a mutual focus for the in-house operator and the person phoning in. Once a consensus on exact geographic location is reached, the discussion can continue to address more specifically the actual concern or problem at hand.
A similar situation occurs when maintenance workers out in the field phone in to request assistance during some operation: “Is there a wire here or not?”, and I can’t answer that … then I’ve taken out my system, then, and then you have to look: ‘Uh-huh, it’s there. Well there you can’t lay down a wire because there runs a ( ), and things like that’ (Geo, 53). These uses of MapInfo illustrate some aspects of the knowledge inscribed in and authority ascribed to it since a person ‘on site’, at the actual geographic location in question, ‘knows less’ about that place than a person who is completely spatially disconnected but has access to MapInfo’s representation of it. Although the Geo participants never speak of MapInfo in terms relating to augmented reality technology, examples of this type illustrate functions to this effect (c.f., Gartner, Bennett, & Morita, 2007; Goodchild, 2004; Ma, 2004; c.f. also section 2.2). The examples also bring to mind the accumulation of knowledge in external representations (c.f., Hutchins, 1995; Latour, 1986; section 4.2.1). I am, however, also told that these types of uses of MapInfo are comparatively rare (Geo, 54).

Usually, though, this type of ‘localising’ informative function does not in and of itself present useful information for the operations and tasks at hand for the Geo participants. They are instead, for the purposes discussed here, rather interested in the features of the tool that pairs up geographic locations with infrastructural elements, physical objects, administrative domains and responsible agencies and entrepreneurs more in line with traditional (representational) secondary artefact uses. Through the superimposition of layers upon layers of data on each of these categories, it is possible to identify the agency or contractor responsible for everything from general maintenance to specific measures when problems occur. The first and most basic step in such processes to identify and effect responsibility is to separate that which has been categorised as the responsibility of the city from the responsibility of other, private, actors in similar fields: “We don’t deal with anything that relates to private property holders or private land at all, but we only deal with that which is the responsibility of the municipality” (Geo, 55).

For the municipal areas, a number of features allow for more detailed determination of responsibility, such as colour-coding schemes used to identify the agency or entrepreneur that is responsible for a particular problem at a particular place (Geo, 56, 57, 58, 59). But since an extensive number of departments and entrepreneurs are involved in the city’s operations, the representation of responsibilities in relation to geographical areas is complicated. No one (at least rarely) has sole responsibility for an entire geographical area, merely for certain infrastructure, tasks or problems located within it. This means that the representation of responsibilities is also layered, and that it is not enough to ask “Who owns?” a particular
piece of land, but that relevant questions also involves “Who does what?” in that particular area:

It can be {Company A} that has the parking surveillance, for example, but it can be {Company B} that takes care of the paving or the maintenance of the street. And then there can be someone else that takes care of the lighting in the worst case. There can be many different entrepreneurs on the same street. (Geo, 60)

When real-life situations give rise to uncertainties concerning who is the responsible agent they resort to MapInfo to resolve the issue: “Then we can use it internally so that we go in and see: is it we that have the responsibility for this area or not … because it can be no more than a hair-breadth difference when it’s their responsibility or ours” (Geo, 61). These uses of MapInfo are all described as indirect uses, although still seemingly important. The reasons for this ascribed power to the tool seems readily explicable in terms of the positive effects of inscriptions described by Latour (1986); not least the way inscriptions through their two-dimensional, simplified, cost-effective and easily accessible (mobile) characteristics help control the messiness of things that exist and happen ‘out there’ (the city itself, traffic accidents).

Turning to the primary visualisations in focus in this case, the traffic accident visualisations, these are perceived to not only help identify “new risks that you hadn’t been able to discover in other ways” (Geo, 62), i.e., to create new knowledge, but to also eventually be used to motivate the allocation of financial resources within a limited budget and in competition with numerous other possible investment areas. In this context, visualised patterns of geographically clustered accidents are thought (or made) to present undisputable proof of hazards that require targeted actions.

The subsequent claims for allocation of resources to address and rectify the hazards identified through analysis of visualisations gain particular political momentum in two crucial ways. The first is by invoking a ‘fact view’ of the visualised information: “All investments have to be weighed against something else, and if it’s not traffic security then maybe it’s accessibility or convenience or some other factors. But if you have facts … then that weighs heavier than if you think that it’s like that” (Geo, 63). The other factor concerns including and referencing a formal national political goal. In the participants’ accounts, the uses of MapInfo as a tool for the allocation of resources to specific traffic security enhancement measures are, to this effect, set in relation to the Zero Vision (c.f. section 6.2.1), whose goals are (naturally) also adopted at the Traffic and Public Transport Authority: “to decrease
the number of injured and killed people and especially injured children” (Geo, 64); “we measure the number of killed and severely injured in traffic— it’s a pretty tough way to measure … but it also becomes very clear … the Zero Vision is sort of the base for the work, really” (Geo, 65). The prominence of this political agenda is noticeable even to the point that it is said to have led to the exclusion of certain types of data that the agency previously included in their analyses because those data were not deemed relevant for and able to contribute to reaching the Zero Vision’s goal (Geo, 66). The Zero Vision is thereby described as influencing both what sorts of data that are analysed and for what purposes, as well as functioning as additional leverage when mobilising data analyses and visualisations as arguments for distributing resources to eliminate the traffic hazards thus identified.

For the Geo participants’ mobilisation of data and the visualisation tool for the allocation and control of resources to serve their own (work related) interests, then the fact view of data and references to externally formulated and legitimised political quantitative goals emerge as particularly decisive. In these ways, the politics of these approaches to and uses of MapInfo in Geo are made to weigh heavily into monetary and agenda-setting priorities and decisions.

All examples described here so far relate to MapInfo’s basic geographical mode of structuring data, but sometimes the participants also place more emphasis on its less developed (c.f., Dodge & Perkins, 2009; Jessop, 2006) but still existing temporal features. This is accomplished either by visualising data sets from several years in a single thematic representation or by creating a series of visualisations of one year at a time for subsequent comparison. In these ways, MapInfo visualisations are also used to follow up on and evaluate past work in order to improve operations and routines: “which you then can analyse: what effect it’s had, for example … That’s our main goal: to be effective and meet our overarching goals” (Geo, 67). In this way, visualisations are then also to certain extents used for self-control and monitoring of their own internal operations.

A description of a particular project illustrates how temporal aspects can feature more prominently also in MapInfo visualisations and analyses for allocation and control of resources. The project is based on a thematic visualisation of a specific category of traffic accidents over a five-year period and the participant describes how the entire work team gathers round the visualisation to seek out the patterns that they find interesting and thereby decide to continue investigating (by allocating more resources to further investigations). Just as with the more strictly geographically focused analyses, certain patterns seem to be ascribed more powerful and valuable meanings than others, but in both cases, they can be said to concern patterns of the ‘positive sort’; i.e., patterns that do show change over time (to be
compared with clearly distinguishable patterns of geographical clustering in visualisations with that focus). When clear patterns are not found, they “put it away and look at something else instead”:

We would it like it [project X] to have been finished by now but we’ve not succeed-
ed with that because we keep finding changes that you wish to look into as you go along. You look: “Ok, so this looks like this, well, maybe we should look more at that”, or: “Ok. No, this doesn’t look at all as what we’d imagined”, or: “For this, we probably thought a lot more would’ve happened. Well, there’s no use in presenting that”, and then we put it away and look at something else instead. (Geo, 68)

In the following section, the Trends material offers of course a richer variety of temporally focused tool-mediated approaches and uses for the allocation and control of resources.

7.2.2 Affecting Action (Trends)

Temporal representations have a political history that is very similar to that of maps and mapmaking described above, so it is no more surprising to find approaches to and uses of Trendalyzer as well for allocation and control of resources. The 24 hour day, for example, measured and controlled by clocks, made it possible to not only tell time but also to exert sophisticated control over industrial employees, their work days and wages. And of course the calendar, administrative and fiscal years standardise and regulate the operations of organisations, schools and entire nations (e.g., Castells, 2000a, ch. 7; Dohrn-van Rossum, 1996). And accordingly, the Trends material demonstrates similar sorts of comparatively basic secondary artefact uses of Trendalyzer although here in more of a continuous ‘follow-up’ sense to not only effect at one point in time, but also affect over a longer time period the control and allocation of resources of various sorts and in various ways. In other words, the participants are seen to use Trendalyzer visualisations to not only justify and bring about specific allocations of resources, but to also work towards ensuring that those resources are used as intended. And just as in Geo, powers to these effects are ascribed to the tool in three main ways: by the clear and simplified focus on a few select indicators provided by the tool; by a view of the data as ‘facts’; and by references to and incorporations of influential (here international) political and quantitatively defined goals. In Latour’s (1986) terminology, we can also say that Trendalyzer (like MapInfo in the preceding section) lends political and power
related leverage thanks to inscriptive features of focus, simplification and ‘rescaling’ of ‘reality’.

Three of the participants in Trends work or have worked with Trendalyzer in these ways to not only effect the distribution of resources to recipient countries (primarily in the form of monetary aid) but also to affect the ways in which they are used by following up on and monitoring actions and progress over time. They describe the processes of financially supporting other nations as typically performed by entering and following (over a set time period) selected, promising and specific strategies and plans for predefined sectors of society produced by the recipient countries. In these cases, the financial support is also described as a bit more free than when it comes in the form of targeted actions altogether decided upon from the outside (by the supporting agency or nation), but still quite far from an ideal situation of being able to go directly into a country’s budget and give contributions to agreed upon purposes that the recipient country can thereafter pursue in ways that seem most appropriate to them. But to be able to provide ‘free’ support in this way, the level of trust between funders and recipients would need to be very high, and this is difficult to attain.

Rather, the participants express significant scepticism towards existing data and statistics and primarily towards certain countries’ own published reports on the state and development of their nation (in which the full data sets are often not included). In lack of trust, thus, financial support could only be distributed in a freer sense according to the preferences of the recipient country if there are means for keeping the process transparent and open for control, scrutiny and follow-up from investors. Through the participants’ accounts, the need for means to maintain both a clear focus and an open dialogue about the use of resources and the effects they have emerge therefore as equally important concerns for investors as for recipients. The investing agencies have considerable responsibilities to demonstrate fair and effective use of public funding, and recipient nations are reliant on being able to clearly account for the use and outcomes of external funding in order to be considered for more funding by the same and other agencies.

In this shared concern, data (or, in the wordings below, “statistics”) and effective ways to analyse and understand them are absolutely crucial, and Trendalyzer (among a couple of similar representations that present visual alternatives to the often proclaimed impenetrable and boring statistics, c.f. section 6.1.2) is apparently felt to answer to these needs. With the availability of Trendalyzer and similar tools and the general notion of data reliance (“We also have a fact based world”, Trends, 53) they describe how recipient countries have started to work consciously with producing more and better data that can be used to control and
follow up on their uses of financial aid and their progress in key areas as a means to attract more external funding:

We can see that there is a very big need for statistics— for being able to understand statistics and use it and also to be able to present it in a good way … this has led us to see a lot more applications from countries that we work with– to make a contribution in statistics, to sort of work with the production and quality of data and things like that. (Trends, 54)

All parts in this process are described as reinforcing one another in a cyclical fashion: investors need good data to control that investments are well executed; recipients need to make available good data to attract funding; and both need common foci to guide discussions and understandings of investments and outcomes. It appears in the accounts as if Trendalyzer has not only contributed to answer to those needs, but also in many respects has helped raise an understanding of the possibility to work with and use data in these ways and for these purposes in the first place.

The importance of externally formulated, influential and quantitative goals and measurements as means to keep and share a specific focus for the accomplishment of tool-mediated control and allocation of resources comes forth not only in Geo (the Zero Vision) but also here in Trends, primarily in the form of the World Health Organization’s (WHO) definitions of categories for health indicators and related measurements (WHO, 2012) and the United Nations Millennium Development Goals (MDGs) (c.f. the description of the Zero Vision and the MDGs in section 6.2.1 above). Since the Millennium Development Goals are applicable to (most) Trendalyzer visualisations, the power that comes from focussing on such influential and measurable (because of their quantitative nature) goals together with more and better data are described as crucial for being able to use the visualisations to exert more leverage and control over the countries they support:

… you have to be able to measure that, and what you did there [the MDGs] was that they defined a certain number of indicators and said that: “These aren’t going to— This is what we’re going to measure and follow up on year by year”. “It’ll be all light on you, everything that you do will show, we want to see progress.” “We go in with the money, but we want to see progress, how will you do that?” (Trends, 55)

Numerical values on the number of people in relation to different indicators such as primary education and income provide quick and clear images of the state
of a country and its inhabitants, as expressed in the quote below. But this function is merely a “good start” and not an end in itself. If the overall (economic) state is not in balance with other types of indicators and levels of data analysis (whether Trendalyzer-mediated or apparent from, for example, field visits), this is taken as powerful proof of a particular type of problem that should be addressed and corrected and the visualisations also serve as evidence and reference points when demonstrating the problems and requesting amends by governments:

It’s a very good way to see how a country functions. It’s seeing how many people that have access to health, and how many that have access to education. It’s sort of a very good start to see how people are doing. And then to match that against the development of the country– If you find a country that has a very strong growth, where a whole lot of things are happening in the economy, and you can see at the same time that nothing’s happening on the level of primary care, out in the small village, or that the children– girls– can’t read, then you know that then you have a distribution problem in that country. And that’s a pretty effective way to quickly see and be able to actually also get in there and question: “How are you doing this?”, “What’s the reason that this does not reach the little person?” (Trends, 56)

The clear focus on development over time together with the quantitative nature of political goals are also felt to allow uses of Trendalyzer as an advocacy tool in work for the production of more and better data in areas where this is missing or not good enough: “It’s an advantage with this [the tool], and it’s an advantage with the Millennium Goals: you can see that the data are poor and insufficient. Well, then we have to work to get data. And then you can work ... backwards to a certain extent, but above all you can make sure that it improves in the future” (Trends, 57).

The shared focus on quantitatively measurable and widely agreed upon goals thus emerges as key for approaches to and uses of the tool for the control and allocation of resources in the Trends context. The participants say that the whole data-reliant development together with a tool such as Trendalyzer has made them and their colleagues start thinking and talking about targeted development issues much more consciously: “What’s happening, really?”, “What are we supposed to look at?” (Trends, 58) With better and more data, and a tool that mediates focus on clear and influential quantitative goals, the possibilities for deception on behalf of unscrupulous nations are also felt to decrease. Prior to this development and the Trendalyzer tool it was much more difficult to get a grip on things, to achieve focus and thereby be able to place demands on recipient countries: “It’s easier to hide when you have fifty-four indicators”, “easier to hide the results”, “easier to get away
with corruption” (Trends, 59). Through a combination of Trendalyzer’s selective focus on a few but widely legitimised and clearly measurable indicators such as the eight Millennium Development Goals it is believed possible to avoid the sorts of problems that arise “if you don’t focus” and stay “very clear with what you’re going to account for” (Trends, 60).

It appears as if the participants perceive it as crucial for the achievement of political and power related actions such as controlling and allocating resources to be able to gather around something that provides at least a momentary mutual focus. The descriptions in the material here suggest also that this is an accomplishment that might be easier to attain with the help of Trendalyzer than with a written report or mere statistical calculations and numbers: “We’ve been able to go from endless presentations to actually having pretty efficient discussions instead; less formal, more focussed on what it actually is that we wish to accomplish” (Trends, 61).

In examples of this sort, Trendalyzer is approached and used as a tool that answers to the requirements of the perceived data reliant (or “fact-based”) world or arena in which they operate. The combined focus on data and change over time for a few measurable indicators is the basis for exerting power and controlling resources. The accounts describe feelings that the tool makes it possible to firstly focus on clear goals, and thereafter monitor and follow up on them without risk of being deceived, because they have this tool-mediated access to the ‘facts’ that show them ‘how it is’ and ‘what is happening’. In the example below, the participant recounts a specific occasion when Trendalyzer was used to visualise the distribution of resources on a regional level in a specific country with which they cooperated. The example demonstrates clearly how the political leverage ascribed to the tool is connected to its focus on specific measurable indicators from a perception of the visualisation as offering on the one hand an undisputable fact-based truth – they were able to show “who is being reached and not reached” – and on the other hand as enabling them to see through national, official accounts of the state and development of the country as a whole to also be able to monitor and follow distribution and development on regional and local levels as well. A third important factor in the power hereby attributed to the visualisation includes also the ways in which it is thought to clearly and directly illustrate for everyone what the problems are, how they are visible, and how they are controlled and monitored (c.f. the perceived ‘intuitive’ characteristics in 6.1). It thereby also becomes a powerful and efficient tool for focussed discussions:

… since we’ve been able to use it [Trendalyzer] to show who is being reached and not reached, then we’ve also been able to conduct a more efficient discussion to-
wards the ministry– and said that: “This is– You have to work with the local democracy, that’s very important for your development, if you want it to be for real.” (Trends, 62)

Interestingly, this tool-mediated “discussion” is not only described as “efficient” but also as conducted not – as commonly described – ‘with’ the ministry in question, but ‘towards’ it, which further underlines the powers ascribed to the tool and its visualisations. The outcome, as described, was successful in that the financial aid really did come to reach the intended local municipalities and contributed to empower the people there to become actively involved in shaping their own life-situations: “They elect their … mayor– and have constant discussions about how to use this money that comes in from the ministry and is being spread out– it’s not a lot of money but it still gives a freedom and a strength in them– in their region. I mean, it has increased the influence …” (Trends, 63).

These sorts of tool-mediated powers are not only achieved by breaking down national numbers to regional levels; they function in similar ways in the reversed direction as well. Both enactments fall back on having access to those data sets that previously have been severed from written reports or other national accounts – or, in other cases; access to better and more complete data on those issues – that make it possible to repeatedly return to the data sets, look at them in other ways and thereby produce analyses and ‘knowledge’ that make it possible to control other actors. Another Trends participant explains such uses of Trendalyzer to follow up on how countries have made use of resources previously given to them: “You say you’ve done these things, but what effect has that had on a more aggregated level?” (Trends, 64)

The resources controlled and allocated in the examples here in 7.2 through the participants’ (in both Geo and Trends) mobilisations of data and visualisation tools concern primarily time, money, personnel (in Geo and Trends) and data (in Trends). Another, and highly valued type of resource, is of course ‘knowledge’ and the ways in which this particular resource is thought to be controlled and allocated through the visualisation tools proved both specific and varied enough to require separate presentation and discussion in the following section 7.3.
7.3 TOOL-MEDIATED ALLOCATION AND CONTROL OF KNOWLEDGE

The final theme to be presented here in this chapter draws on examples from the empirical material which illustrate that the participants construct both MapInfo and Trendalyzer as mediating also knowledge related power relations and political interests. These understandings are seen to be based on the participants’ perceptions of the tools as levelling data access opportunities on individual, organisational and societal levels, and seem to have less to do with particular instantiations in the form of visualisations with specific informational content and ‘meanings’, than with an appreciation of data as knowledge resources mediated (made democratically accessible in both physical and cognitive senses) by the visualisation tools. Key features mentioned in the following are how the tools enable repeated and varied analyses, broad access and instant and contextually relevant meanings. The variations within this material rather concern whether these effects are seen as positive or negative, and whether they are actively sought through mobilisation of data and tools or perceived as more or less automatically caused by the tools’ sheer existence.

