Virtual Acts of Balance!: Virtual Technologies of Knowledge-Management as co-Produced by Social Intentions and Technical Limitations

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Abstract: This paper presents an analysis of official documents and white papers pertaining to two web-portals (The Policy Grid Project and FEED) that are launched in the United Kingdom (UK) and the European Union (EU) respectively. The aim of the portals is to filter and synthesize information relevant for policy discussions and thereby improve ´knowledge-democracy´ in different ways. The paper denotes such portals ´virtual technologies of knowledge management´ and it presents documental data as a window to analyze and discuss the infrastructural choices of such portals. The analysis is grounded in theories related to 'Social Construction of Technology' and it shows how the framing of the portals and the concrete digital choices taken in relation to the infrastructure are influenced by the intentions of relevant social groups as well as by the technical limitations on computers' abilities to process semantic data. It is especially emphasized how technical web-ontologies implicitly carry with them deeper philosophical ontologies about phenomena such as ´politics´, ´scientific intentionality´ and ´freedom´. The compromise between these technical limitations and the social intentions is described as a ´virtual act of balance´. The paper accordingly concludes that a co-production of technical infrastructures and social values takes place in the process of designing these types of portals. It illustrates the necessity of formalizing part of the policy-making process if semantic machines are to play a significant role in policy-making. Computer-based information-processing makes software increasingly powerful and it is argued that the ´e-governance community´ has to be reflective about this development and constantly consider the trade-offs between structured semantics and looser types of classification of policy issues.

Keywords: e-governance, knowledge-democracy, socio-semantic web, social construction of technology, discourse analysis

1 Introduction

Policy-makers (and their advisors) are constantly facing conflicting information from different stakeholders when drafting legislation and other regulatory documents. Since the amount of such information often exceeds the resources available for evaluating it there is an increasing need for standards and procedures that allow policy-makers to distinguish between relevant and irrelevant sources of information and data with regard to their regulatory decisions. Practices through which information is filtered and synthesized into policy-relevant knowledge are therefore bound to be extremely powerful and one of the ambitions of the e-governance community has been to utilize information and communication technology (ICT) to optimize such filtering. The last ten years have shown a rise in the number of web-portals that aim to synthesize and structure information from stakeholders and thereby enable policy-makers to make better-informed decisions when faced with complex societal problems. Especially institutions in the European Union (EU) and the United Kingdom (UK) have spent a considerable amount of funding on portals intended to enhance ´knowledge-based´ democracy by improving the information-processing capabilities of policy-making.

The paper will refer to these types of portals as ´virtual technologies of knowledge-management´ (VTKM) and it defines them as online modes of organization that are used to synthesize stakeholder information into structured, manageable and policy-relevant knowledge. Such VTKMs will most likely be influential in the process of establishing future procedures for policy-making and it is therefore assumed that current decisions about investments in the infrastructure and design of VTKMs will have important long-term effects on the informational basis for policy-making and policy debate (Woolgar & Coopmans, 2006: 2; Horrocks & Pratchett, n.d.). This makes it important for the ´e-governance´ community to reflect on the design and infrastructure of paradigmatic cases of VTKM and this paper contributes to this reflection by examining the following two research questions:

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- How are choices about the infrastructure of VTKM influenced by on the one hand social intentions of relevant groups (designers, users etc.) and on the other hand by technical limitations on computer intelligence?
- What types of policy-making does the resulting infrastructures favor?

The research questions will be examined by analyzing two VTKMs launched by the EU and the UK. The UK portal is called ´The Policy Grid Project´ (PGP) and its aim is to provide technical tools that make ´Evidence-Based Policy-making´ (EBP) possible through improved management of social scientific data. The EU portal is called ´FEED´ and it is aimed at creating infrastructures that support interactive deliberation between citizens, scientists and policy-makers during the process of policy-formulation. This is done by giving these different actors access to contextually relevant information at relevant moments in the policy-making process. The empirical data used to examine the research questions is all publicly available documents and white papers related to the portals. The details of the cases and the analysis will be outlined below. The findings of this analysis will then provide the basis for a discussion of two research questions, including the kind of democratic challenges that are involved when designing VTKM for policy-making. This also involves a discussion of the way in which technical ontologies behind the portals necessarily carry with them specific models of policy-making and evidence. A concluding section briefly discusses implications for practice as well as future research.