In Geo, the broad levelling of data access and thereby connected access to knowledge ascribed to MapInfo comes with two opposing connotations. On the one hand, MapInfo is seen with positive overtones as bringing efficiency and security to their overall (but ‘in-house’ restricted) work tasks and organisational goals (7.3.1). On the other hand, it is also seen as a potential threat to individual expertise by replacing topical and experiential knowledge with generic tool operating skills, and to a certain extent also as a threat to organisational equivalents by risking public detection of flaws in data sets (7.3.2). In Trends, similar perceived and Trendalyzer-mediated effects are exclusively seen in a positive light with two main emphases. Firstly, the tool is ascribed powers to flatten or even reverse knowledge hierarchies by questioning dominant accounts by nations and other actors with (previously) privileged monopoly on data sets and their interpretations (7.3.3). Secondly, it is thought to support and increase democratic participation by allowing local and alternative interpretations and voices to come across and take part in data based discussions, thus adding multiplicity on local, national and international levels (7.3.4).

7.3.1 Sharing and Efficiency (Geo)

In Geo, MapInfo is described as mediating control and allocation of knowledge in ways that are also felt to respond to an intentional organisational goal of informa-
tion sharing. Some of the perceived effects are to make work tasks both more efficient and secure since they are thought to become less dependent on individuals’ knowledge and freed from more access restrictive physical-material storage devices. In these positive accounts, the tool’s meanings and uses are described as fulfilling important functions as a sort of contextualising environment and entry gate to the data they work with; it is perceived as a mutual foundation that provides democratic (‘in-house’) access through releasing data sets from individual and file related restrictions and ties and making them available to the whole group of users. These democratising aspects are, then, described as the positive outcomes of having a common base, shared by and accessible to, everyone:

(Participant): Yes, well, you have a mutual ground to stand on; place everything in a common system. As opposed to having it in personal files or personal local (…)  
(Interviewer): So it becomes accessible, you mean, or?  
(Participant): Yes, it’s sort of a goal of this business activity to make the information available for all executive officers and also many others. So the map then is an entrance gate to the data sets. (Geo, 69)

In addition to serving as structuring device for the revelation of patterns in data, then, the map based representation in MapInfo is also understood as providing a sort of sharing environment that opens up the organisation’s collected data resources for – at least in theory (see further below) – free and equal access by all employees. In this perception, MapInfo is constructed as a democratising platform through comparisons with more traditional applications and solutions for data management and analysis that appear connected to individual-related ties and restrictions to access such as (presumably) Excel documents and the like (“personal files”) and computer hard drives (“personal local […]”). MapInfo, then, is seen as different in a positive sense, able to reduce interpersonal and intra-organisational barriers to access by functioning as a “mutual ground to stand on”, as an “entrance gate” to their data. In short, MapInfo is seen to level and mediate data access and this understanding is in various ways associated with all subsequent power and political related perceived effects for allocation and control of knowledge presented in this 7.3 section.

In staying with this first Geo-related sub-theme, however, one central contributing factor to this positive, democratising, common-platform view of MapInfo as by-passing person and physical storage related barriers to access in the participants’ accounts emerges on a comparatively basic and practical level as due to the structuring device (map based) focus on geographic location. Since virtually all data
central to Geo work tasks and operations have geographic parameters (i.e., they
represent objects and events that have happened or exist ‘somewhere’), then both
different data and different work areas have been able to be accommodated by one
basic system that all employees can operate and relate to:

… that we have the same foundation, no matter what we’re showing— I mean, whe-
ther it’s responsibility for a land or if it’s a parking space or whatever it might be. I
mean that the base map is the same since afterwards you can place different layers
then. That’s the one thing, of course, that’s a major advantage. (Geo, 70)

In both Geo and Trends it is in fact possible to compare several of the
perceived political effects of the visualisation tools with the ways in which inscrip-
tions, according to Latour (1986) ‘scale’ and ‘merge with geometry’. For the exam-
pies in the previous section (7.2) on how the tools are approached and used as
mediators of material resources, the geographical and temporal referencing of data
can be seen to allow political effects by helping to establish perceived direct
relationships with the ‘world’ and things ‘out there’. And the examples of tool-
mediated control and allocation of knowledge in this section are, to a certain
extent, underpinned by the possibilities emanating from the wide applicability of
referencing the data in each case to either place or time. By specific ‘structuring
device foci’, data can be aggregated into comprehensive resources. These possibili-
ties are described as allowing the participants to make use of their data in new ways;
to accumulate, combine, superimpose, open up and make accessible for all emplo-
yees (or the public at large) vast and disparate quantities of data by making them all
‘scale back onto’ the same structuring device.

In Geo, the ubiquitous georeferencing of data that has come with MapInfo
has apparently helped solve prior problems associated with the merging of data sets.
Major difficulties were previously experienced when attempting to analyse different
data sets together since they are often produced and stored in different formats and
according to different logics or foci. But by focussing on geographic location as the
primary common denominator, they are now able to combine and make conveni-
ent use of these data in new ways; able to overlook or work around inconsistencies
through this mutual geographical focus: “now we can combine them without
[having to] make new systems that are thought through from the beginning. We
can combine data collected in one manner with other data that are collected by
another person where the location is the common denominator” (Geo, 71).

The perceived enabling of shared access to the aggregated data resources
emerges as an important feature from a security viewpoint as well. In freeing up
You might say it creates a kind of freedom, so you don’t have to go and find that guy that sits on exactly that information. Even though {NN} is not in, I can actually find out what type of post that stands there, if I need to know about that post or that bicycle road or things like that. It makes it more accessible and not quite as person dependent ... And if he was to kick the bucket, then the information is gone. So I think the accessibility and the security is better this way. (Geo, 72)

As demonstrated also by another account, these perceived democratising effects of MapInfo not merely diminish person dependence in favour of a distributed cognition-like situation in which knowledge is perceived to be externalised and inscribed into the tool and thereby (at least physically) accessible to all employees. As suggested by the quote below, the tool even makes the performance of work tasks less knowledge dependent altogether; more automated and delegated to the visualisation tool. With MapInfo, the workers at Geo are not required “to know” beforehand; everyone is thought to become competent to perform work tasks in at least the primary and most basic secondary artefact senses of tool-use previously discussed (section 7.2.1) if they are merely capable of mastering MapInfo:

Well, if you compare with what it was like in the old days: maybe they sat with the map from the yellow pages, and only the one who knew the town was able to answer questions, then I definitely think it’s had a positive effect on work– Where everyone all of sudden is competent enough to answer questions. I think so. (Geo, 73)

Without MapInfo, the organisation’s operations would be more subjected to individuals’ knowledge: “Like, I only know {place A}, and then you call me about something at {place B} I could never give you an answer. That’s what would happen in that case. And with the help of [MapInfo] we can answer either way, no matter if it’s there or here” (Geo, 74). The enactments of MapInfo in relation to this issue suggest that with MapInfo, situated topical knowledge becomes less important compared to generic skills on tool-operations. They construct the tool both in line with Hutchins’ (1995) theories on how material representational artefacts distribute cognition between people through accumulating externalised
knowledge, to more sociotechnical notions of tool-delegation (e.g., Latour, 1986) by which, for similar reasons, artefacts take over increasingly more activities previously performed by humans. Both theoretical terms are non-specific on the degrees to which users ‘appropriate’ such tool-externalised knowledge or merely ‘benefit’ from their effects – as are the empirical examples.

With a different emphasis, those very features of MapInfo that are construed in positive terms as enabling efficient and secure sharing and democratic access to data through more generic tool-skills are also at times associated with more negative consequences. In such accounts, MapInfo is experienced as a threat and a challenge to individual expert roles, and possibly also to organisational expertise, as demonstrated in the following section.

7.3.2 Control and Expertise (Geo)

Whereas the examples of approaches to and uses of MapInfo presented in the previous section concern tool-mediated (and tool-delegated) allocation and control of knowledge associated with positive effects for individual empowerment and organisational efficiency and security, the empirical material also demonstrates a number of more negatively framed critical approaches and uses that (re-)construct these same features as challenging or threatening individual and organisational expertise.

On the individual level, one participant explains a perceived reluctance or at least hesitance among co-workers to share their data through MapInfo by referring – through an Internet analogy – to a subsequent loss of control over those data: “When you let it go– out on the Internet or wherever– then you lose, to a certain extent, control over your own information. You don’t become as much [of a] specialist. So it can be a psychological thing– that you don’t want to give up data, sort of” (Geo, 75). The wording conveys the perceived importance of possessing – and retaining – control over data and what happens if this is lost. To “let it go” means to “lose control” over that information, and that also means losing the privileged state of being an expert in a particular area and on a particular subject (“you don’t become as much of a specialist”). At a workplace in particular, it is hardly surprising that holding a privileged expert role in an area or on a certain topic is highly valued.

In this account, exclusive control over data is a way to produce knowledge for one’s own sake of establishing a role as expert, and also an incentive for not allowing others to access that data. The more this expert role is felt to rely on the access to data, the more the act of sharing that data becomes perceived as an act of distributing expertise. Against the previously described background of notions that
MapInfo makes topical knowledge and thereby the expert less important, it is not surprising to find that it is also perceived as such a costly affair to “give up data”.

Access to inscription devices is what gives scientists, engineers and the like a privileged power position (Latour, 1986; Latour & Woolgar, 1986/1979), but these ideas only hold ground as long as inscription devices are out of reach for non-experts and the public in general. If visualisation tools through not only their no-cost availability on the Internet today are moreover also starting to attract ‘ordinary’ users by lowering the cognitive threshold and demands on prior knowledge needed to operate the tools for data analysis, interpretation and presentation (c.f. section 6.1, c.f. also Latham, 2006; Sluijs, 2008; Yau & Schneider, 2009), then power issues previously connected with limited tool access and expert status would have to be sought and enforced in other ways. Some of the examples here illustrate enactments that seem based on such an understanding of power and expertise as increasingly related to data access. One participant, for example, recounts significant resistance at one of the Geo case localities when MapInfo was first introduced, a resistance that also to a certain extent appeared to remain at the time of the interview: “They do have a territorial thinking: ‘Yes, but this [data set] is mine’ ... ‘It’s I who is running this’, and so on. So there was a lot of persuasion there ... A lot about building bridges and tearing down walls for a while here” (Geo, 76). When ‘everyone’ has access to and can control the inscription devices, then the data sets – the raw material for visualisations – seem to have become a more important power factor.

But intra-agency rivalry and knowledge monopoly benefits are not the only distinguishable causes of concern that give rise to reluctance in Geo towards (releasing data through) MapInfo. In relation to the possibility of MapInfo data sets and visualisations becoming publicly available on the Internet – a small number of simplified geographic visualisations are already available – another but related challenge to the role of the expert is also voiced. This concern presents another take on the connection between MapInfo visualisations and the data sets upon which these are based. Besides distributing and making available for everyone the data upon which the expert’s knowledge is built, there is also the risk that if such data are called into question, then the expert role itself can be called into question in a ‘the emperor has no clothes’ turn of events: “If you release information to the public then it has to be pretty accurate because they – the public – are good at finding faults” (Geo, 77). Simply put, this concern implies that the agency as a whole might appear non-professional if they through MapInfo visualisations were to release data sets that were found to contain faults or uncertainties, since data form a significant base for their operations and thereby connected authority and knowledge.
The construction of MapInfo as threatening or challenging knowledge and expertise thus combines a view of the tool as an inscription device out of control and as a mediator of access to data, the raw material and bases for knowledge claims. Of course, other explanations for resistance or hesitance towards public access to MapInfo visualisations of Geo case data can and have here also been connected to the sort of ‘benevolent guardian’ stance (c.f., section 6.2.3), as a public authority’s obligation to protect the public against potentially inaccurate or sensitive information.

At the heart of all accounts of allocation and control of knowledge here, however, is that MapInfo, in mediating access to full data sets, retains the connection between visualisations and those data. These characteristics are similarly central to related approaches to and uses of Trendalyzer in Trends, although framed with different connotations and aims as shown in the two following sections.

### 7.3.3 Questioning Dominant Accounts (Trends)

As mentioned, critical approaches to and uses of Trendalyzer as mediating allocation and control of knowledge only have positive connotations in Trends, although associated with two slightly different meanings: as multiplying the voices heard and increasing democratic participation (presented in the last section 7.3.4), and as a tool for questioning dominant accounts and reversing knowledge related power hierarchies (this section, 7.3.3).

The material presented in this section illustrates several ways in which Trendalyzer is used or approached as a tool to undermine other actors’ prior accounts on the states of nations, regions and the world, or to overthrow dominant power hierarchies concerning data access and interpretation possibilities. The activities are intentionally political and rely on various mobilisations of data and the tool. The powers of the tool in this context are mainly connected to the way it enables alternative analyses of data from prior accounts; how it opens up for new users to be part of data analysis; and by invoking an objective fact-view of data and visualisations.

In the first variety of these critical approaches and uses, then, Trendalyzer’s political power is associated with abilities to complicate or counter anything from written reports to institutionalised beliefs or the narrow and restricted focus associated with traditional uses of statistics: “[Trendalyzer] breaks down those statistics from the global level to the regional level, and also within countries, and that, that’s what for me is the whole point about using this animation— because it shows so very clearly that you cannot generalise that much concerning the economic distribution in the world” (Trends, 65). The understanding seems to be that there are problematic tendencies to pay too much attention to one and crudely generali-
sing level in other, more traditional data analyses, a problem that Trendalyzer is felt to highlight by, at least in this particular visualisation, switching between different levels of analysis, thereby demonstrating that other and most importantly multiple levels of analysis are necessary for a better understanding.

Comparisons between both MapInfo and Trendalyzer and more traditional ways of analysing data return frequently in the accounts of the participants. In all of these, the tools’ abilities to retain the link between data and visualisations are central. The tools are seen as superior since the data can be returned to, looked at in different ways, with different focus, to for example easily shift between national, regional and international levels in Trendalyzer or, in MapInfo, shift between levels of granularity, geographical areas or specific variables such as types of vehicles, age and gender without becoming lost or restricted in focussing on just one and the same sort and level of percentages and numbers. In comparison to Excel sheets and statistics, the tools appear to be perceived as on the one hand more focussed (c.f., section 7.2) and other hand also more versatile and flexible, powerful, easy and intuitive, and therefore able to provide many more meaningful analyses in more easily accessible (understandable) ways (c.f. section 6.1).

Trendalyzer’s time based representation with its many indicators that places all the countries of the world alongside each other is, thus, also described as particularly powerful and useful in the sense discussed here (to question dominant accounts), with reference to its flexibility that allows for comparisons on different scales. The quote below, for example, illustrates how the tool is used to question all forms of prior accounts (oral, written, statistics, numbers or graphics) on the state of – in this case – a nation (“you might say that ... but ... look at these”). The effect is achieved by a mobilisation of data and the tool to produce alternative analyses that complicate those prior accounts through shifting between different levels of analysis:

In all poor countries of the world, the UNDP has an office, and when they themselves easily can take this [Trendalyzer] and input data from this country and compare this country with the neighbouring countries and go to the government and say that: “Look, why do we have such a low educational level when our neighbour countries are here?” Or maybe move it up the region and say that: “Ok, you might say that on average this country is doing well, but that’s just the capital– look at these provincial regions, they’re doing much worse than poor Malawi, you got to fix this”, sort of. Then it becomes an incredibly powerful advocacy tool. (Trends, 66)

With the continuous tool-mediated data set connections and accessibility come then also this crucial empowerment possibility to perform other, complementary,
alternative and opposing analyses on the same data that the nations’ own accounts are (or claim to be) based on. The political effect is further boosted by possibilities to switch between levels of analyses; to ‘zoom out’ to make international comparisons or ‘zoom in’ to regional levels, thereby complicating what is perceived of as one-sided and often biased prior analyses. The effect is described as shifting power from the top to the bottom, and also providing arguments and focus in ways that help put pressure on those in charge (“you got to fix this”) (c.f. also the more elaborate discussion on uses of Trendalyzer for the allocation and control of resources in section 7.2.2).

For these sorts of enactments, in which Trendalyzer is approached and used as a tool to question and reverse knowledge monopolies by making the data accessible and analysable in several different ways, it matters also significantly who performs the analyses. The ‘real’ empowerment here is associated with broad public and NGO involvement in data analysis (thought possible because of the ease and intuitiveness of Trendalyzer compared to more traditional analytical tools (c.f. section 6.1). With increasingly accessible data and user-friendly tools – processes that even beyond Trendalyzer’s scope are thought to be well in motion – empowerment comes not only from complicating prior accounts, but from public possibilities to produce their own alternatives; completely free-standing analyses of data on the basis of which conclusions can be drawn and knowledge claims presented. This understanding comprises both the participants’ own uses of Trendalyzer, and the hopes they have for how it will be used more widely, that “people” will come to use it “to analyse data”, to “actually understand for yourself where the world has moved”. The real empowerment here comes with not having to be subjected to other actors’ interpretations, aims and biased accounts, but to be able to find out how it ‘really is’, on one’s own: “‘The world is much better today’, I say. ‘And how do you know that?’, sort of. ‘Well, but look at the statistics. Because I’ve analysed them myself’, then” (Trends, 67).

The third manner in which Trendalyzer is approached and used to affect the allocation and control of knowledge resorts to similar fact-based views on the underlying data and resulting visualisations as invoked also for the control and allocation of (other) resources (c.f., 7.2). This fact view goes so far as to construct Trendalyzer as not only fact based but also value neutral. Accounts to this effect describe the tool as ridding the process of data analysis from human intervention, subjectivities and interests, and from the associated needs in other and more traditional ways of dealing with data and statistics to choose just one or a few things to look at or present in subsequent oral, written or graphical presentations.
Trendalyzer is instead seen as able to provide ‘the whole picture’ and thereby avoid subjective choices of just one or two foci and interpretations.

In accounts of this sort, the power to make a whole or several datasets intelligible all at once in their entirety and present them in a value-neutral way, without ‘adding’ ‘interpretation’ has the effect of hiding the tool’s materiality. It seems instead as if there is no difference between the visual representation and what it is intended to represent. When the participants (as they frequently do) refer to the visualisations as showing “what it’s like”, they are not referring to the data sets, but to the state of the world or a particular country. The many stages and sites of construction in between data and visualisations; the choices, interests, restrictions and the like involved in the production of data, indicators and the tool itself, are at once hidden from view and the visualisations become instead constructed as unmediated reflections of the world. Constructing the visualisations of data as both comprehensive and unmediated (i.e., as neutral, objective and true) then, illustrates another means to the same end: to tear down prior knowledge monopolies, this time by giving everyone the same opportunities to ‘see how it is’ and discuss, interpret and argue on the basis thereof. The data become open for all to judge, evaluate and interpret:

Now you don’t have to select the concrete main messages, but you can actually capture the trend and show the data in a way so that you can see all of the data and understand them, instead of me sitting and adding up, sort of, multiply tables and calculate a percentage– what country has developed the most, and sit and do my own analyses primarily and then just select a message, saying: “This is what it’s like”, and throwing that in the faces of people. Now I can show here, and I can still have done that, and say: “It’s like this as well, but, look– draw your own conclusions from this development”, sort of. Yes, it’s a completely different way to handle statistics, actually. (Trends, 68)

By detracting subjectivity in this way, hard facts and unmediated truths are constructed; similar to what is described by Latour and Woolgar (1986/1979) in relation to (laboratory) inscriptions or by Campbell (2007) and Joyce (2005) in relation to visual and automated imagery. This perceived ‘factuality’ and neutrality of the tool and its visualisations explains much of the political force with which it is presented in the accounts here. Trendalyzer is described to say or claim nothing by itself, and it thereby becomes politically powerful by being perceived as objective, comprehensive and fact based. It means, basically, that ‘everyone’ is given the same possibility to make analyses, draw conclusions and present interpretations either for
themselves or to attempt to convince others. As a consequence, of course, these desired political effects of providing counterarguments, of reverting the power (im)balance in favour of the ‘little person’ or subgroups will only come if there is a sufficient number of other users (as in this example, non-governmental organisations, NGOs) that will mobilise Trendalyzer for alternative purposes: “the best is when an NGO can take out graphs and say: ‘Look, you promised to do this but our statistics— all statistics show that we’re behind. You have to do this’. Then it becomes such a tool where you can place demands on improvements and transparency and so on” (Trends, 69). The most important and tool-mediated effect becomes, in these views, focussed on levelling the start-point, and thereby opening up for critical discussions on how to interpret these perceived neutral and unmediated visualisations.

This purpose of Trendalyzer is based on a fact view of data and their values for society and knowledge (through tool-mediated physical and cognitive accessibility) that rings of objectivist and positivist epistemologies (c.f., Kapitzke, 2003a; Pawley, 2003; Simmons, 2005) and notions of neutral technology (Campbell, 2007; Joyce, 2005) as increasing “the fact based discussions in the world; get some more, sort of, reality into the discussion, or that it should be built on common— Instead of being built on these a priori assumptions; ‘This is what the world looks like’ and then read statistics after that” (Trends, 70). The examples in this section, then, represent comparatively targeted approaches to and uses (mobilisations) of Trendalyzer as a tool to affect and change knowledge monopolies and hierarchies based on exclusive control of data and (through associated exclusive rights of interpretation) their ‘meanings’. For these effects, the tool’s perceived abilities to mediate and retain access to full data sets are crucial. In the following section, a less antagonistic, but similarly perceived tool-mediated power and political related effect is presented.

7.3.4 Empowerment and Democratisation (Trends)

This last section presents variations on the theme of critical approaches to and uses of Trendalyzer as mediating the allocation and control of knowledge, through which it is seen to be constructed as a tool for empowerment and democratisation. These enactments are based on perceptions of the tool’s abilities to help multiply the perspectives on data and their meanings and the voices heard in data based discussions. They paint a picture of tool-mediated empowerment and democratisation not so much in terms of vertically oriented conflicts as the examples in the previous section, but rather as horizontally aligned goals and goods in themselves; not so much in opposition to something else as additions to what already exists. These empowering and democratising powers are ascribed to Trendalyzer by
emphasising three characteristics in particular: the enabling of public, free access to data and the means to make them meaningful; the facilitation of creation of information that is objective and factual; and the enabling of flexibly tailored information in response to individual and community concerns and interests. And again, as in several previous examples (primarily section 7.1), the value of specific, singular visualisations as information resources is secondary to more comprehensive appreciations of data as raw material for the production of knowledge and the tool itself as an enabler of almost infrastructural public good character.

From a slightly different perspective, one can also say that the empowerment and democratising powers ascribed to Trendalyzer in the examples here shift between emphasising on the one hand ‘liberation’; on the other hand ‘(re)invention’ of data as information resources. The liberating view emphasises tool-mediated additions of perspectives and alternative interpretations by making data that were previously exclusively controlled by nations and major international interest organisations available to the broad masses (c.f. also 7.3.3). The (re)invention view emphasises how the tool in a more innovative sense transforms altogether unexploited, forgotten, hidden or (previously considered) ‘useless’ data into valuable information resources, making them “acknowledged”, “used to their full potential” and “available to more people”:

... to make statistics more understandable and available to people ... that’s incredibly important: that that type of information, that is available in many different places but that might not always be acknowledged, and as a result not being–sort of used to its full potential– that it becomes available to more people. It [Trendalyzer] has an enormous potential to be able to influence decisions in a direction that’s–Well, a well-informed direction, simply put, irrespective of what that information is saying. But that’s a really important aspect of democracy. (Trends, 71)

The way that Trendalyzer (and some similar tools also sometimes mentioned by the participants) mediate access to the full data sets is a further and crucial aspect of its ascribed powers to engage the public and raise the status of data as information resource. References to written, official reports and file formats such as PDF are recurrently used to symbolise lock-down, restrictions, and what might be described as black-boxing in the sense that these formats are most commonly used for presenting merely the ‘final results’ of data analysis without including the full data sets on which the analyses have been performed. In contrast, Trendalyzer makes the full data sets both physically and intellectually available.
In these accounts relating to tool-mediated empowerment and democratisation, Trendalyzer is actually construed as tapping into or awakening – and most importantly, combining – not just one but two under-explored democratic resources: forgotten or undervalued data; and the general public. The more information available and the more hands and eyes involved in their analysis and interpretation the better, according to the Trends participants. Such increasing involvement of the public and general awareness and appreciation of data as valuable information resources are sometimes thought to follow almost automatically from the introduction of more innovative tools for data analysis and presentation such as Trendalyzer simply because it is thought to make data more easy and interesting to work with, analyse and understand.

If there’s a good tool that can show statistics, then maybe people will show their statistics through it and make them more accessible, instead of working with them in PDF files in Washington, sort of. Or New York, if it’s the UN. (Trends, 72)

But there are also examples of more active mobilisations of Trendalyzer by the participants to negotiate with and steer other actors in the desired direction. Such activities involve practical demonstrations of how large and maybe forgotten data sets can be turned into useful, interesting, and easily understandable visualisations by running them through Trendalyzer. The resulting visualisations are hoped to be attractive enough to use Trendalyzer as a tool for the negotiation of data access:

Our basic view is that all data shall be distributed, and we pose as demands on those that want our help today: “Hey, can we get a graph for our website?” “Yes, but then you have to give out your statistics for free”, we say. And most of them want to do that because- I mean- Not everyone can do that, and then you have to say “No, then we can’t cooperate with you.” (Trends, 73)

In Trends, thus, Trendalyzer is not only experienced to function as a tool for analysing data. It is also described as a tool that carries a potential for a more politically active goal of liberating, opening up, and making available data as information resources for democratic and participatory activities of individuals, communities, and organisations. The tool in itself is thereby approached and used as advocate for more and free data resources. The real potential for opening up data as public information resources in the service of democracy and transparent governance is, however, perceived to be dependent on broad public use of the tool on an international level:
Then it [Trendalyzer] becomes such a tool where you can make demands on improvements and transparency and so on. And I hope it will be able to do that- it has the potential for that, but then it has to find its way all the way out to those who will use it that way. And like I said, it makes demands on people to unlock their data bases, just a thing like that, I mean. (Trends, 74)

Whether or not Trendalyzer was originally intended for such purposes, advocating the production of more, better and publicly available data has clearly become one of the most important uses of the tool for the Trends participants.

National statistical agencies, of course, are potential goldmines for data access in this sense but they are mostly seen as uncooperative and overprotective. This concerns not only non-democratic countries’ statistical agencies, but also the Swedish agency Statistics Sweden (Statistiska Centralbyrå, SCB) which is frequently criticised for hindering, for no apparent good reason, the democratizing development now envisioned with tools like Trendalyzer: “They’ll still have an SCB stamp on [the data] when they do it [make them publicly available], and then they’ll have a site so– Let a hundred students choose and run– And then they can stand as senders, then it’s interesting” (Trends, 75). The explanation for these agencies’ reluctance to provide full and free access is thought to be fear of letting go of control of data sets; the implication being that one can never be sure what will come out of analyses of data: “But as long as no one has paid any attention to data, well, then they can lie there in a drawer at the statistics office and no one cares because they’re completely risk free” (ibid.). The perceived effect is to hinder democratic transparency.

Other participants present a more optimistic view and hope that the ready-made visualisations that are, after all, presented by SCB on their website will at least help raise awareness and interest in data and visualisations as information resources with associated democratizing potentials. As demonstrated by the quote below, an important aspect in achieving this effect is the way visualisation tools can keep the connection between data sets and visualisations. A visualisation does not simply show one ‘image’ to interpret and analyse, but is also thought to function in a more general sense as an entrance to one or several data sets (c.f. section 7.3.1) that makes the data not only cognitively but also physically accessible in an easier way thought to encourage more users and uses, sometimes even making people discover topics and areas of which they are previously unaware:

I mean, the information was there before as well. It’s that they get more available of course, easier for each and every one to take out, then, compared to having to maybe
write first and ask to get it out or something like that. I mean, really it’s the same democracy issue at heart, but it’s the availability to it that naturally makes it easier for many more to take it out. And it can even be that you might not have had any idea that it existed, and not even thought about the issue, but of course, by seeing it through coincidence makes it possible to enter an area that you become interested in for some reason or something like that, you know. (Geo, 78; c.f. also Geo, 79)

The tight connections and overlaps between perceived tool-mediated democratizing effects in vertical and horizontal directions are continuously apparent. Access to data and the means to make them meaningful through free and user friendly visualisation tools such as Trendalyzer are deemed useful for both questioning dominant accounts and critiquing the actions of those in power as well as for producing alternative analyses and adding new perspectives to issues or simply learning and discovering things of interest to oneself and one’s local community. The bases for information and knowledge production – the data – are basically the same; the main change concerns who performs the analyses and interpretations: “So there will be an all new third stage [in data analysis processes]: then Amnesty will be able to take data from the World Bank; use Swivel or use Gapminder; make a graph that they use against the government in Botswana or anywhere. And then we have a new way to go, instead of the World Bank itself…” (Trends, 76). This change entails a power reversal concerning who is able to determine what issues and aspects thereof that are to be in focus; what variables that are interesting and important to look at.

Getting people involved, engaged, and equipped with the tools to independently analyse, interpret, and discuss issues of concern with the help of different types of data from various sources is a democratic accomplishment both thought to come almost automatically by the existence of Trendalyzer (and also similar tools) and actively pursued through mobilisation of it. In the latter cases, Trendalyzer is construed as an advocacy tool for getting people to start talking about data (or “statistics”) as an information resource in general; “to get listeners– the ones that I’m speaking for– to use these tools to start talking about statistics” (Trends, 77). Public participation and data based discussions become goals and goods in themselves.

From the positive perspective in the Trends accounts, Trendalyzer is seen as one tool among several others that have combined to bring about – or at least are a significant part of – a more general development for the better, towards increasing openness and access to, as well as alternative users and uses of data resources through new tools. A force of motion in terms of free access and increased public
interest and participation has been set in motion and reached a momentum by which it is thought to evolve on its own and from its own force:

What I think I’m seeing are things opening up now, we’re getting a new openness from the statistics organisations … And then they turn around and they see: what options are there? And now we have a completely different infrastructure than we had ten years ago … So we have statistics, percent, there—sort of at the bottom—with raw data. And then we also have a couple of new organisations: Gapminder, Google is in, Many Eyes, Swivel, and a variety of these. And it looks very promising, and I can’t imagine they’ll slow down now, but I think it goes on. And that depends on us going on, having free data, and that there are people that help visualise them and animate them, maybe even to greater extents, and make sure that people understand them, sort of. So I do think there is—And just the technology as a rule is also an accelerator in itself. (Trends, 78)

What we also see here is an understanding in which “information” reaches its real potential for democratisation and empowerment when accessible in the “raw” form of data; i.e., not previously analysed, interpreted, packaged and formalised in, for example, a written report or a newspaper article. Trendalyzer is seen instead in many accounts as providing such means for an open climate, or forum, of discussion, arguments, counterarguments, criticism, and scrutiny by tool-mediated leveling of access opportunities to data and the (easy) means to analyse them. By, in addition to this, also constructing those data as ‘real’ and ‘true’ facts, the tool is perceived to raise “the level of the discussion … so it becomes more factual”. A telling statement here is this description of the value of grounding debates and discussions in ‘real’, ‘true’ and ‘neutral’ information sources “so that you don’t just sit and philosophise freely” (Trends, 79). In this view, then, Trendalyzer is constructed as a tool that can turn objective data (facts) into easily understandable information without simultaneously tainting this information with the views and agendas of interested parties and actors in power positions:

... then I can say: “This is what it looks like today”, and then they themselves can come with opinions on what it depends on and make the analyses from that … “But why did it get like that?”, “I don’t know that, I just show the numbers”, I say … And that’s pretty cool, somehow, that there’s someone who can deliver the statistics in themselves. (Trends, 80)

Enactments of Trendalyzer as a neutral tool that provides unmediated access to objective ‘facts’ coupled with normative calls for public involvement clearly
reflect the knowledge ideals and traditions of the Enlightenment with its strong emphasis on science, facts, reason and intellectual discussion materialised and symbolised not least in the great encyclopaedic ventures of the 18th century (c.f., Haider & Sundin, 2010; Kapitzke, 2003a):

We’re just supposed to provide facts and then we’ll just be happy if different sides argue, use them … If there’s someone that is sort of sceptical towards global warming and they want to use our data they can do so, but, sort of, in some way at least, raise the level of the discussion … so it becomes more factual and things like that. (Trends, 81)

A logical extension (within this case-context) of such an understanding of the tool as providing the basis for reason and informed discussion (and also in line with Enlightenment ideals) is to also see public involvement in data analysis and data based discussions not only as a right, but close to an obligation: “if there is information then you should relate to it somehow” (ibid.).

The approaches to and uses of Trendalyzer found within this theme comprise, however, not merely democratisation powers in a societal-citizen perspective, but also in terms of the empowerment of individuals in other and interesting ways. Besides free and easy availability to data, tool-mediated empowerment and democratisation in these ways are also connected to the level of openness to user input and customisation; that it becomes possible to look at issues of concern to an individual or a local community. A participant remarks, in relation to one particular visualisation, that it contains “sixteen indicators, but there are hundreds, thousands of indicators that would be interesting for different groups” (Trends, 82); a goal of total inclusiveness worth striving towards. The more flexibility, openness and choice, the more multiplicity would of course be added to the tool’s features: “that you can input your own data … so that it’s possible for more people to be involved and affect what types of indicators that are found there” (ibid.). And being able to choose what data and indicators that can and are to be included becomes, in these views, like having the power to decide what, when, and how that should be acknowledged and brought up on the political agenda.

The enactments of the powers of Trendalyzer in relation to this theme, then, position the tool well beyond what more traditional information resources such as newspapers and radio are thought to offer. Instead, and in more of the popular 2.0 sense of the Internet, it is described as making it possible to choose and analyse information of direct concern to individuals and communities: “This is really a way to create access to information. Because it’s not just through having access to
newspapers and to radio, but it’s also about having access to the Internet, and to information about oneself” (Trends, 83). In such accounts it is almost as if a new dimension of information based on social data is opened up, one that not only describes ways in which people can become affected by various social data production, management and analysis processes, but how they are also themselves part of those data. Such an understanding has also previously been presented and advocated in an analysis of a commercial visualisation tool incorporating U.S. census data (Sluijs, 2008). In his analysis, Sluijs suggests that tool-features supporting subjective relationships with data are highly important and should be further developed since a “tighter connection between user profiles and the visualized demographic information would enable a deeper personal involvement for the user, and subsequently facilitate special interest discussions”. Similar ideas of how ‘seeing oneself in data’ can help people understand themselves and their situations in new light, it seems, are held by participants here as well.

Democratising data access and analysis possibilities through Trendalyzer is, thus, not only thought to benefit society at large by adding to the plurality of voices and challenging dominant accounts and narratives; it is also seen as an important step towards individuals’ empowerment through helping them learn about themselves and their own conditions. Getting an understanding for these things is connected to acquiring the knowledge and tools for acting to change things in their favour: “what poverty is, and what ... the power to, well, to be able to change your own life, to have power over your own health and things like that, your children and so on” (Trends, 84). As social beings, all (or at least most) individuals are hereby understood as having ‘existences’ also as (political) constructs in contexts beyond their immediately lived and perceived experiences; as numbers in aggregated data sets structured, measured, appraised and analysed according to statistical standards and political goals and interests. And those who are not even represented in these ways might then also become aware of that through more user friendly and alternative tool-mediated analyses. The associated empowerment and democratisation established in such accounts is based on understandings of the tool as mediating insights in and perspectives on the natures, meanings and consequences of data (from existent to non-existent or low quality varieties) on both social and individual levels and perhaps also be empowered to act towards change.