2 Theoretical background: Technological design as a co-produced phenomenon

The analysis below is grounded in the body of literature known as Social Construction of Technology (SCOT) and this section will outline the central analytical concepts to be used. The central contributors in the SCOT literature are Trevor Pinch and Wiebe Bijker who have argued that we should understand the design of technologies by looking at the social influences that have shaped them rather than at the technical efficiency of their design (Pinch & Bijker, 1984). Pinch and Bijker use the concept of ´interpretative flexibility´ to illustrate their point of view and emphasize that both successful and failing technological artifacts have been open to more than one interpretation. The design is not determined by technical functionality alone because the function of any given technology is debatable.

Because there is flexibility in the way technological artifacts are designed it is crucial to understand the process through which this flexibility is stabilized. Pinch and Bijker call this process ´closure´ and they primarily focus on the way social definitions of technological problems establish closures. Their study of the development of the bicycle, for instance, illustrates how different social groups had different problems that they intended to be solved by this specific technology. When influential groups assign specific meanings to a technology and thereby play a crucial role in its development they are referred to as ´relevant social groups´. Pinch and Bijker defined such groups as follows:

[The concept of a relevant social group] is used to denote institutions and organizations […], as well as organized or unorganized groups of individuals. The key requirement is that all members of a social group share the same set of meanings, attached to a specific artifact (Pinch & Bijker, 1984: 30).

Any given technological artifact may have different functions for different social groups and these groups will therefore want different solutions in relation to the design of this technology (Pinch & Bijker, 1984: 42). In the case of ´e-governance´ and VTMKs such groups can, for example, be ´policy-makers´ and ´computer engineers´ and they may have quite different ways of understanding web-portals and their proposed functions. In the analysis below, SCOT will be used to guide attention to the fact that the design of any VTKM will bring out technical as well as moral problems and also to emphasize that the solutions to such problems are not only technological, but also moral and juridical. This theoretical approach thereby suggests focusing on the balance between technological and social influences with regard to the interpretations of a VTKM and it indicates that technological design is co-produced by these influences. This balance and its relation to problems stated by different groups will be central in the analysis below.

The framework of SCOT is, however, supplemented by the concepts of ´computerization movements´ and ´technological action frames´ as they have been introduced by Grace de la Flor and Eric Meyer (2008). Being especially tailored to ICT developments they introduce different analytic sensitivities that are useful to mix with the SCOT concepts above. Flor and Meyer define a computerization movement as follows:

[Computerization movements are] movements whose advocates focus on computer-based systems as instruments to bring about a new social order. [These movements] communicate ideological beliefs about what computing is good for [and they forge] links between computerization and a preferred social order which help legitimize computerization for many potential adopters (Flor & Meyer, 2008: 3).

This concept is of interest because VTKMs are also powered by movements that promote digital solutions to policy-problems. Flor and Meyer rely on public discourses as data to detect how such movements establish relationships between technological innovation, public policy visions and organizational practices. The analysis below will follow this methodological approach by using publicly available documents pertaining to PGP and FEED as data. The specific discourses of interest will be conceptualized as ´technological action frames´, which Flor and Meyer define as follows:

[A] technological action frame is comprised of a series of arguments developed by proponents of [computerization movements] that form the core ideas about how a technology works and how a future based on it should be envisioned (Flor & Meyer, 2008: 4).

Because technological action frames are ideas that give direction to large-scale projects they can later be used to justify decisions about software development and to provide a rationale for the development of government programs (Flor & Meyer, 2008: 5). They can accordingly give a valuable insight into potentials paths in the development of VTKM as an element of ´e-governance´ (Meyer, Schroeder, & Dutton, 2008: 1; Woolgar & Coopmans, 2006). Besides that they illustrate how social and technical influences are balanced in creating that path and the resulting choices about the infrastructural design.

Dutton (2007) calls such design-choices *digital choices* and he argues that the combination of technological action frames and digital choices has a transformative potential because it can change the communicative power of stakeholders. Examples of digital choices in Dutton´s text are the choice of changing the cost structures related to distributing information, providing or taking away anonymity in communication, restructuring the architecture of networks and creating or eliminating gatekeepers (Dutton, 2007: 3-4). The analysis below will include the way the digital choices and technological action frames of PGP and FEED are influenced by relevant social groups as well as by limitations in technological programming language they rely upon.

3 Methodology and case-selection

Having outlined the theoretical foundation that will guide the empirical analysis this section will first outline the details of the discourse analysis that will be used as the methodological foundation to analyze the public documents pertaining to PGP and FEED. After that the section will provide the reason for choosing these portals as the cases to be analyzed.

3.1 Discourse analysis as methodological approach

The theoretical themes outlined above are productively explored through textual analysis of publicly available documents. The more specific methodological tools that will be used to conduct the empirical analyses in this paper are adopted from Norman Fairclough´s Critical Discourse Analysis (CDA), which is a specific approach to textual analysis. The concepts outlined below are central to CDA analysis and they served as important guidelines for the way the present analysis was carried out.

Two basic concepts are ´linguistic chains of difference' and 'linguistic chains of equivalence´. Fairclough (2003) argues that such chains are amongst the most important discursive characteristics of texts and that any textual analysis should look for such chains in order to show how meaning is created through logics of equivalence and logics of difference. The former logic is explored by listing entities as belonging to the same class of things whereas the latter logic is explored by listing two entities or themes as being distinct from each other (Faircough 2003: 88). The analysis below will look for such chains and use them to detect technological action frames related to the production of VTKMs and the analysis will have special focus on the way social and technical elements of these frames are related through linguistic chains.

Another important concept in CDA is ´logic of appearances´, which refers to the elaborative listing of appearances connected to a phenomenon without explicating the causal logic behind the connection. In

relation to VTMKs this logic is, for instance, explored by listing appearances and qualities connected to artificial intelligence without explicating the connection. This kind of ´logic of appearance´ is also being applied to temporal relations that connect, for instance, technological development and progression without giving the causal argument.
A third concept that will guide the analysis is the concept of ´nominalizations´, which refers to grammatical metaphors that represent processes as entities by transforming clauses (including verbs) to nouns (Fairclough 2003: 139-144). An example could be referring to processes like ´globalization´ and ´computer systems´ as subjects that do something. Fairclough argued that this discursive approach is often used to push agency away from the individual unto super-individual structures. The analysis below will show how this approach is characteristic of the computerization movements that promote portals like PGP and FEED.

The analysis finally builds on Fairclough´s suggestion to look for direct and implicit ´inter-textuality´ in the documents. Inter-textuality is the linguistic move of placing references to other texts within a text and it can appear both be in the form of direct references and citations and as implicit references to established systems of thought in the argumentation (Fairclough 2003: 39-42).

The public documents pertaining to PGP and FEED will be analysed with a focus on the way these four linguistic characteristics are visible in the presentation of the two web-portals. Inspired by the theoretical foundation above the analysis will especially pay attention to the way these approaches are used to establish the meaning and function of the portals, the way they carry references to social and technical influences on their design and the way they implicitly favour specific modes of policy-making. The textual analysis is in that sense guided by a general theoretical interest but it will also detect specific ´acts of balance´ that have emerged from the empirical coding of the public documents. It is therefore partly inspired by inductive and iterative analytic strategies such as the so-called ´grounded theory´ developed by Glaser & Strauss (1967)

3.2 PGP and FEED as empirical cases

PGP and FEED have been chosen as cases on the basis of four clearly defined criteria. Firstly, the cases had to be developed under the heading of either the ´UK Economic and Social Research Council´ or the ´EU E-government/E-participation Initiative´ because these two bodies are the major bodies working with policy oriented VTKMs in Europe. Secondly there had to be a broad range of publicly available documents to analyze. These constraints narrowed the choice of cases dramatically and the third criterion for picking the two cases was that none of them should be 'extreme cases' in the VTKM environment. This criterion is important because the aim of the paper is to provide a general understanding of the socio-technical influences that shape the infrastructural design of state-the-art policy oriented VTKM. The study if therefore a so-called ´paradigmatic case study´ (Flyvbjerg 2004) that uses exemplar cases to highlight general characteristics of an emerging social phenomenon, which in this case is the construction of policy-oriented VTKMs.