A crucial component in this democratising tool-view is then that it is seen as a way for each individual to be able to create his or her own personal relationship with data. Interesting to note is also how, in accounts of this type where the empowerment of individuals is in focus, the otherwise fairly common ‘fact view’ of data disappears from the accounts. In relation to individual empowerment, the par-
participants emphasise instead data sets as biased sources affected by numerous materialities and interests. In levelling access possibilities to data, and by providing a tool that makes them easily understandable for all, the powerful democratising effect here is about helping people to “remain critical to the data”:

with the help of this tool and with the help of getting across that ... statistics shouldn’t just be for experts but they should be for everybody, sort of. That everybody that’s interested in an issue should be able to take part of the information that exists. You should be able to relate. It should be easy for an ordinary newspaper reader to remain critical to the data, and get access to the data they want, and see what they have to say and so on. (Trends, 85)

Trendalyzer is here described as instrumental in opening up a rather unique possibility for individuals – any common layperson (“an ordinary newspaper reader”) – to find out on their own about things that they are interested in, and form opinions of their own, and on their own. But even though data here again are constructed not as true facts but as cultural, material resources the view of Trendalyzer remains neutral; it is described as providing access to data without affecting the process in other ways, as an inactive conduit that thereby allows users to “relate” on their own. But compared to the objective, fact-based constructions of data in the mobilisations of the visualisation tools in both cases as power agents (primarily section 7.2), the view on data that comes across here is again more in line with the distanced approaches and uses recounted in section 6.2. And as shown in the next chapter 8, the analysis also found additional and critically informed approaches and uses that arise in more direct user-tool interactions.

7.4 CONCLUSIONS

The analysis presented here has been performed as a search for ways in which the participants approach and use the tools as mediators of political and power related interests. The sorts of critical approaches and uses referred to by the formulation of this research question places focus on information policy related strands of prior critical literacy definitions that mainly focus on the formulation and asking of questions concerning who has access to produce and consume information and how and with what consequences they exercise those capabilities coupled with normative propagations of associated distanced intellectual critical positions. There is, in this, also room for more active actions by which critical literacy denotes exercising
capabilities to transform dominant discourses or even produce alternative ones. In the analysis, three main themes emerged, described here as “data access conflicts” (7.1), “tool-mediated allocation and control of resources” (7.2), and “tool-mediated allocation and control of knowledge” (7.3). These themes relate to the focus of prior critical literacy definitions in various ways and are based on different views – or lead to different constructions of – the visualisation tools as information resources.

Whereas in the presentation of the first theme, “data access conflicts”, it might seem at first as if the participants are rather passive ‘objects’ of other actors’ unjust political and power related actions resulting in the restriction of access to data that are needed in each case, the participants’ enactments of the tools in these examples can also be understood as strategic mobilisations of ideas intended to construct the tools in ways that work in their favour. By referring to data as facts, raw material, and public goods, and to the tools as neutral mediators of access to those facts, forceful ideological arguments for access to data are constructed and can be used in what is clearly perceived in both cases as arenas characterised by politicised and power related data access conflicts. These enactments represent both identifications of perceived problematic issues relating to who has access to produce and consume information (data), as well as counter-strategies by means of constructing data and tools in these ways.

In the second theme, “tool-mediated allocation and control of resources”, the power relation is reversed and the participants are seen to actively mobilise the tools and data as visualisations to control the actions of other actors and to effect and affect their own (work related) interests. They are seen to translate into action some of the narratives presented in section 6.1 by which the tools are constructed as fact-based, unmediated sources of knowledge. Critical approaches and uses in this sense involves yet again the constructions of data as true facts and the visualisation tools as neutral objective mediators of access to these facts. The enactments seem to fall well in line with what Kapitzke (2003a) describes in terms of “foundationalism”; of seeking and using ‘facts’ to make a hard case or argument, and which represents, in her terminology an instrumental or operational approach to information. And in these examples, the participants are clearly seen to construct the tools and data in these ways; in order to achieve the necessary authority with which the tools can settle, control and decide actors’ actions and relations in the ‘real world’, it is necessary to establish a sufficiently proportionate 1:1-relationship between visualisations and ‘reality’ by which the tools can be used to act upon and change things in the real world. These enactments represent also a delicate balancing act between the necessity of maintaining a fact-based understanding of the data upon which analyses are performed and conclusions drawn, and the need to also
introduce values in the interpretations that legitimise and give sufficient weight to the case they intend to make and the actions they wish to control. This balancing act seems to be upheld by referencing and incorporating externally formulated quantitative goals and measurements such as the Zero Vision and the Millennium Development Goals.

The third and final theme, “tool-mediated allocation and control of knowledge”, is more internally complex and varied compared to the previous two. The enactments of the tools found here comprise a striking variety of information views and epistemologies: from approaches and uses that emphasise the same fact view of data and neutrality of the tools as above and by which they become constructed as tools for reason and democratic discussion in the traditions of Enlightenment and rationalist ideas and ideals; to views of the tools as enabling distributed cognition and shared knowledge; to emphases of instead the material, cultural and constructed nature of data as erroneous, afflicted by bias, and manipulated by actors with political interests that can be successfully counteracted by a levelled infrastructure of public access to data and tools of analysis. In all these views, however, the way the tools mediate access to the full underlying data sets and retain that connection is absolutely crucial, the significance of which will be further discussed in the concluding chapter nine.
This chapter presents findings from the analysis guided by the third research question: *What other critical approaches and uses emerge in the interactions between the participants and the tools?* The question is intended to direct focus towards views on enactments of meaning in the theoretical framework that lack counterparts in previous critical literacy definitions. The missing aspects in this sense primarily concern those aspects of the sociocultural perspective that describe how meanings of representational artefacts are neither completely predetermined by ‘canons of representation’ and established ‘communities of interpretation’; nor by precise and isolated internal cognitive ‘decoding’ of epistemic content with one essential, universal meaning carried forth by an inactive and neutral ‘conduit’ (document).

The understandings in focus here emphasise instead that there is room for dynamics and change in interactions between humans and representational artefacts. Local, new and alternative meanings and ‘readings’ can thereby arise as situated co-constructions every time an individual strives to make sense of and interpret the externalised and fixated representations and ‘knowledge’ inscribed into a material representational artefact. The ways in which meanings are seen to be constructed with this emphasis tie into aspects of socioculturally related theories on representational artefacts’ affordances of meanings and humans’ local, situated interpretations and appropriations of the same, as well as to aspects acknowledged
also in the sociocultural tradition concerning unexpected knowledge arising from the superimposition of different inscriptions on top of each other.

These sorts of critical approaches to and uses of the visualisation tools are found in the parts of the empirical material produced with contextual inquiry methods, i.e., they emerged in the participants’ demonstrations of concrete, common work tasks and ways of interacting with the tools whilst simultaneously commenting and explaining to me what they were doing and what it meant to them. This suggests that these enactments of meaning represent knowledge and skills that are of a more tacit and embodied character and that the participants might not be as readily aware of them as they are of those other critical enactments presented in previous chapters which were more explicitly and verbally formulated in the interviews.

The ways in which the participants are seen to ‘read’ and interpret the visualisations in these examples are divided in the presentation here into four main themes relating to the identification of errors in data (8.1); to the understanding of limitations in the structuring devices (8.2); to discernments of bias and discrepancies within and between data sets (8.3); and to using the visualisation tools as start-points for new and complementary questions and information seeking rather than as providers of answers and end-points of analyses (8.4).

8.1 TRAMS OFF TRACK AND CRASHING BUBBLES:
ERRORS IN DATA

The most concrete and basic aspect of ‘critical literacy’ is obvious to the point of not being specifically mentioned in the critical literacy definitions discussed here (c.f. section 3.3.1) but it is most likely – or at least it should be – implied. It concerns, of course, awareness of the likelihood that there are errors and faults in information (documents) that are not there as the result of intentionally inserted bias and manipulation to favour an actor’s interests, but merely as the result of human mistakes and technological problems. There is, however, also a major difference between stating that users should be ‘aware’ of possible (likely) errors in a general sense in all sorts of documents, to actually being able to detect and deal with specific errors. In the participants’ accounts presented in section 6.2, considerable emphasis was placed on the need for situated, topical and data set-related experience and a priori knowledge for being able to deal with errors in the data. In the examples presented here we can see, however, that the participants also enact a number of more generic and tool-mediated ‘cues’ and meanings for
detection of errors and faults that do not seem to require similar sorts of situated, topical knowledge.

Although not intentionally used for the purposes of detecting errors in data, the structuring devices in each tool are seen to afford a number of ways for the participants to discern faults more easily than if they had worked with the data as numerical values in Excel files and similar formats. Not seldom, the errors may even have occurred in the participants’ own processes of data management and preparation or when uploading data sets into the tools. For Trendalyzer, visualisation-ascribed cues of errors in data primarily have to do with sudden and unexpected movements of bubbles. The ways in which these cues are described make no references to needs for a priori topical knowledge or experience. While pointing at and demonstrating such a visualisation to me, the participant quoted below assumes that I will see the errors just as easily as he/she does (“you can see for yourself the ones that stand out here, you pay attention to those”). These visual cues rather seem to be perceived of as intuitively symbolising and conveying ‘error’ in more generic and universally intelligible manners:

Trendalyzer gives ... you can see pretty clearly when it’s round the bend ... Because it can be that you’ve moved a column or something or just– There can be something wrong during data import and things like that. But it’s easier to see here than to see it in an Excel file when you’ve made a mistake, because then as a rule you get completely unreasonable answers, and then you can see that here it goes “Swoosh” and then it jumps down there: “What was that?” kind of. And then you see: “Well, but that has to have been something wrong or something.” So it’s easier to discover faults, I think. When you run it over time like this you kind of see very unreasonable things. (Trends, 86)

The same participant goes on to show me several other instances where the visualisation reveals faults in data to him/her:

I was just going to show this about life expectancy to see just how clear it is, when something breaks the trend, sort of. That’s when you discover the faults: if most of the countries have been going in the right direction, and we then all of a sudden have countries that go here– If we look here (...) So here some country will take a dive there: “Oh, what’s that?”, sort of. “Was that something wrong?” (Trends, 87)

The corresponding visual cues of data errors in Geo primarily have to do with strange or unreasonable placements of traffic accident sites on the map. These sorts
of cues might not be as directly perceptible as a sudden, drastic ‘crash’ of one or the whole set of bubbles in the Trendalyzer visualisation, but even though they might require more concentration and focus, they should also be comparatively apparent to non-experts. A car accident positioned in a park, for example, might appear suspicious (although possible, it is at least rather unlikely), and a tram accident positioned far from the track is interpreted as a certain error: “and then you see there that a tram accident happens fifty meters from the track ... then you know that some information has to be wrong” (Geo, 80).

None of these tool-uses are premeditated and intended as primary work tasks but rather seem to occur as ‘side-effects’ to productions and analyses of visualisations. Nevertheless, these features and the meanings associated with them are also seen to have become highly valued and important aspects for at least those participants that also actively work with data management, upload and production of visualisations.

All errors can of course not be detected in these ways: when objects or events (such as accidents) are misplaced, but at reasonable locations, it still takes topical knowledge or first-hand experience to identify those errors (if at all possible to detect), such as “when you find a school that’s misplaced, then it’s just because I know that [that school] is here, because I live here, and I know the area” (Geo, 81). But regardless of the participants’ relations to the data sets and whether they are looking for faults or not, it seems difficult to ignore cues that suggest errors:

Well, I don’t search for them [possible errors] actively ... But sometimes there are obvious errors that (…) You find peculiarities in the result that makes you rack your brains: “What might be the problem now, then?”, “Is it here?”, “Can it really look like that?” And then you go further and further down in the data, and eventually you understand that “No, this is probably wrong”. (Geo, 82)

At least one Trends participant has even upgraded this sort of use of the tool more explicitly and intentionally to search for errors (“that’s a good way to use the program ... see if there seems to be something that seems strange”) and mentions two additional types of visual cues that are also ascribed such meanings of signalling problems or errors in data, this time in the form of one or several bubbles moving along a completely straight line, or as an unlikely placement of a bubble (Trends, 88).

Compared to the fairly straightforward errors discussed in this section, more complex aspects of previous critical literacy definitions point not least to bias in information resources. Whereas bias is most commonly understood as something actively and intentionally inserted by actors that want to promote a certain view
and further certain interests (c.f. in particular section 7.2 above), bias in a more abstract sense can also be related to the theoretical views on materiality and representation advanced here (c.f., ch. 3 and 4). In these perspectives, bias can be understood in terms of restrictions imposed through acts of representation and externalisation: the structuring devices needed for representation can ‘encourage’ certain ways of thinking and acting and restrict or hinder alternative ones (c.f., Hutchins, 1995; Säljö, 2005; section 4.2.1). Section 8.3 below illustrates examples of identification of the more direct and actor-related forms of bias in data, whereas the following section 8.2 presents also a number of occasions of tool-interactions in which the participants become aware of restrictions in the tools’ structuring devices.

8.2 UNEMPLOYMENT AND FALLEN TREES: STRUCTURING DEVICE LIMITATIONS

Whereas integrity issues related to social data do not seem to play such a major part in critical approaches to and uses of the tools that I had first imagined when choosing the cases, another and unexpected aspect relating to social data appeared in the analysis instead. Compared to more inert types of data (such as, for example, soil samples), social data represent, as described by Jessop (2006), much more dynamic, fuzzy and unruly relations. And for these reasons, social data also, as the analysis presented here illustrates, push back against representational artefact restrictions and inscription related goals to simplify, abstract, and control ‘the world’ (c.f., Latour, 1986). From the interest here in critical approaches to and uses of visualisation tools, it is particularly interesting to see the numerous examples of occasions in which the study participants, because of this ‘unruly’ nature of social data, are made aware (or reminded) in situated tool-interactions of the limitations of the structuring devices in each tool. The effect can be explained in terms of bringing (back) into focus the materiality of the tools; of countering naturalisation and black-boxing processes reminiscent of suggestions associated with hypermediacy and technotexts (Bolter & Grusin, 1999; Hayles, 1993; 1999; Voithofer, 2005; c.f. also section 4.1.2).

The many colourful examples in the empirical material relating to this theme include a wounded badger falling in between a neat classification system of responsibilities in Geo (Geo, 83) and local, aggressive outbursts of dengue fever in Coatepeque prompting adjusted foci and levels of analysis of data (Trends, 89). Below, however, two other examples are used to illustrate these relations between social
data and structuring device restrictions more specifically: the case of a fallen tree in Geo, and unemployment data in Trends.

Whereas the analysis presented in section 7.2 on uses of MapInfo for the allocation and control of resources can be said to represent occasions of ‘inscriptional victory’ over the world and the actors that it is intended to represent, the examples here represent instead those times in which the map falls short. The messiness of real world events and relations thus also from time to time highlight the weaknesses in its static, two-dimensional and simplified representation of reality as the tool is unable to resolve those things that do not map easily onto its strict geographically divided areas of responsibility. A map is, above all, a static abstraction; a two-dimensional and frozen artefact decontextualised from the objects and events that it is used to structure and give meaning and order to and when real world objects and events are to be represented on the map, their messiness bring forth a number of limitations and restrictions.

“The case of the fallen tree” provides an illustrative example of how easily upset the powers of geographical representations of responsibility can be: the map simply does not afford the means to deal with an object such as a tree that, after falling, can stretch across several of the map’s strictly demarcated and responsibility-coded areas. In this case, MapInfo fails to function as a tool for the negotiation of responsibility, and it can be a time consuming process to find other ways to sort out the issue. Eventually, inspectors may have to visit the actual place to make an assessment and judgment call of how to resolve this real-world problem of a fallen tree:

Then there are, like I talked to you about, these different types of demarcation problems, you know ... If they say: “A tree has fallen here”, I mean, then it can just as easily be on this– ((points to the screen)) the one who owns the land here, or it is right on {Agency X’s}. And sometimes that means you have to take a shot, then [and] send the errand off to {Agency X} and then they can see it on site and decide. If you’re really unfortunate in a situation like this then it’s a giant tree from the private property that falls across here, on to {Agency X’s}, across {Agency Z’s} road, and in to the {Agency Y’s} schoolyard. Then it can become a full-day errand before someone gets it removed ((laughs)) (Geo, 84)

The social world, in other words, does not easily and quietly lend itself to mapping onto strict and fixed geographical areas of responsibility; the real world situations for which MapInfo is used demonstrate the limitations of the representational inscription that is the map. In the Trends case, other relations between data and structuring device appear.
A Trends participant demonstrates how Trendalyzer’s animated bubble chart produces rather confusing and meaningless visualisations on the bases of data with few observations or that do not show comparatively slow and clear trends:

(Participant): If you’re going to animate over time it has to be something that doesn’t shift too much from year to year ... Indicators that have very few observations ... For example, twenty-year-olds that have been murdered: not very many occur per year and there are no trends, then, in the same way, so that one year [there] might be five and [the] next it’s forty and then there are three and so on. There’s no particular– It’ll be a bunch of bubbles that– A cloud that jumps around like this ... That’s another example: unemployment. That is not particularly well suited to show over time because– Or [economic growth– ... ((turns to the screen to demonstrate this example)) (55) It won’t be a particularly interesting animation. Because it can shift from one year to the other. So that type of indicators don’t work particularly well to show in this way.

(Interviewer): No. Growth– Yes, ok– No! ((laughs)) More like jumping gravel there. (Participant): It has to be sort of like this– ... If it goes up and down from year to year, but that the trend is clear ... So that’s such a thing that this is not well suited for but then maybe an ordinary honest line graph or something like that would be better ... I guess that’s an experience that I’ve made ... (Trends, 90)

The example again illustrates situations in which it does not seem necessary to have extensive prior or topical knowledge – it is apparent from a glance of even an untrained eye that the ‘pattern’ demonstrated in the visualisation in the quote above (showing small dots frenetically jumping up and down along the base of the y-axis) is unclear and that the particular combination of structuring device and representational mode in Trendalyzer is not suited for showing something meaningful from those data.

A similar example is described by another Trends participant after attempting to analyse historical data on alcohol consumption in Sweden from the 18th century onwards, but without comparable data for other countries (“we do have good data in Sweden”). The attempt is described to have illustrated in a similarly clear, graphical manner the need to have at least more than one country (or similar entities) to compare with: “but when it was in Sweden it was pretty uninteresting because then it’s just a dot moving up and down ... It’s the comparison that’s the important thing about a diagram. In itself it’s just a bubble going straight up and down, so that there are several countries is incredibly important” (Trends, 91).

These sorts of ‘mismatches’ between social data sets and the structuring devices can then be said to function as reminders of the materiality and restrictions of
the tools as representational artefacts. The participants are seen to respond in two main ways: by choosing other data sets that are better suited to the tools, or by choosing another tool for analysing the data (such as ‘an ordinary line graph’).