The fourth criterion was that the cases had to operate on the basis of similar technical programming languages while at the same time be guided by different social intentions. By comparing the technological action frames and digital choices of two portals that share the same technical language it is possible to detect interesting differences that can improve the understanding of the social shaping of VTKM. These differences cannot be attributed to differences in the technical programming language and must therefore be related to differences in the technological action frames and digital choices that are used to shape the technology. Interesting similarities between the portals will, however, be discussed with reference to their shared technical language. Such similarities will serve to illustrate how the technical limitations of the programming language also become influential in the process of establishing technological action frames and making digital choices about the infrastructure of the portals. If two portals with different social intentions end up suggesting similar models of policy-making it could be because of the shared technical infrastructure and we will see that this is the case in the analysis below. FEED and PGP meet the fourth criteria because they both subscribe to a so-called socio-semantic approach to knowledge classification and the rest of this section will provide a few more details on this shared programming language.

3.3 A shared socio-semantic approach

The ´semantic´ element of the shares approach to knowledge classification is inspired by a philosophy of web-design denoted as 'the semantic web'. This philosophy contains a plea for organizing information on the Internet through machine-readable classification of data that makes automatic processing of this data

possible (Berners-Lee et al., 2001 & Berners-Lee et al., 2006). The semantic web represents a move from the syntactically oriented Hyper Text Mark-up Language (HTML) to the Resource Description Framework (RDF) that enables the computer to detect the meaning of objects through ontological relationships between entities on the web (Berners-Lee et al., 2006: 98). In RDF language it is possible to establish such relationships through so-called 'triples' that connect an object with a value on a certain attribute. An example is that an RDF triple could be encoded with the information that I (object) have brown (value) hair (attribute) (Alesso & Smith, 2009: 89). This triple exhibits a relation that machines can understand and the basic idea is that such a structured meta-language enables a move from a 'web of documents' retrieved by syntactic keyword-searches to a 'web of things' where classes of objects and the logical relationships between these are understood by the computer. A condition for reaching this goal is the possibility of encoding detailed meanings and rules of inferential logic into the web (Berners-Lee et al., 2006: 98). One of the hopes behind the semantic web is that this makes it possible to construct proof systems to automatically derive statements from premises via software agents (Alesso & Smith, 2009: 150-162). The idea behind RDF is that the web will be able to structure data and enable shared semantics, common ontologies, integrated data and languages for shared meaning as a basis for semantic interoperability (Berners-Lee et al., 2006: 96-97). We will see this semantic ambition reflected in both PGP and FEED.

The idea behind the semantic web can be contrasted with another popular attempt to classify information on the Internet. This attempt goes under the popular name of 'web 2.0'. Well-known examples of this design are Wikipedia, Flickr, del.i.cious and Facebook (O'Reilly, 2005; Bruns, 2008). An important difference between the two approaches is that web 2.0-applications makes use of a ´hive´ of human beings as the main mode of organizing and this allows for ambiguous classification. This is, for example, exemplified by the act of tagging in del.i.cious where different human agents can tag each picture with contradictory words. The idea behind web 2.0 is that a person's social networks guide him/her through the 'semantic mud' and that it is the human inter-linkages in these networks that relate data and give it meaning.

The semantic web and web 2.0 are accordingly two paradigms that have suggested quite different solutions for deciding the meaning of information (Flordi, 2009; Neumann & Prusak, 2007, Shirky, 2005). Different groups of people can have different semantics in web 2.0 environments and this is quite different from having different groups relying on data coded in a consistent machine-readable language. Ontologies on the semantic web are built to remove ambiguity and to map relations whereas the tags of web 2.0 represent a much more loose and ambiguous approach to classification (Berners-Lee et al., 2006). Inferences on the semantic web are accordingly based on formal logic whereas inferences in on web 2.0 are statistical and based on clustering in social networks. Both PGP and FEED aims at combining these philosophies into a so-called socio-semantic approach but they do that on the basis of quite different social intentions. The characteristics of these intentions and the way they shape – or are shaped by – the socio-semantic infrastructure is explored in the analysis below.