A third example of data – structuring device mismatch occurs in Geo when visualisations are found to show no patterns at all (in contrast to the more ‘meaningless’ pattern in the Trends example above). ‘Meaningful’ patterns for the visualisations of traffic accidents in Geo are commonly agreed to be reliant on uneven geographical distributions of accidents: primarily, i.e., the participants look for quantitatively significant accumulations of accidents at specific places or areas. It appears as something of an irony that successful applications of knowledge gained from MapInfo visualisations ultimately also makes the tool less useful:

Gothenburg has come so far now that we can say that— based on this— if we look at it geographically, we can say that we don’t have aggregations of accidents and things like that that we can see otherwise, how: “God, this is an intersection where a lot of things happen– then we have to do something about this intersection”. Now it’s more about us having to use the information we have in another way, because now we see that it spreads out … must take the example of bicycle accidents then: they’re spread out like stars on a night sky across the entire town. (Geo, 85)

Usually in Geo, when clear geographical patterns are found, responses to the visualisations take hold of those patterns (in the form of clustering of accidents in restricted areas) and then they target that area with traffic enhancing measures to physically remove the causes of accidents by rebuilding or adapting the environment. But when clear patterns do not appear, different ways to analyse and find meaning in the data sets are sought by starting to look into other variables outside the geographical representation:

“Well, okay, what does that tell you then?” And then we have to start using this data that we have in another way and start looking more at, maybe, what age categories it is; what types of injuries it is; environments it is, and not, sort of, precisely that intersection but intersections of that type … And that’s exactly what we’re doing in the analyses for [a specific programme] now, so now we’re looking at age distribution; sex distribution (...) And since we have included hospital reported accidents, we can also look at degrees of injuries according to the medical classification there, and then we can see … if we find patterns. (Geo, 86; c.f. also Geo, 87)

Yet another option in the absence of clear patterns is to ascribe meanings also to ‘non-patterns’. The evenly scattered nature of slip-and-fall accidents, for
example, has led to changes in the routines for sanding and sweeping the streets in the city (Geo, 88). Another such example concerns alcohol related accidents. When no patterns emerge, other meanings become attributed to those “non-patterns” and lead to conclusions that other actors and other actions and measures are requested – when they can’t “build this away”. Again, the influence from and power of the Zero Vision for interpreting and enforcing the meanings of visualisations is illustrated, invoked here to demand wider recognition of how the responsibility to reduce the number of accidents is shared by many actors outside both the Geo case and Gothenburg city:

And with the Zero Vision also comes [a] more shared responsibility, so that besides this about the traffic environments– I mean the street environments– then it’s also about, sort of, how you design vehicles and there we can make demands, as buyers of transports, say that: “Here there should be some form of drunk-driving prevention technology”. Because we can see, I mean if you look at alcohol related accidents in this information system for example, then you can see [that it’s] really hard to find patterns ... Okay, then maybe we can place demands on what we can influence: we can’t sort of build this away. (Geo, 89)

From a critical literacies view, these sorts of data-tool mismatches can be interpreted as beneficial in Hacking’s (1999) ‘unmasking’ sense (c.f. also Bowker & Star, 1999) in that they make visible such things that otherwise easily become naturalised and taken for granted as the right and only ways to think, act, and represent. The ways in which at least some of these ‘visual cues’ are also described as easily understandable even without prior knowledge provide interesting counter-weights to the emphases on the importance of topical knowledge, experience and professional vision (Goodwin, 1994; c.f., section 6.2). Other and similar examples draw the participants’ attention to bias in whole data sets.

**8.3 DIFFERENT STORIES: BIAS IN DATA**

The theme presented here includes examples of how the participants utilise and ascribe meanings to visual cues (graphical and animated patterns, movements or placements of data representations) as revealing bias in the data sets. The most common and perhaps graphically articulate examples of such patterns occur when combining and representing several data sets in one and the same visualisation. There are more examples of these sorts of uses in the Trends case than in Geo, most

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likely due to the overall use of a greater variety of data sets in Trends.\textsuperscript{30} However, depending on what perspective that is applied to the occurrences of duplicates in the Geo visualisations of traffic accidents (i.e., if they are interpreted as the results of conflicts of interest rather than as errors; c.f. section 6.2.1), these can also be understood as examples of visual cues for detecting bias in the sense discussed here. In both cases, thus, through simultaneous representation of different data sets in one visualisation, the participants are made aware of congruencies and discrepancies between different data sets; i.e., their attentions are drawn to comparisons of data sets. Perceived inconsistencies give rise to questions concerning methods and origin: who has collected and processed the data; how has this been performed; and in what interests and for what purposes.

One of the Trends participants demonstrates, for example, in front of Trendalyzer, how the combination of two different data sets in one and the same visualisation can result in two different patterns or cues perceived to demonstrate various sorts of bias. When data sets are compared in Trendalyzer visualisations in this way, the bubbles that usually represent countries or continents are here instead made to represent the different data sets. The milder version of differences discerned in this way between data sets is explained to appear as a fairly consistent dislocation; i.e., the visualisations of the two data sets will ‘mimic’ or resemble each other (follow the same general curve or pattern), but consistently differ on one of the axes, so that there will be, for example, a consistent difference in ‘height’ of the curves. Such a difference might indicate the use of different exchange rates for calculating GNP:

Yes it [Trendalyzer] is very practical to use, precisely this about, like I said, comparing GNP series. Because then you can choose here (…) ((demonstrates on the screen)) two (…) (11) Just to show what a big difference it can be (…) This is GNP per capita according to the World Bank, and this is GNP per capita according [to] this Madison.\textsuperscript{31} And they’re supposed to– in principle– measure the same thing. And as you can see there’s a pretty big difference, and people can use– I mean both are used [as] sources for GNP … (Trends, 96)

\textsuperscript{30} It should be noted that this comment is only valid in the context of this dissertation with its case-related restricted focus on the uses of visualisations of traffic accidents in Geo. In their ordinary work practices, the agencies and companies that are part of the Geo case also work with numerous different types of data and other uses of MapInfo that are not included in this study.

\textsuperscript{31} Madison is another data set resource sometimes used for Trendalyzer visualisations.
Standardisation constitutes another example of ‘fiddling with’ data that the study participants find comparatively (compared, as usual, to raw data sets, Excel sheets or written reports) easily identifiable in Trendalyzer visualisations and equally irritating and potentially misleading if there are no adequate descriptions (which, they state, there often are not) of how the data have been produced and processed. One such ‘visual cue’ is when all values end up on whole numbers:

Here’s another example of when you can see certain things with the data ... looks at the graphs, then you see that all of them are here on the lines. On whole numbers. And then you can suspect that they have certain standard values, sort of, that they put them into. The Czech Republic has three, then four; there’s no one that has three point twenty-seven or something like that. And for certain indicators you can see very clearly when you add them, then, that they end up like this: “bonk, bonk, bonk, bonk” on lines, without there being a comment in the data set that “We have certain standard values”, and things like that. (Trends, 97; c.f. also Trends, 98)

While the examples above illustrate, as mentioned, the more harmless or at least less intentional sorts of bias in the form of differences that occur in data and statistics due to the use of different methods and measurements in the production and processing of data, more serious meanings are ascribed to patterns in which the curves for different data sets start going in different directions. Those types of patterns are interpreted as more severe evidence of bias and data manipulation, but they are similarly easily detectable in the visual representation. The participant illustrating the height-difference problem above continues here to illustrate what it looks like when accounts on the states of nations differ significantly between two data sets:

But then it might be even worse. The difference in some cases it is even, sort of, the pattern for this one looks different so that (...) it doesn’t at all look as if there’s a crisis there but here it goes up instead– ... Let’s run it several times and then you can see if there is someone that seems to move in a weird way– ... ((clicks and searches for something on the screen)) (26) Yes, here you can see one drop– and it’s not so very clear, there are some others where you really see it taking off– like that, and then you can see kind of: the story that the statistics give there are two completely different. In the one case it looks like a country that suddenly they’ve done very well (...) While in another case it looks like they’ve entered an economic crisis. Then you don’t know what to believe really– Because then it’s just not that there are maybe some differences in height, so to speak, but then it’s two completely different stories
that give (...) ... And there you wonder: “Well, how can that be then?” And then you have to know how they have calculated to come up with that. (Trends, 99)

As explained, the two data sets visualised here are clearly seen to provide “two different stories” and it becomes obvious that something, somewhere, is amiss with one (or perhaps both) of the data sets. The only way to get a grip on the situation is to look into the underlying data sets, hopefully also to metadata associated with those data that describe how they have been produced, and then start a sort of source criticism analysis. In this case, the participant had actually tried for several weeks to get information about the data in one of the sets but so far without luck, and was therefore without means to critically examine and scrutinise them and find out what the problem might be. But even without knowing the cause of the problem, it had in this way been alerted through what became visible in the Trendalyzer visualisation, thus enabling at least a distanced approach to those data.

A similar reflection is also provided by one of the Geo case participants involved in processing and visualising numerous data sets: “If you have redundant information then you can probably eliminate some of– or find what is right perhaps /.../ It’s very good if you can have several– I mean, check data in several different ways. Then you have the possibility as a user to judge the quality” (Geo, 92). Even though different data on the same thing is described here as “redundant information” the benefit mentioned is the same as in the Trends example; parallel or simultaneous visualisation of data for the same variables and indicators can be used to find inconsistencies, for checking the data, and for “judging the quality”.

One of the Trends participants even has ideas on how Trendalyzer, by providing these visual cues and illustrations of data set inconsistencies could be used even more specifically as a tool for illustrating the value and meanings of source criticism, and for learning associated critical competences. By specifically focussing on the visualisation of similarities and differences between data sets, their trustworthiness and values as information resources come into focus and users can start a source criticism discussion comparable to the more established critical literacy discussion relating to text and print books:

... instead of having different countries in the bubble diagram ... we could add Botswana’s life expectancy, what the UN says, what the World Bank says, what the voluntary organisations claim, and what Botswana itself wants to say, and then you can see that the numbers are different, and then you have to say: “But who do I trust the most?”; or (...) And then you have to click on them somehow and retrieve: “Well, how have they done this?”, “How did they arrive at these numbers?”, sort of.
And then you’ll probably see then that Botswana today claims that their life expectancy is higher than according to the UN, it’s down at below thirty-five years today, but Botswana itself is saying that “No, it’s over forty at least”, and things like that (...) So then you have to say: “Yes, but we believe the UN”, “No, they have no clue, we rather believe (...)” And so you have to (...) And that type of judgement you always have to make when you (...) in all types of research or when you’re reading a book. (Trends, 100)

The example illustrates how visual cues that indicate bias in the data are both perceived and enacted by the participants as leading towards critical scrutiny in the form of looking into the bases for visualisations; the different data sets. The quote above really provides a text-book example of source criticism as going to the ‘root of the problem’ by checking the source of the information. It also goes a long way to place data on the same level as other sorts of information – a claim that has previously been presented by leading researchers in LIS such as Michael Buckland (1991).

In these sorts of approaches and uses, then, the visualisation tools (mainly in the Trends material) are constructed as valuable tools also for detecting bias in data sets in ways that are clear and easy enough even for non-professionals and outsiders. Another set of seemingly situated interaction emergent critical approaches and uses similarly cued by the visualisations are found to trigger further questions and information seeking for other and ‘tool-external’ events and relations in ‘the world’ that can explain the patterns or visual cues that appear in the visualisations.

**8.4 “WHAT WAS THAT?”: A START-POINT FOR QUESTIONS**

As previously demonstrated, visualisation tools are predominantly constructed in academic discourse and narratives as more or less automatic generators of ‘new’ and objective (fact-based) knowledge that is also more or less seamlessly transferable and ideally adapted to human cognitive characteristics (c.f. section 2.1). On certain occasions, many of these ideas are also found in accounts offered by the study participants here (c.f. section 6.1), although primarily interpreted as reflections of popular narratives since most of the other examples in this dissertation demonstrate significantly varied and critically informed enactments of meanings. The analysis presented in this section offers yet another contrast or opposition to these ‘popular narrative reflections’ in illustrating a variety of critical approaches to and uses of the tools of an almost directly opposite nature whereby the participants use the tools to find and ask new questions rather than to look for answers.
Approaching and using the tools and their visualisations not as ‘providers of answers’ but as ‘generators of questions’ and as ‘guides for further information seeking’ might be understood as a sort of use that one would expect from the application of an analytical tool onto any sort of data to be analysed. In practice, however, those types of uses and approaches might not be entirely obvious and self-evident; there are certainly quite a few examples in everything from newspapers to scientific reports when an ‘analysis’ is considered complete and finalised merely through the production of a median value or a percentage (‘15 % of XX and 3 % of YY’). In the material here, however, a number of comparatively ambitious further approaches and uses are seen to move the tools well past not only primary but also secondary artefact uses to construct them as tertiary artefacts that on a higher, more abstract and creative level support reflection and discussion on different possible ways to see, understand, explain and act in ‘the world’.

Sometimes these critical approaches and uses lead to more focused continued exploration of other sorts of data available through the tools, as in this Geo example when the participant first takes out a geographical visualisation and proceeds from that to look into additional material such as scanned police and hospital reports connected to the visualisations of the accidents:

Well, if I’m curious about– … what the light motorcycle accidents look like– then I do this– … I can take all light motorcycle accidents– because there are people in their fifties in light motorcycle accidents as well– Then I can just sort of perform a search where I say that: “I want to look at all accidents where a light motorcycle is involved” … Sure. And then I start with the map image, yes, say: “Uh-huh, that’s right, that’s what it looks like.” And from that, then, I can say, well: “Youths, or elderly, or (...)?” Then I can sort of experiment with this material. (Geo, 90)

But also, in both Geo and Trends, the visualisations are used to raise questions that require complementary information seeking ‘outside’ the tools. Research and environmental scanning is an important aspect of such further uses of analyses in Geo (e.g., Geo, 91) and the Trends participants describe how patterns in the visualisations give rise to all sorts of questions concerning what possible historical, social, political, economical, cultural or climate related events and relations that might explain what they see. Often they also describe how, for these uses, they sit down together with other co-workers and discuss the patterns as they come forth when ‘running’ or ‘playing’ a certain animated visualisation:
Then as a rule you’re a small work team and then you can actually take out graphs and then you can show it and then you can say: “Look at this!” “Oh, how exciting that was—”, kind of, “to see what’s happened with this part of Botswana: it’s moving in the wrong direction while the rest of the country is moving that way: What happened there?” “Well, that’s where AIDS have struck the hardest”, “Wow, what an effect it had”, and things like that. That you can analyse it like that (...) Because you see (...) It gets so easy when you see it from year to year what happens. Where the curve dives up or down, then something has happened, sort of. (Trends, 101)

In the Trends case in particular, similar sorts of ‘visual cues’ that were also seen to be given meanings as identifying errors in data, i.e., all sorts of deviances, anomalies, strange movements and placements of bubbles, are also ascribed meanings in these examples although here, then, in the form of triggering the participants into asking further questions based on the visualisations. In the lengthy quote included here below it becomes particularly clear how all sorts of strange movements are picked up as incentives to seek out – through tool-external information seeking – explanations to those patterns, as this participant has evidently done. The example is also a good illustration of how closely the participant relates to the visualisation; there is really in fact a conversation going on here, and even though it is intended to illustrate the analytical process to me as an observer, the conversation is ‘with’ the tool, almost forming a dialogue of visualised patterns and counter-questions. The animated visualisation is played and then stopped by the participant every time a perceived interesting, unexpected and deviant movement is discerned. The participant follows up on the reasons for pausing the animation by pointing out the anomalies that have prompted his/her attention in some way, and then explaining what events that he/she has found to provide plausible explanations to them:

And, if you look a bit further back (...) We can take this one that’s a little bit better: if we look here (...) Here we can go back to 1950 and then we run this slowly here and then we see: “Wow, stop! That was a strange country, what country is that?”, “Well, that’s Korea (...) Had very few children (...)” North Korea, that is... “That’s right, they have very few children but very high child mortality (...)” —53 (...) Well, that’s the Korean war, it’s not very strange they had few children. And then you see, yes– But then it enters (...) Then we’re in the sixties here now (...) ... “What kind of a strange country is that, has the most (...)?” “Yes, that’s Yemen. Lots of children per woman and sky-high child mortality–” No (...) Really poor– This is money, then (...) The poorest in the world Yemen was in 1968 (...) Lots of children per woman (...) Yes, and so you see– The years go on here, sort of (...) —73 (...) Then we have
some country that takes a dive here, then you think like this: “Oh, what country is
that, that (...)” ... And then you see: “Is there something wrong?” Wait. Oh, look,
they’re there: jumping up and down. “What country is that there?” “Well, that’s
Equatorial Guinea”. They found oil here, so Equatorial Guinea is pretty rich now.
Look, they have as much today as (...) Slovakia. (Trends, 102)

It might seem as if the ‘cues’ for identifying errors (c.f. section 8.1) and these
‘cues’ for asking questions and seeking tool-external explanations are identical and
therefore reintroduce the importance of experience, topical knowledge, and profes-
sional vision for the sorts of critical approaches and uses demonstrated in the exam-
pies here. And certainly there is room for overlap, but there is also, at least in the
examples provided by the empirical material here, a difference in degree in that the
cues for error are more drastic and represent development or lack of development
that is extremely unlikely or downright impossible. It is, for example, virtually
impossible that a country shows no change at all over a longer time period (and
thereby moves on a completely straight line) for the vital indicators in focus for
Trendalyzer visualisations, or that a country or several countries suddenly drop
straight down to zero values. The somewhat curious “jumping up and down” seen
in the case of Equatorial Guinea above, on the other hand, is perhaps unexpected
but at least not close to impossible (as also demonstrated by the explanation offered
by the participant).

Sometimes these cues or patterns concern one country in particular and
sometimes they involve a whole continent (both cases illustrated by the following
example). And although the visual cues of the type presented here may make it
comparatively easy even for a non-professional user to understand when something
strange happens and when there might be interesting explanations to seek out in
terms of social or natural events, the sheer scope of the questions becomes, of
course, staggering. Based on what is included in these visualisations, the questions
triggered can potentially concern any country of the world, at any time during at
least the last fifty years, in relation to a vast number of indicators:

So here, some country will take a dive. There! “Oh, what’s that?”, sort of. “Was that
something wrong?” No, then you know— And there was another one, right? And
then comes AIDS (...) So first (...) The first case was that (...) Pol Pot (...) That was
the first (red)– In Cambodia (...) And then there was the genocide in Rwanda and
then AIDS came (...) And then all the other countries [in Sub-Saharan Africa] came
down (...) So you can see clearly when there’s an exception from the normal. So you
can see what it is (...) (Trends, 103)
When used in these ways, to follow up on questions triggered or cued by the visualisations, the tools are given completely different meanings compared to the popular narratives of ‘providers of answers’. They serve as start-points for new, continued or further questions, information searches and discussions in more of a tertiary artefact sense (Säljö, 2005; Wartofsky, 1979) which rather help their users explore, question and reflect on several different ways to think about and interpret phenomena and relations in the world. For the Trends participants, with their particular focus on empowerment and democratisation, these questions are also connected to these goals and ideals as important first steps that also make it possible to take the next step to more ideologically focussed discussions; from: “‘Why did it get like that?’, ‘Whose fault was that?’, or ‘Whose contribution was that?’” to questions that also look forward, to: “‘How should we proceed now?’” (Trends, 104)

8.5 CONCLUSIONS

The utmost (and negative) consequence that can be inferred from theories on appropriation would be that users relatively unreflectively come to ‘learn’ limited manners of thinking and reasoning through the ‘disciplinary effects’ of the tools that they use. Interestingly, thus, the results from the contextual inquiries here seem to illustrate how a number of critical literacies can actually be supported by, and emerge in, situated interactions between tools and participants as co-constructions of meaning. The findings suggest that the participants appropriate and adapt a number of affordances in manners that are not part of the ‘public repertoire’ and primary intentions of the tools, nor fall back on their own a priori knowledge.

The complexities of these sorts of critical approaches to and uses of the tools range from more concrete to abstract: from finding errors in data; to detecting bias within and between data sets; to highlighting structuring device limitations. For the first time here, the constructed nature of both data and tools come into focus through visual cues functioning as hypermediacy traits; as features that draw attention to the data’s and their own materiality (c.f., Jessop, 2006, for conscious visualisation design exercises to create similar user awareness of historical data bias).

All these uses seem to move the tools toward more abstract tertiary artefacts, not least the examples in the final theme of using the tools to ask questions rather than seek answers. Similar promising evocative potentials to support the formulation of questions have previously been noted in relation to satellite imagery by (Parks, 2009), by virtue of the visual imagery’s abstraction and indeterminacy.
PART IV

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FINAL DISCUSSION,

REFLECTIONS AND RECOMMENDATIONS
In this final chapter, the gaze is lifted again from the more focussed analyses and discussions relating to the three research questions in the preceding analysis chapters to draw together the results from these into a more comprehensive discussion of how they combine to shed light on the overarching research aim of this dissertation: *to analyse mutual enactments of critical literacies and social visualisation tools as information resources*. As such, the discussion presented here is more theoretical in character and rejoins into new formations under one principal perspective findings from the analysis that have been presented and discussed in preceding chapters.

The expressions of critical literacies found through the analysis are described and presented in section 9.1 below in terms of three main directionalities as *reactive, proactive* and *adaptive critical literacies*. Each critical literacy directionality is also seen to be associated with specific idea traditions, information views, and constructions of the visualisation tools as information resources. As further conclusions on the basis of these findings, section 9.2 also presents and argues for a new and more nuanced narrative of visualisation tools that emphasise their potentials as *evocative* and *non-blackboxed information resources*. In section 9.3, I present critical reflections and discussions on choices and shortcomings of the study and the final section 9.4 suggests avenues for future research.
9.1 DIRECTIONALITIES OF CRITICAL LITERACIES

In this first section, then, I regroup the findings from the previously presented analyses in a complementary or continued ‘reading’ of the empirical material on a higher level and in dialogue with the theoretical framework and disciplinary traditions invoked here with the intent to address more directly the overall interest formulated in the research aim concerning the mutual shaping of critical literacies and the visualisation tools as information resources.

The concept of critical literacies as used here, the reader will remember, denotes pluralistic situated enactments of meanings through which the study participants identify, question and transform perceived cultural, material bias and restrictions; power related aspects of access, control and use; as well as other possible expressions of distanced and questioning approaches to and uses of the tools.

From a comprehensive perspective on the empirical material and the results from the three primary analyses, the participants’ critical literacies are described here in terms of three main directionalities as reactive, proactive and adaptive. Each of them is also seen to be associated with different idea traditions, information views, and constructions of the tools as information resources. The reactive and proactive critical literacies conform with established notions of critical literacy, whereas the third set of adaptive critical literacies exemplify critical approaches and uses that seem thus far overlooked or at the very least under-researched in not only critical literacy contexts but also in the larger fields of information literacy and literacies research. The critical literacy directionalities, their associated views and tool-constructions are summarised and presented in Table 9.1, and further explained and discussed in separate sections below. The non-critical enactments described as reflections of popular narratives presented in section 6.1 are not included in the discussion in this section since they fall outside the scope of the term critical literacies as defined here.
Table 9.1

**Directionalities of Critical Literacies**

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Data view</th>
<th>Tool view</th>
<th>Ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reactive</strong></td>
<td>Receiver</td>
<td>Artefacts</td>
<td>Neutral conduit</td>
</tr>
<tr>
<td></td>
<td>(Participant ← Tool)</td>
<td></td>
<td>Expertise</td>
</tr>
<tr>
<td></td>
<td>Sender</td>
<td>Facts (true and objective)</td>
<td>Neutral conduit</td>
</tr>
<tr>
<td></td>
<td>(Participant → Tool)</td>
<td></td>
<td>Foundationalism</td>
</tr>
<tr>
<td></td>
<td>Sender</td>
<td>Facts (raw material)</td>
<td>Neutral conduit</td>
</tr>
<tr>
<td></td>
<td>(Participant → Tool)</td>
<td></td>
<td>Enlightenment</td>
</tr>
<tr>
<td><strong>Proactive</strong></td>
<td>Co-construction</td>
<td>Artefacts</td>
<td>Artefact</td>
</tr>
<tr>
<td></td>
<td>(Participant ↔ Tool)</td>
<td></td>
<td>Hypermediacy</td>
</tr>
</tbody>
</table>

### 9.1.1 Reactive Critical Literacies

The reactive sets of critical literacies correspond to prior critical literacy definitions as reading against or assuming an intellectually distanced position towards documents and describe enactments of meaning that come forth in the empirical material in a variety of ways. The term represents a set of approaches and uses that comprise enactments of participant-tool relationships in which the participants position themselves as receivers of data perceived to be influenced or even determined in both form and content by contexts, conditions, actors and interests at some point of initial or intermediary state of ‘production’. In other words, the data are perceived as cultural, material constructed ‘artefacts’ in a comparatively concrete sense.

The participants describe, as parts of these reactive critical literacies, a number of errors and bias understood as at certain specific points ‘inserted in’ or ‘imposed on’ data sets, for example through an inaccurate geo-referencing of a traffic accident, or an actor’s intentional manipulation of data. To these literacies also belong critical identifications and reserved stances towards parallel external documents and
forces felt to more continually act upon and influence the focus and content of visualisations, primarily in the form of influential national and international political agendas such as the Zero Vision and the Millennium Development Goals.

The participants’ corresponding approaches and uses in response to these understandings range from intellectually distanced positions and questionings of specific data sets; to questionings of the uses, values and effects of data as information resources in a more general sense; to more concrete counteractions such as compensating known errors or weaknesses in one data set with known strengths in another. In all these enactments, however, the participants construct the visualisation tools as information resources in terms of fixed and free-standing objects, as externalised matters-of-fact that require specific knowledge-based responses.

The relations established between participants and tools are of a dualistic, character and the visualisation tools are constructed in line with the transmission metaphor tradition as neutral and inactive conduits that carry ‘content’ without affecting it between senders and receivers. The visualisation tools, thus, are in these enactments constructed as carrying data that have been input at one point and become received and unpacked in unaltered form at another point. These sorts of critical approaches and uses, in other words, do not acknowledge situated constructions and reinterpretations of meaning and are in this sense highly conformant with the most traditional forms of critical literacy definitions.

When documents are constructed in this way as neutrally carrying content with fixed, ‘original’ and universal (non-situated) meanings and users are positioned (by themselves and cultural conventions) as recipients thereof, the understanding of critical approaches and uses in both prior definitions and the material here also take the form of normative views on ‘right’ and ‘wrong’ ways to act and think. In critical literacy definitions, the specified critical ‘skills’ are of generic character (‘read against’, ‘look for bias’), whereas the examples in the cases here comprise both such generic and situated, topical skills (‘Zimbabwe has poor data’, ‘hospital reports are less accurate on location’). All, however, are firmly based on the participants’ valorisations of a priori knowledge, experience and acquired professional vision: without such knowledge, these sorts of problems cannot be known and therefore not readily available to outsiders.

Taken together, these views and positions ultimately lead to constructions of the tools as problematic for non-experts; they are perceived of as challenging, difficult, and easy to misunderstand and misuse. The effects can be, as in the Geo case, to hesitate towards or restrict public access. Even the Trends participants that are avid advocates of broad public use of and access to data and visualisation tools frequently construct the data and visualisations as problem-filled, difficult and
demanding resources requiring both topical and generic data and statistical knowledge, together with a certain level of technical skills for perceived critically appropriate uses. The overall outcome of the views and relations characteristic of these reactive critical literacies is to construct the visualisation tools as information resources mainly for professionals, for experienced experts.

9.1.2 Proactive Critical Literacies

Proactive critical literacies describe a quite different set of active and intentional reinterpretations and transformations of data and visualisations including also the production of new alternative narratives and knowledge. The term describes enactments of meanings in which the participants shift positions from receivers to senders; a reversal yet repetition of the hierarchical and dualistic relations between users, data and tools as free-standing entities. In these enactments, the view of the tools remains, as described for the reactive relations above, in the transmission metaphor idea tradition as neutral and inactive conduits. The decisive differences concern here instead the shifting position of the participants into senders that mobilise data and the tools to further their own interests and produce visualisations and narratives that relate to themselves and their own (work related) needs.

The most notable aspect of these mobilisation processes involves the abandonment of the material and cultural view of data as constructed artefacts characteristic of the reactive critical literacies discussed above. Instead, the dominant view of data in these proactive critical literacies equates data with facts in two different ways: as objective truths, and as unconstructed raw material.

The first sort of construction of the data as facts in the sense of objective truths represents, however, not a ‘real’ positivist or objectivist position, but precisely intentional political mobilisations necessary to make the visualisation tools speak with the authority that the participants need in order to control and allocate resources in the form of time, money and knowledge. By constructing the data as ‘true’ and the tools as the means to access this knowledge, they can use the tools for operational and instrumental purposes: the tools become politically powerful and authoritative by being constructed as objective and showing ‘how it really is’. These constructions of the tools help the participants to, for example, muster up ‘evidence’ to decide upon and mobilise resources for specific traffic enhancement measures or the distribution and control of monetary aid to recipient countries. The constructions also provide the power to question and counter other actors’ prior knowledge accounts with ‘better’ and ‘harder’ ones. In this sense, these approaches to and uses of the tools correspond to what Kapitzke (2003a) describes
as “foundationalism”; as seeking out facts and using them to further arguments and make a case.

Other examples of fact-constructions of the data and visualisations are closely aligned with the ideological and philosophical ideas of rationalism, reason and scientific progress characteristic of Enlightenment ideals (c.f., Haider & Sundin, 2010; Kapitzke, 2003a). In these enactments, the constructions of data and visualisations as objective facts turn the tools into political obligations for citizens to take part of in the interest of rational discussion and for the furthering of value-neutral, fact-based politics, public participation, and transparency.

The effects of both these sorts of fact-invoking enactments of data are to construct MapInfo and Trendalyzer as objective sources of knowledge and tools of politics and power. In these constructions it also seems particularly crucial for the participants to emphasise the neutrality, or altogether wipe away traces of the existence, of the visualisation tools as mediating the data. The tools ‘disappear’ in descriptions and actions that rather suggest unmediated access to facts. When interpretations, values and measurements are introduced, they are associated with externally formulated political goals and agendas. The moves imply a complex construct in which maximum effect is achieved by retaining the data as neutral, true facts separate from – but ‘held up against’ – influential external political goals. The enactments are reminiscent of popular narratives of images as real and technology as objective, combining into authoritative and persuasive visual techno-narratives (c.f., Beaulieu, 2002; Burri, 2012; Campbell, 2007; Joyce, 2005).

The effects of these enactments of meaning are to construct the visualisation tools not primarily as information resources but as political tools for flattening or even overthrowing and reversing knowledge based power hierarchies (c.f. also Gartner, Bennett, & Morita, 2007; Tulloch, 2007). When set against the background of the enactments described in the reactive set of critical literacies in particular, the sorts of proactive constructions of the tools presented here appear as intentional critical literacy accomplishments in line with local empowerment and resisting or overthrowing dominant power orders as propagated by Freire (2000/1972) and Kapitzke (2003a) in the sense of recreating or producing new documents and narratives for the furthering of own, alternative interests.

The other sort of construction of data moves them instead towards notions of ‘unconstructed’ or ‘naturally occurring’ ‘raw material’. These enactments represent less direct strategies or mobilisations that take a detour through which the participants construct themselves and the potentials of the visualisation tools as victims hindered and restricted by primary data holders’ unethical or illegitimate restrictions on data access. Through these enactments, however, the participants likewise position
themselves as senders of meanings with the intent to further their own interests, change dominant accounts, and steer and control the actions of other actors. Cases and arguments in their own favour are sought through describing the situation as a political and power related conflict which hinders the potentials of the tools, constructed in terms of generators of public good knowledge and mediators of democratisation processes through improved infrastructure for transparency and public involvement. These enactments represent mobilisations of the data with ideological roots in similar complex balancing acts between not least libertarianism and utilitarianism characteristic of traditional public domain ideas (c.f., Boyle, 1996; Hemmungs Wirtén, 2004).

9.1.3 Adaptive Critical Literacies

Adaptive critical literacies, finally, describe a set of critical approaches to and uses of the visualisation tools made visible through the analysis here that seem thus far largely overlooked in prior critical and information literacy theories and studies. They do appear close, however, to what has previously been declared as under-researched and ‘under-theorised’ yet crucial aspects of human-tool constructions of meaning by Tuominen et al. (2005) from a sociotechnical perspective and by Sluijs (2008) with reference to sociocultural views.

The examples of adaptive critical literacies demonstrate how the participants – besides the above described ‘recipient-reactive’ and ‘sender-proactive’ relations – also position themselves, or rather enter into, collaborative and dialogic relationships with the tools in situated interactions and interpretations of meanings. I have described these approaches and uses as adaptive critical literacies because they seem to suggest that the participants have developed certain affordances of the tools in their local contexts of use by ascribing meanings to patterns in the visualisations that are not ‘common knowledge’ or part of popular narratives of the meanings and uses of the visualisation tools. The participants, in other words, seem to have adapted and reinterpreted certain visual affordances of the tools for critically informed meanings and uses.

In these sorts of enactments, visual cues in ‘real time’ interactions are ascribed critically relevant meanings and the participants demonstrate two completely different approaches to and uses of the tools compared to the previously described reactive and proactive literacies. Affordances of the tools are used to, firstly, identify errors and bias in and between data sets, and secondly, to indicate mismatches between data and tools and constraints in the structuring devices. The visual cues associated with these meanings are described to be of a comparatively generic
character and do not, in the views of the participants, require the sort of prior topical knowledge, experience and acquired professional vision suggested by the reactive literacies accounts. These cues and their meanings are instead described and enacted as either derivable through logic (a tram accident cannot possibly occur far from the track) or mere universal intuition (drastic, ‘impossible’ movements of bubbles or placements of traffic accidents are felt to clearly indicate that something is ‘wrong’).

As affordances of meaning, the participants thereby seem to describe these sorts of visual cues in line with the less formalised and more universal sorts of ‘direct perception’ (compared to interpretations of more advanced symbol schemes and classifications in terms of ‘recognition’) described by for example Greeno (1994). Accordingly, these enactments of meaning also seem to be of a more tacit and embodied character and represent a set of critical literacies that the participants themselves are not fully aware of and recognise as such. A likely explanation is that they do not fit with dominant critical literacy definitions that emphasise source criticism, intellectual distance and a priori knowledge and skills to determine beforehand ‘good’ or ‘bad’ sources and ‘right’ or ‘wrong’ uses (c.f. section 3.3.1).

These approaches to and uses of the tools are also interesting to consider in relation to theories on hypermediacy works (Bolter and Grusin, 1999) and technotexts (Hayles, 1993; 1999; Voithofer, 2005). The theories describe, not least, the paradox that although new representational artefacts aim to create more ‘real’ and ‘un-mediated’ experiences (as for example 3D movies), then the technology required for this experience still tends to remind the user of its own materiality and constructed nature by, e.g., malfunctioning or being obtrusive (the 3D goggles may be heavy and require plugging into a power outlet). The visual cues and meanings ascribed to them have similar effects of directing the participants’ attention to errors and bias in the data sets and to limitations in the tools’ structuring devices – even when they approach the tools for other primary uses.

Through these enactments, the tools also become constructed not merely as information resources but as tools for developing critical literacies through which the participants identify and question cultural and material constraints and bias relating to both data and structuring devices.

The results presented here demonstrate both the needs for and promises of further elaboration of the concept of critical literacies from sociotechnical and sociocultural perspectives for applications to empirical research in order to gain a better understanding of how the interpretation of meaning from visual patterns afforded by (social) visualisation tools come about. In particular, they seem to
emphasise the need to include tool-mediated tacit, embodied, situated and interactional interpretations of meaning into the concept.

The examples of adaptive critical literacies are also seen to move the tools toward *tertiary artefact uses* which seem to culminate with uses of the tools to ask new questions. From a critical literacies perspective, this brings up good reasons to suggest a new narrative of visualisation tools.

### 9.2 A NEW NARRATIVE OF VISUALISATION TOOLS

In conclusion, the findings of this study are used to argue that the dominant cognitivist and positivist popular narratives and academic definitions of visualisations should be replaced with more nuanced alternatives that rather emphasise the potentials of visualisation tools as *non-blackboxed information resources* and *evocative tools*. That is to say, an understanding of the tools as supporting the formulation of new questions rather than as providing answers, and as enabling repeated analyses from different perspectives rather than as simplified abstractions with severed links to the data upon which they are based, are thought to benefit both future uses and developments of visualisation tools as information resources from a critical literacies perspective.

The results from this study illustrate that one of the most striking and interesting ways in which the participants approach and use the tools construct them as *enabling both ‘interpretation of’ and ‘access to’ data*. These enactments, in other words, construct the tools as information resources that both provide a sort of higher-level, abstracted meaning of data, whilst they also and in a highly concrete sense retain the link to the data sets upon which these abstractions are based.