The selection of PGP & FEED as cases is accordingly based on the four mentioned criteria and the data of the analysis is all the public documents and white papers available on the homepages of the two portals. The data that is the source of the analysis of PGP is taken from the project website www.policygrid.org. Under the heading ´publications´ 19 documents can be publicly downloaded. These documents explain different aspects of the portal and they have been published or presented at conferences from 2007-2009. The data that is the source of the analysis of FEED is documents taken from the project website www.feed-project.eu. Under the heading ´publications/presentations´ there is one paper presented at a 2009 conference and under the heading ´downloads´ there is one newsletter and 6 deliverables dating from 2008-2009. All the data is publicly available.

4 RQ 1: Balancing social intentions and technological limitations

The first part of the discourse analysis intends to answer the first research question above. It is aimed at highlighting the ways in which technological action frames and digital choices are shaped by social intentions and technical limitations respectively. The analysis starts with a focus on the different social intentions of relevant groups influencing PGP and FEED, it then proceeds to reflections on how these influences are translated into digital choices and it ends by emphasizing the way technical limitations in turn influence these choices and the technological action frames surrounding them. The analysis will thus illustrate how the social

and the technical aspects of the VTKM are co-produced and how these influences need to be balanced by the designers.

4.1 Social intentions as the initial driver

Because PGP and FEED both rely on socio-semantic classification it is straightforward to begin the analysis by emphasizing how different social groups shape the rationales of (technically similar) portals by defining the problems they intend to solve. If we start by looking at the documents pertaining to PGP it is quite clearly stated that the aim of the portal is to provide policy-makers with social scientific data that can enable them to reflect critically on the evidence they use as a basis for policy decisions (PGP17).[1] The aim of supporting evidence-based policy (EBP) is stated in different ways throughout the available public documents and it is legitimized through inter-textual references to other official documents such as the Green Book and the Magenta Book:

The requirements for evidence outlined in the Green Book and the Magenta Book are essential parameters for inclusion in any *e*-Social Science tools being applied in [EBP] (PGP07:1).

The Green Book and The Magenta Book both stress the need for EBP and the reference to these documents illustrate the specific social groups that have shaped the policy problems to which PGP is supposed contribute. These groups belong to already established knowledge-creating institutions, such as governmental research units and universities and their influence on the design of PGP is explicit throughout the documents.

The reference to these groups and the idea of EBP makes it essential for the documents pertaining to PGP to establish the difference between policies that are based on valid and reliable evidence and policies that are not. The way this is done in the documents indicates the first steps of the technological action frame that provides the reader with the core idea of the portal. Figure 1 illustrates the main findings of the discourse analysis in relation to the ´linguistic chains of difference and equivalence´ that is used to frame EBP in the documents.

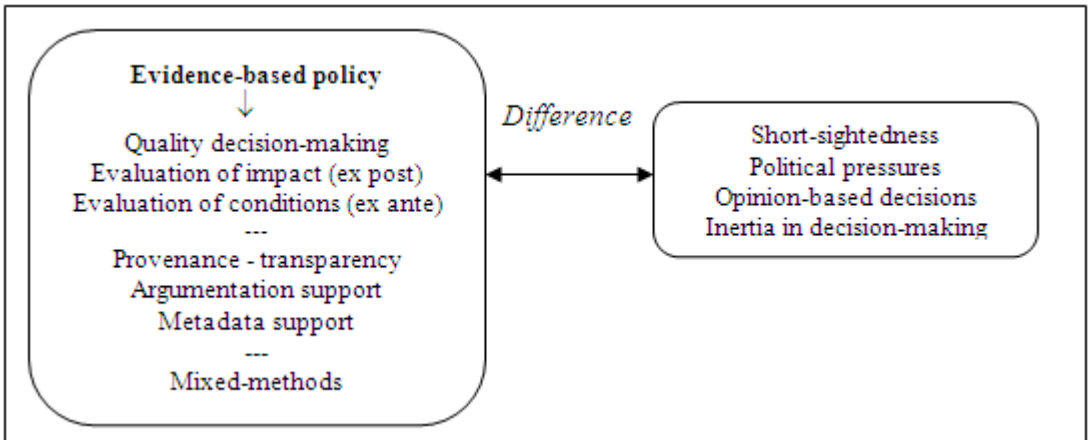

Figure 1: Chains of Difference and equivalence in relation to 'evidence-based policy' in PGP

The rounded squares indicate chains of equivalence detected in the empirical analysis. The square to the left shows that EBP is associated with possibility of data-evaluation and quality decision making. The horizontal double-arrow indicates that this mode of policy-making is seen as an opposition to short-sighted and opinion-based decisions that are influenced by shifting political pressures. These chains of equivalence and difference carry two implicit assumptions that are central elements of the social shaping of PGP.