In light of the theoretical framework, these enactments of meaning combine to suggest constructions of the visualisation tools as examples of a unique specimen of information resources that incorporate the powers of inscriptions without the costs of cascading simplifications and black-boxing. The findings suggest, in other words, that the combination of full data sets that can be returned to indefinitely by – at least in theory – all users to be scrutinised and analysed from various perspectives, together with the focus afforded by the structuring device in each case (the geographical and temporal representations) provide simplification, control, ‘knowledge’ and abstraction without wiping away traces of, and stages in, the process. Whereas Latour and Woolgar (1986/1979), thus, describe the meticulous work of scientists to create harder and harder facts by repeated ‘refinement’ and ‘abstraction’ of data into successively new inscriptions and at each step discarding
or ‘hiding’ the data that lead up to a particular theory or other form of inscription (data in these accounts literally go into the waste basket of laboratories in the processes of creating facts and truths in the form of inscriptions) the data are retained in the visualisation tools studied here.

These enactments of meanings are very far from the definitions presented in section 2.1 which construct visualisations as true and objective automated sources of (new) knowledge more or less seamlessly adapted to human cognitive functions and thereby possible to ‘absorb’ without effort or even much conscious action. Instead, many enactments here describe a sort of dialectical readings or interactions in Bruce’s (2000) sense as ‘reading against’ documents. Here, such actions also take on a very literal meaning in that the participants move back and forth between both their own instantiated visualisations and the data sets upon which they are based to look up other things, try to gain different perspectives, and seek other meaningful patterns. These repetitive and data-inclusive tool-characteristics are also what enable re-analyses and questionings of other actors’ readings and analyses of the same or other data on the same topic.

The ways in which the tools both ‘hold’ and mediate access to full data sets, then, are central for the perceptions of the tools as enabling efficient and democratic sharing of knowledge and multiplication of voices and perspectives (7.3.1 and 7.3.4). They also appear central for enabling the questioning of dominant accounts and challenges of privileged expert roles based on restrictive access to data (7.3.3). “Repeatability” in two ways appears crucial to these sorts of critical literacies. Firstly, there is the possibility to replicate prior analyses on (supposedly) the same or equivalent data sets, which allows critical scrutiny of and the means to question earlier accounts. Secondly, there is also the possibility to repeat analyses of the same data sets from different perspectives, by different people, with different foci which allows questioning, critical discussion, a multiplication of perspectives and voices heard, and a possibility to target and tailor information issues of concern to oneself and one’s own life situation.

These approaches and uses move the tools well past primary and also secondary artefact uses in Wartofsky’s (1979; Säljö, 2005) sense towards tertiary artefact uses. The related uses of the tools to ask questions rather than seek answers push these functions even further with specific significance for critical literacy developments.

The abstract, non-propositional character of the visualisations emerges here, as suggested also by Parks (2000) in relation to satellite imagery, as supporting the development of critical literacies by giving rise to questions rather than answers. The scope of these appear, however, wider than expected and include not only critical approaches to and uses of data but also of constraints relating to the tools’...
structuring devices. From such understandings, technology developers and providers might find better prerequisites to experiment more consciously with the design of information resources with the intent to support different kinds of critical competences that the users themselves appropriate in interactions with the systems. For a concrete example of a library that has already made such a conscious effort in their design and development of an interactive information resource based on documents from World War II, see Jessop (2006). By premeditated choices of visual representation modes, structuring devices and interactional features, focus was consciously directed towards uncertainties and bias in and differences between different historical information sources.

The results of this study, drawing on the analysis of material from two case studies, point thus to a need for new narratives and definitions of visualisation tools as information resources that are more varied and do not repeat and reinforce the apparently still highly influential and widespread positivist, objectivist and cognitivist connotations of visualisation. A new narrative and understanding of visualisation tools as non-blackboxed information resources and evocative tools should emphasise instead visualisation tools as documents that:

- provide access to data sets and function as platforms for distributed knowledge,
- provide focus and patterns without severing the links to the data on which those abstractions are founded,
- enable repeated analyses from different perspectives,
- highlight the materialities of both data and structuring devices, and
- support new questions and the development of critical literacies.

9.3 SHORTCOMINGS AND OTHER REFLECTIONS ON THE STUDY

Looking back at the choices and decisions that over a long time period finally resulted in this dissertation, there are of course a number of things that I would have liked to have done differently. One of the most obvious of these concerns the choice to include two cases, although this particular choice has not only caused problems but also proven highly rewarding. A disadvantage of this choice concerns the considerable additional and time consuming practical work involved in finding, selecting and setting up two cases of such different characters and for the relatively demanding sorts of critical ethnography inspired methods applied here. That time
came to be taken from the possibility to spend more time on one case, doing more and
deeper observations and perhaps making use of additional data production measures.

A further problem with two cases was that the need to keep them on
comparable levels meant that I was unable to use some of the additional empirical
material available in the Trends case (documentation relating to the tool and the
organisation) simply because there was no corresponding material for the Geo case.
The distinct character of the two cases and the need to continually distinguish
between them has also made the analysis itself and not least its presentation more
difficult than it otherwise would have been.

On the other hand, and as a decisive advantage, the two cases – despite, or
perhaps rather because of, the small number of participants and the significant
differences between them concerning the nature of the tools and data and
organisational structures and work tasks – have in comparatively forceful ways
made it possible to demonstrate the many areas of correspondence that might be
understood as more generalisable concerning the meanings and uses of (social)
visualisation tools as information resources. With only one case, this study would
have been an entirely different type of study and would not have been able to serve
as it now does as more of an exploratory overview of the nature of interactions and
relations between critical literacies and visualisation tools as information resources
mainly intended as basis for continued and future research. Considering the close to
non-existent research in this area today, the benefits of two cases in this sense seem
to outweigh the drawbacks in terms of fewer observations and time on sites.

Further, the embodied nature of many enactments of meaning observed in the
contextual inquiry sessions would clearly have gained analytical value if I had made
use of some form of visual recording. Such methods, however, are still rare in LIS
(c.f., Lundh, 2011, for a recent notable and innovative exception and contribution
to LIS methodology) and given everything else that seemed new and untested with
this study, I decided that the introduction of contextual inquiry-inspired
methodology was innovative enough for the methods section. But as the analysis in
chapter 8 illustrates, it is precisely these contextual inquiry parts of data production
that gave rise to situated interactions of such distinct physically expressed and
interactional character that it would have been desirable to analyse that material
with a clearer focus on embodied interactions and their meanings. The participants
were very active in front of the visualisations and their computers; pointing, waving
their hands, sometimes jumping up and down themselves and illustrating their
interpretations and meanings of patterns and events in the visualisations also by
making illustrative sounds.
All of this could have been analysed further with the help of visual recorded material to go back to. It would probably also have helped illustrate the presentation of the analyses in a clearer sense for the reader as well, if photos, sketches or video frames of such examples of embodied interaction could have been included. Nonetheless, the participants’ verbal descriptions and the detailed transcription notation system are at least deemed sufficient for illustrating the occurrence and basic significance of such interactions and situated co-constructions of meaning in the material and for the exploratory research aim here.

A somewhat related possible disadvantage of the study concerns the relatively few participants. Arguably, for a deep-going and more traditional ethnographic study it can suffice sometimes with much less – even two-three participants – but the approach here is indeed different and aimed towards exploring and charting a new perspective on and territory concerning visualisation tools as information resources and for that it might be argued that additional participants would have been desirable. In response, I can only point to the difficulty of finding and delimiting suitable cases in which participants shared both the same sort of tool (or varieties of visualisations thereof) in at least similarly focused or related work tasks. These aspects were deemed important in order to be able to detect potential variations within shared contexts since the theoretical views here emphasise the importance of context and practice for interpretations of meaning.

If I had not decided to focus specifically on social visualisation tools, it might have been easier to find examples where more users interact with the same tool and visualisations for the same purposes, perhaps in large research projects or at command and control centres such as air traffic controls. Comparable examples of large-sized operations organised around social visualisation tools and visualisations, however, are rarer. One option that I considered was to instead focus on non-professional users in visualisation communities on the Internet, where I could get access to large quantities of visualisations produced by ‘the public’, but that would have come at the expense of the close interactional perspective on situated interpretations of meaning through the contextual inquiry sessions that I wanted to include here. The strategy became instead to compensate through more varied and focused data production through a combination of methods. Looking again at the results, I feel that the scope of the empirical material was satisfactory for both the primary and associated aims of the study: to analyse the mutual shaping of critical literacies and visualisation tools as information resources, but also to open up a new research area and new perspectives on visualisation tools as LIS research objects.
9.4 SUGGESTIONS FOR FUTURE RESEARCH

Sociotechnical and sociocultural perspectives on literacies are still in their infant stages and the entire area of information literacy research has likewise been declared lacking deep studies on situated practices with focus on technological artefacts as co-creators in the practical accomplishments of everyday information activities (Tuominen et al., 2005, p. 330; c.f. also Bruce, 1997). This dissertation has aimed to counter this lack of empirical studies and also contribute to theoretical and methodological development in the field. It also argues for more research in the overlaps between critical analyses of information organisation systems and literacies research to continue to explore how these by now comparatively well-researched problems of representation concerning classification systems actually play out in situated user interactions. Possible research objects for such types of studies also need to be complemented to broaden the dominant focus on classification systems to a wider consideration of information organisation systems and practices, to which here are specifically added visualisation tools as information resources.

Above all, however, this study points to the vast amount of work that needs to be done in order to attain a better and research based understanding for visualisation tools and their constructions in user interactions as information resources. There needs to be more studies of both the same and other types of visualisation tools as analysed here, with professional as well as non-professional users. The rapidly increasing uses of visualisation tools for so-called self-monitoring purposes related to health, dieting and exercise, not least, present interesting examples to explore further with more pronounced focus on information privacy and ethics (c.f., Yau & Schneider, 2009).

The background to visualisation and maps presented in this dissertation also illustrates the need for a comprehensive overview and analysis of visualisation tools today in order to develop a useful classification and terminology that combine empirical analysis with constructionist theories able to include material and situated understandings of visualisation tools rather than the current reproductions of immaterial understandings and narratives with roots in positivism, objectivism and cognitivism. The (social) visualisation tool concept suggested here functions satisfactorily for the purposes of this dissertation as alternative to the fuzzy and problematic dominant (information or data) visualisation or map related concepts, but it is unquestionably time for a terminological overview and a new perspective.
on this whole field of research, practice and theorising that take into account sociocultural and sociotechnical perspectives and understandings.

Sociologically inspired studies of images and visuality are likewise declared under-researched even outside of LIS (Burri, 2012; Campbell, 2007; Joyce, 2005). Continued empirical studies in the area presented here can hopefully generate deeper understandings of how different users interact with representational artefacts of non-text based, non-authored, and non-propositional character. The establishment of shared interpretations of visualisations, for example, are seen here to constitute sociocultural and sociotechnical processes that deserve considerable future attention – not least since it is beyond question that visualisation tools and other types of visual information resources are rapidly increasing (Johnson et al., 2009; Johnson et al., 2011). These types of studies and focus of attention should be given more place within LIS as well, so that LIS does not forget about novel types of information resources and becomes positioned as mere support function for a visual development of primary concern to other disciplines, e.g., cartography, pedagogy and human-computer interaction by one-sidedly focussing only on management, search and retrieval solutions for visual material (c.f., Neal, 2009; c.f. also section 1.4) instead of embracing visualisation tools and similar representational artefacts as documents and information resources in their own right as (re)conceptualised here.

For the development of these types of studies and approaches in LIS, visual methods for data production and analysis also need further attention and elaboration, as does theoretical elaboration. Visual ethnography supported by video recordings and digital photography constitutes one important aspect of this development, as do more specific tools for capturing user interactions with digital and interactive screen-mediated representations. The main challenge, however, does not have to do with software solutions but with theoretical tools of analysis. The combination of sociocultural theories on tools and sociotechnical theories on inscriptions introduced and developed here seems promising for moving forward with additional studies to produce understandings of the relations between abstract level problems of representation and situated user interactions and constructions of meaning.

The results of the study contribute to shed light on the interdependencies between specific ways to structure and present information and the ways in which it is interpreted and used. Further, the dissertation has also attempted innovation both in choice of cases, method, and theory. This has created openings that hopefully can inspire various forms of future research both within and outside LIS into the social, cultural, and technological aspects and usages of visualisation tools as information resources.
En tid och plats för allt?
Sociala visualiseringsverktyg och kritiska kompetenser

Avhandlingens övergripande syfte är att analysera det ömsesidiga formandet av kritiska kompetenser och sociala visualiseringsverktyg som informationsresurser. Ett centralet antagande är att artefakter genom deras materialitet medierar sätt att se på och förstå världen och som vi tar till oss när vi interagerar med dem, men också att artefakterna tillskrivs mening i sådana aktiviteter inom ramen för sociala och kulturella praktiker.

Det centrala begreppet kritiska kompetenser utvecklas för avhandlingens ändamål och anpassas till dess teoretiska utgångspunkter genom att omdefiniera och utvidga tidigare definitioner av kritisk kompetens (critical literacy) med hjälp av sociokulturella och sociotekniska teorier om interaktion mellan människor och redskap. Kritiska kompetenser definieras härigenom som kritiska sätt att relatera till och använda informationsresurser i pluralistisk, situerad bemärkelse. Begreppet kommer således i studien att inkludera alla sorters empiriskt urskiljningsbara meningsskapanden genom vilka studiedeltagarna till synes identifierar, ifrågasätter...
och omskapar värderingar, begränsningar samt politiska och maktrelaterade aspekter såsom medierade genom verksamheten likväl som andra potentiella uttryck för att inte oreflekterat acceptera dem såsom oproblematiska och sanna.

Som forskningsobjekt med relevans för biblioteks- och informationsvetenskap konceptualiserar visualiseringsverktyg i studien som dokument enligt definitionen upprepningsbara representationella artefakter, en definition ämnad att bibehålla det karakteristiska biblioteks- och informationsvetenskapliga intresset för information i form av materiellt manifesteade uttryck, med tillämpbarhet även på icke-fysiska, digitala, dynamiska och interaktiva informationsresurser. Därutöver positioneras forskningsobjektet så som det studeras här i ett tidigare relativt ouppmärksammat område i gränslandet mellan en tradition av studier med fokus på representationsproblematik (mestadels i form av kritiska studier av klassifikationssystem) och ett underområde till likaledes väletablerade studier i området informationskompetens (med fokus på underområdet kritisk kompetens/critical literacy).

Detta medför att visualiseringsverktyg här förstås som en särskild sorts dokument som på samma sätt som andra uttryck för informations- och kunskapsorganisation reflekterar och medierar begränsningar och felaktigheter, men att angreppssättet är annorlunda. Till skillnad mot traditionella kritiska studier i denna tradition med fokus på utläsande av samhälleliga diskurser, kunskapsanspråk och ideologier genom analys av informationssystemen, fokuserar denna avhandling istället på att undersöka vilka och hur sådana representationsproblem kommer till uttryck och ges mening i användares interaktion med systemen.

Studien bygger på en analys av användares interaktion med visualiseringsverktyg som valts ut för att motsvara två huvudsakliga intressen. För det första används verktygen för att analysera sociala data, med vilket avses data som relaterar till människor, deras göromål och relationer. För det andra bygger verktygen på olika sorts primära sätt att strukturer och visualisera dessa data i form av geografisk kartbaserad visualisering (geografiskt informationssystem) i det ena fallet, samt i form av visualisering som representerar förändring over tid genom dynamisk animering i det andra. Fallstudie 1 ("Geo") är huvudsakligen lokaliserad till Trafikkontoret i Göteborgs stad samt ett antal andra företag och myndigheter inom och utanför staden med vilka Trafikkontoret samverkar för det gemensamma syftet att analysera och minska antalet trafikolyckor med hjälp av verktyget MapInfo. Fallstudie 2 ("Trends") är huvudsakligen lokaliserad till den Stockholmsbaserade stiftelsen Gapminder samt två externa organisationer vilka använder verktyget Trendalyzer för att analysera och sprida kunskap om utvecklingen i världens länder över tid med särskilt fokus på variabler som hälsa, inkomst och utbildning.
Den kunskapssyn som avhandlingen bygger på är konstruktionistisk, och det teoretiska ramverket utvecklar en delvis ny konstruktion för att förstå och analysera kritiska kompetenser och det ömsesidiga skapandet av dessa och betydelser och användningar av informationsresurser i situerad interaktion. Detta teoretiska bygge åstadkoms genom att kombinera aspekter från det sociokulturella perspektivet på redskap med sociotekniska teorier om inskriptioner. Särskilt fokus placeras på de tre övergripande teoretiska begreppen externalisering, mobilisering samt appropriering vilka här tillsammans bildar ett teoretiskt ramverk med gemensamt fokus på mediering och meningsskapande via artefakter utifrån ett breddat maktperspektiv med fokus på såväl kulturella praktiker som på aktörers intressen.

Metodologiskt har fallstudierna utformats utifrån ett så kallat (kondenserat) kritiskt etnografiskt angreppssätt. I fallstudierna deltog 6 användare i fallet ”Geo” (baserat kring det geografiska informationssystemet MapInfo) samt 5 användare i fallet ”Trends” (baserat kring det dynamiska visualiseringsverktyget Trendalyzer). Metoderna som användes för att producera empiriska data utgjordes av en kombination av semistrukturerade intervjuer, observationer, samt contextual inquiry. Avsikten var dels att producera en så rik uppsättning empiriska data som möjligt under jämförelsevis korta platsbesök, samt att täcka in såväl de kritiska förhållningssätt och användningar som studiedeltagarna var förmöga att uttrycka och beskriva i ord, samt motsvarande sådana av mer tyst och förkroppsligad kunskapskaraktär och som företrädesvis kommer till uttryck och kan observeras och förstås i situerade aktiviteter av interaktion med verktygen.

Analysens resultat visar en sameksistens av såväl icke-kritiska sätt att beskriva verktygen vilka konstruerar dem som kraftfulla och intuitiva förmedlare av svar och sanningar, som en rik och varierad uppsättning kritiska kompetenser vilka beskrivs i termer av tre huvudsakliga riktningar som reaktiva, proaktiva och adaptiva. Medan de två förstnämnda överensstämmer väl med tidigare definitioner av kritisk kompetens framstår de här så kallade adaptativa kritiska kompetenser som hittills förbisedda. De adaptiva kritiska kompetenserna tolkas här som exempel på kritiska kompetenser som, till skillnad från de reaktiva och proaktiva motsvarigheterna, inte bygger på i förhand förvärvad kunskap och erfarenhet utan framträder som ett situerat samskapande i interaktionen mellan deltagare och verktyg. På basis av dessa resultat argumenteras för att dominerande kognitivistiska och positivistiska synsätt på visualisering bör ersättas med mer nyanserade beskrivningar som tar fasta på visualiseringsverktygens potential att uppmuntra nya frågor och vidare informationssökningar, samt tillåta upprepade analyser av samma data från olika perspektiv.
REFERENCES


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ESRI – See Environmental Systems Research Institute.


doi: 10.1111/j.1475-5661.2012.00539.x


232


USHMM – See United States Holocaust Memorial Museum.


WHO – See World Health Organization.


APPENDIX A: FIRST CONTACT LETTER, GEO

Veronica Johansson, doctoral student
Swedish School of Library and Information Science
The University of Gothenburg and the University of Borås
Gothenburg 2007-02-12

[To: name and affiliation]

I am contacting you because I recently read a report from MapInfo about Gothenburg city’s use of Geographic Information Systems (GIS solutions) for different parts of your administrative authority operations. I am a doctoral student at the Swedish School of Library and Information Science (the University of Gothenburg and the University of Borås) and my research is about the interactions between humans and these types of complex, automated information systems in work practices and organizations. I therefore find your investments in these areas highly interesting and I would like to learn more about how you are using the system and what your thoughts about it are.

I wonder if it is possible to come and visit and talk with you (or some other suitable person) and have a little bit more concerning your specific situation and experiences explained to me? I would be especially grateful if there could also be an opportunity for me to see some practical example of this tool “at work”.

Ultimately, I am looking for suitable case studies for my dissertation, and some part of Gothenburg city with its GIS solutions would, the way I understand things now, really make for a very interesting example in my research. Perhaps then we could also at such a proposed meeting discuss potential future possibilities for me to conduct a case study somewhere within your operations? If this last thing is something that I should rather discuss with someone else from Gothenburg city I would be grateful for advice on whom to contact with such questions. My interest in a visit for “study and information” purposes, however, remains under all circumstances.

Thank you for your time. Sincerely,
Veronica Johansson

[Full contact information originally included below has been excluded here]
APPENDIX B: FIRST CONTACT LETTER, TRENDS

Veronica Johansson, doctoral student
Swedish School of Library and Information Science
The University of Gothenburg and the University of Borås
Gothenburg 2007-05-21

Hello,

I am contacting you at Gapminder because I have heard about your interesting and innovative solutions for presenting statistics and developing information systems in several different contexts recently. I am a doctoral student at the Swedish School of Library and Information Science (the University of Gothenburg and the University of Borås) and my research is about interactions between humans and such types of complex, automated information systems. I therefore naturally find your investments and developments highly interesting and I would like to learn more about how you work with and what you think about data based information systems.

I wonder if it would be possible to call and speak to some suitable person at your organisation. I would be very grateful if I could receive a phone number and a suggestion of a time when I can call and speak to someone and explain a bit more about what I am interested in. All of my contact information is included at the bottom of this e-mail.

Thank you for your time. Sincerely,
Veronica Johansson

[Full contact information originally included below has been excluded here]
APPENDIX C: PARTICIPANTS IN GEO

Participants in the Geo case; their organisational belongings, the connections between them, and their relation to the MapInfo tool as D: developer, A: administrator, and/or U: user. Brackets around one or several of these letters indicate that the relation in question is of a comparatively minor extent. The five departments and organisations in the Geo case are represented by the square boxes in the figure below. Each participant is represented by a triangle and positioned within his/hers corresponding department or organisation. The lines in the figure indicate direct connections between individuals in their work with MapInfo and relating to traffic and public transport issues.
APPENDIX D: PARTICIPANTS IN TRENDS

Participants in the Trends case; their organisational belongings, the connections between them, and their relation to the Trendalyzer tool as D: developer, A: adminstrator, and/or U: user. Brackets around one or several of these letters indicate that the relation in question is of a comparatively minor extent. The three organisations in the Trends case are represented by the square boxes in the figure below (Sida is an acronym for the Swedish International Development Cooperation Agency, and UNDP stands for the United Nations Development Program). Each participant is represented by a triangle and positioned within his/hers corresponding organisation. The lines in the figure indicate direct connections between individuals in their work with Trendalyzer.
# APPENDIX E: TRANSCRIPTION LIST

**LIST OF CODES**

*Participant ID:*

SVT = Name of interviews (Social Visualisation Tools)

- **C1a** = Geo (Case 1a): Traffic and Public Transport Authority
- **C1b** = Geo (Case 1b): Street maintenance agency, sub-contractor to the traffic agency
- **C1c** = Geo (Case 1c): External consultants working for the traffic agency
- **C2a** = Trends (Case 2a): Gapminder
- **C2b** = Trends (Case 2b): Sida
- **C2c** = Trends (Case 2c): UNDP

01 etc. = Two-digit numbers make for unique Participant ID (falling time-order)

D/A/U = Developer / Administrator / User (indicates study participant’s relation to the tool)

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<th>Transcript/Participant ID</th>
<th>Category / Subgroup</th>
<th>Date</th>
<th>Length</th>
<th>Time</th>
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<td>070611</td>
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<td>13.00-14.30</td>
<td>DS-10199</td>
<td>Pdf and ppt printouts from MapInfo</td>
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<tr>
<td>SVT C1b02</td>
<td>D,A,U</td>
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<td>2h12m</td>
<td>10.00-12.20</td>
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<td>Start</td>
<td>End</td>
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<td>15.00- 16.40</td>
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<td>SVTC2a10</td>
<td>1h37m</td>
<td>070910</td>
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<td>12.00- 13.30</td>
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<td>SVTC2a11</td>
<td>1h40m</td>
<td>070911</td>
<td>DS500023</td>
<td></td>
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</tbody>
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APPENDIX F: CONSENT FORM

CONSENT FORM FOR PARTICIPATING IN RESEARCH PROJECT

This interview is part of a research project concerning people’s learning and interaction with digital information systems. The purpose of the study is to seek an enhanced understanding of the learning and interactions that occur in work practices organised around technical systems where different types of data are structured, represented and combined in order to generate new information and knowledge. I am interviewing people on different levels and with different work tasks related to the same system to collect as many expressions of, and perspectives on, the interactions as possible.

The study is a part of my dissertation work which is carried out at the Swedish School of Library and Information Science (SSLIS), the University of Gothenburg and the University of Borås. The dissertation project runs from 2004 to 2009. The research is co-funded by the Swedish Knowledge Foundation’s (KK-stiftelsens) national research program LearnIT and the Swedish School of Library and Information Science.

Your participation in the study will be in the form of an interview. During this interview, I will ask you questions about your work in relation to the information system, and about your own thoughts, experiences, and opinions about the system. The interview is expected to last between 60–90 minutes.

If you have any further questions after this interview, please contact me as the main responsible person for the study:

Veronica Johansson, doctoral student, Swedish School of Library and Information Science (SSLIS), Göteborg University and Borås University
e-mail: veronica.johansson@hb.se
telephone: xxx – xxx xx xx
address: Swedish School of Library and Information Science, University of Borås, Allégatan 1, 501 90 Borås

If you wish to receive additional information and references, you are also welcome to contact my supervisors at the Swedish School of Library and Information Science:
This study follows the guidelines set up by the Swedish Research Council (Vetenskapsrådet), which means that you as participant are assured the following rights:

— Your participation is completely voluntary and you have the right to terminate your participation without negative consequences at any point during the study
— You have the right to decide for yourself the conditions under which you participate
— All data are treated confidentially
— The collected data will only be used for the research purposes stated in this document

Excerpts from these data may be included in the dissertation and other related research reports and presentations, but your name or other individual traits will not be included in any of these.

The result of the research project will become an official publication (a dissertation). You can decide for yourself if you wish to read through and correct any possible errors in the transcription of your interview, and if you wish to receive a copy of the published dissertation.

☐ Yes, I would like a copy of the transcribed interview with possibilities to suggest adjustments and corrections of possible faults
☐ No, I do not wish to receive a copy of the transcribed interview
☐ Yes, I would like to receive information about publications and a copy of the dissertation
☐ No, I do not wish to receive information about publications or a copy of the dissertation

Please sign the two copies of this form to confirm that you have read and agreed to them. One copy is for your own archive.

Thank you for participating in this study, your contribution is valuable.

Date and signature:_________________________________

Please text your name:_______________________________
APPENDIX G: INTERVIEW GUIDE

“X” = name of application in each case

1 WORK TASKS AND RELATION TO X
   Can you describe your work in general at your work place?
   How long have you worked there? How long with these tasks? How long with X?
   Can you describe you work with X?
   Why do you need X?
   Main benefits; differences from other alternatives or similar systems; main challenges/problems?
   What is the main idea behind your use of X?

2 CHANGES IN / BEFORE / AFTER X (IF APPLICABLE)
   Which of your previous work tasks do you now use X for?
   What are the differences? Do you do anything differently now? How?
   Have any new work tasks emerged due to X?
   Do you work with data and visual representations in the same way now as you did before?
   How? Why/why not?
   Have there been any major changes in X since you started working with it?
   New types of data? New working partners? New structure or representational mode? Why?

3 PLACE AND USE OF X INTERNALLY AND EXTERNALLY
   What does X “do” for you?
   What types of questions do you seek answers to; what do you need to know; what does it “tell” you/help you do; what are your reasons for using it?
   How is X used/how does it function internally at your work place?
   How do you use X externally?
   In relation to government agencies, media, the public, other actors? What external actors use X, when and why? What types of questions/help/support do they ask for? How do you handle that?
4 INPUT DATA: CHARACTER, STATUS AND FUNCTION
What types of data do you have/do you put into X (for Y work)?
Where do they come from? How do you get access to them? Are there any problems with this?
Who selects these data?
How is this decided (on what grounds/motives)? In what form do you get access to them?
How do you judge the data’s reliability, quality, and provenance?
Do you think it’s important that external users know what types of data that are used and where they come from?
Why/why not? How do you enforce this (or why not?)
Do you ever return directly to the underlying data sets (after they have been run through and processed in X)?
When? Examples? Why/why not?
How do you view data and statistics as information resources in today’s society? In your own line of work?
Do you think there have been any changes in the view of the value and usefulness of data?
For your work/in general?
Does it occur that your external partners request the full data sets of underlying data?
Why/why not, do you think? Examples?

5 RELATION TO X: TRUST AND EXTENT OF USE
Have you discovered faults/deficiencies in the data sometime?
How? When? Before or after they were input in X? By looking at the data through X or in some other way?
What do you do if you for some reason feel uncertain about the “answers” that X provides/shows?
Go to the underlying data sets; seek out other complementary information outside X and the data set; discuss with colleagues or others?

6 INTERACTION WITH X: HOW, WHY, WHEN
Do you prefer different representations for different work tasks or purposes? For different types of data?
When? Examples?
Do you discuss alternative means to structure and present data in your work group?
When, how, why? Examples?
Do you think there is any structuring mode (variable, dimension, or indicator) that is more basic or important than the others for representation of data in X?
Why/why not? Why that/these? Why is this so important to your work?
Do you feel that some things are difficult to handle, “read”, or understand in X? 
How? Examples?

7 SIDE EFFECTS (POSITIVE OR NEGATIVE)
Have you experienced any unexpected benefits or positive side effects in your work due to X? 
What? How? Examples?
Have you experienced any unexpected downsides or negative side effects in your work due to X? 
What? How? Examples?

8 FUTURE AND DEVELOPMENT OF X INTERNALLY AND EXTERNALLY
What do you think of the future and development of X in the work with Y? 
Internally? Externally (the public, media etc.)? How? Why?

9 REFLECTIONS ON VALUES IN X
Has X affected your work in relation to the environment and notions of sustainable development in any way? Do you think it was ever intended to? 
Has X affected your work in a democratising sense in any way? Do you think it was ever intended to? 
E.g. towards more fair distribution of resources; increased participation and commitment; increased transparency and influence among colleagues, citizens and external interested parties?

Interviewer’s own thoughts and reflections immediately after the interview and observation, description of the environment etc.:
### APPENDIX H: TRANSCRIPTION

#### NOTATION SYSTEM

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>NAME</th>
<th>INDICATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>[word]</td>
<td>Brackets</td>
<td>Indicates the start and end points of overlapping speech</td>
</tr>
<tr>
<td>=</td>
<td>Equal sign</td>
<td>Indicates the break and subsequent continuation of a single interrupted utterance</td>
</tr>
<tr>
<td>(number)</td>
<td>Timed pause</td>
<td>A number in parentheses indicates the time, in seconds, of a pause in speech (used when the pause is unusually long)</td>
</tr>
<tr>
<td>(...)</td>
<td>Untimed pause</td>
<td>Three dots in parentheses indicates an untimed pause</td>
</tr>
<tr>
<td>–</td>
<td>Hyphen</td>
<td>Indicates an abrupt halt or interruption in utterance</td>
</tr>
<tr>
<td>ºwordº</td>
<td>Degree symbols</td>
<td>Indicates that the enclosed speech was whispered or delivered in reduced volume</td>
</tr>
<tr>
<td>word</td>
<td>Underlined text</td>
<td>Indicates the speaker is emphasizing or stressing the speech</td>
</tr>
<tr>
<td>wo::rd</td>
<td>Colon(s)</td>
<td>Indicates prolongation of an utterance (the more colons, the longer the prolongation)</td>
</tr>
<tr>
<td>(word)</td>
<td>Parentheses</td>
<td>Speech which is unclear or in doubt in the transcript</td>
</tr>
<tr>
<td>(     )</td>
<td>Empty parentheses</td>
<td>Speech which is inaudible</td>
</tr>
<tr>
<td>(word in italics)</td>
<td>Double parentheses</td>
<td>Annotation of non-verbal activity, i.e., paralinguistic behaviour, usually represented in common descriptive language such as: ((both laugh)) or ((the interviewee's cell phone starts ringing))</td>
</tr>
<tr>
<td>$word$</td>
<td>Dollar signs</td>
<td>Indicates that the enclosed speech was delivered in a laughing or smiling manner</td>
</tr>
</tbody>
</table>

In addition to the above selection from Jefferson’s notation, three extra mark-up features were added to the list:

---

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>NAME</th>
<th>INDICATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>{word}</td>
<td>Curly parentheses</td>
<td>Indicates that the enclosed speech contains sensitive information (e.g. personal names or other individual identifying markers) that needs to be taken out or rewritten prior to publication of extracts of the transcript</td>
</tr>
<tr>
<td>Uhmm</td>
<td>Hesitation</td>
<td>Standardised representation of the many different types of humming and similar audible hesitations</td>
</tr>
<tr>
<td>Mm</td>
<td>Affirmation</td>
<td>Standardised representation of the many different types of sounds expressing agreement or affirmation</td>
</tr>
</tbody>
</table>
APPENDIX I: TRANSCRIPTION MANUAL

General Instructions:33
The digital sound files are transcribed in Word; Arial 10 pts; default margin settings; left justified.

Labelling for Individual Interview Transcripts:
All transcripts include the same set of labelling information left justified at the top of the document. Example:

Transcript/Participant ID: SVTC2a06
Interview Name: Social Visualisation Tools (SVT)
Participant Category: DAU
Site/Location: NN’s office
Date of Interview: 2007-06-11
Date of Transcription: 2007-06-30—07-04
Time of Interview: 13.00 – 14.30
Length of Interview: 1 h 20 min
Sound File ID: DS-500015
Interviewer: Veronica Johansson
Transcriber: Veronica Johansson

The Transcript Body:
A single blank line is inserted between the file header information (labelling) and the actual interview transcript. A double pound sign (##) precedes and follows each participant identification label (i.e. Source ID). A single hard return is inserted immediately after the Source ID, and the transcribed comment or response begins on the next line. Example:

##Interviewer##
Ok let’s start
##Participant##
Can I sit like this

33 The transcription manual is developed in accordance with recommendations in McLellan, MacQueen, & Neidig (2003).
Sound File – Transcript Section Orientation Markers:
At the top of each transcribed page, the corresponding time indication ///hours:minutes:seconds/// from the sound file is inserted between three right slashes. Example: ///1:09:37///. The end of each interview is indicated by typing END OF INTERVIEW in uppercase letters on the last line of the transcript.

Content:
The sound files are transcribed verbatim (word for word, exactly as said), including some nonverbal sounds (laughter, sighs, etc.), following Jefferson’s transcription notation system (see Appendix F).
APPENDIX J: TRANSCRIPTION SENDOUT

Gothenburg 2008-05-05
Dear NN,

It has now been some time since I had the opportunity to meet with you and conduct an interview, and I wish to thank you once again for your generosity with time and information. The meeting and interview, as you know, was a part of my research project dealing with people’s learning and interaction with digital information systems (you can visit my website for more information about this research: http://www.adm.hb.se/-vej/). I had hoped to be able to return to you sooner, but the transcription of interviews took longer than expected. Since you notified that you wished to take part of the transcription, I enclose a copy for you in this e-mail. I would be very grateful if you are still willing to take the time to read it through, since that will raise the quality (minimise the risk of faults and misinterpretations) in my interview material in general. In connection with this, however, I also need to explain certain basic and important things.

The transcription of interviews has not been done by me, but by a contracted third party. This person, however, has worked under the same research ethical rules and considerations that apply to the entire research project. These guidelines were summarised and recounted in the document “Consent Form for Participating in Research Project” that you read, signed, and received a copy of prior to the interview. I include a copy of that document in this e-mail.

The transcription itself, i.e. the transference of the interview from sound file to text file follows to a certain extent a convention known as Jefferson’s notation system. This means that ordinary written language punctuation such as commas, full stops, question marks, capitals etc. are not used. To recapture the oral communication more closely, another set of symbols are used instead, and I explain the most common of these here below.

[The list of notation symbols and their meanings originally included in this letter are here excluded. See Appendix H for the full list of transcription symbols used].

In the transcription, your name has been replaced with a randomly chosen alias.
If you find any errors, mistakes, or misinterpretations during your reading, or if you wish to mark out certain passages that you feel might be sensitive and not suitable for publication, I suggest that you highlight and comment upon them directly in the text file, preferably with some sort of colour coding. After that, you can send the document back to me, with explanations of the passages that you have marked. Another option is that you call me, so that we can discuss your views and comments over the phone (my cell phone number is: xxxx – xx xx xx).

For me to be able to consider your comments, I need to receive them within five weeks, i.e. no later than in week 25. If I have not heard from you prior to that date, I will assume that you have no objections to the transcription as is. If you have any further questions, you are more than welcome to contact me.

Thank you for your help, and thank you once more for your valuable contribution to this study.

Kind regards,
Veronica Johansson
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