The first is an assumption saying that reasons *cause* action and it is connected to the assumption that possibilities for policy-evaluation will improve the quality and efficiency of decision-making (PGP17: 2). Success of PGP is accordingly built upon a belief in the existence of a rational policy-maker. The second assumption is

[1] The references to secondary literature will be cited as e.g. PGP01 when it belongs to the analysis of PolicyGrid Project and e.g. FEED01 when it belongs to the analysis of FEED. The number after the acronyms indicates the relevant document to look for in the in the reference list.

that the policy-decisions that come out of these rational actions will have a long time perspective in comparison with opinion-based policy. This implies a temporal relation connecting EBP to long-term policy-making. These assumptions and chains are not explained in causal details and they resemble the ´logic of appearance´ as it was explained above. As mentioned above it is evident from the PGP documents that specific institutional actors and their intentions have a strong influence in establishing this part of the technological action frame that provides the rationale of the portal.

When we compare the social intentions in the design of PGP with intentions in the public documents pertaining to FEED it is evident that the RDF language and the approach of socio-semantic classification is envisioned to solve quite different problems in the two portals. In contrast to the PGP, FEED does not use RDF to promote EBP. The aim of the portal is rather to provide citizens, scientists, policy-makers and other stakeholders with information that enable them to engage in a deliberative discussion about policy-problems (FEED03: 7-10). The intention is to use socio-semantic classification to create a space for deliberation rather than an infrastructure for evidence. An essential assumption behind FEED is that the existence of relevant information at specific points in a policy-making process will enable the users of the portal to construct better arguments and to determine the best course of action in relation to the part of the processes they are interested in (FEED05: 6-8). Contrary to 'evidence' it is emphasized that ´relevance´ can change from person to person and from situation to situation. The value of information is bound to the context and figure 2 illustrates the steps that the designers of FEED imagine that information need to go through in order to satisfy the social intentions behind the portal. The detailed kind of deliberation that FEED aims to support is still blurry, but for now the important implication is that the same socio-semantic programming language can be used to develop very different portals due to the very different social intentions and technological action frames behind PGP and FEED.

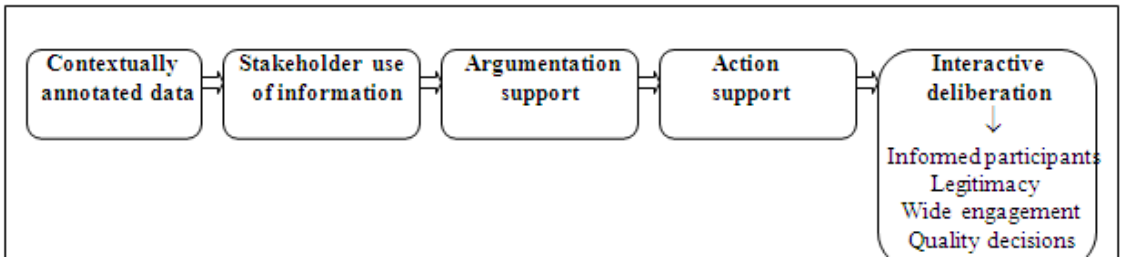

Figure 2: Causal chain towards 'interactive deliberation' in FEED

Translating social intentions into digital choices

The section above highlighted the fact that even though PGP and FEED are built on socio-semantic approaches to classification they are shaped by quite distinct social intentions. These social intentions, however, need to be translated into concrete digital choices that establish the infrastructures of the portals and this section describes this translation in the two cases. To start with PGP the analysis showed that the assumptions about EBP are translated into three technical tools that are envisioned to ensure that the intentions of the portal are fulfilled. These tools are a) transparent structures of provenance, b) argument support systems and c) structured metadata-creation. These tools are listed below the first punctuated line in the left box of figure 1 and each of them represents digital choices that are important in shaping the design of the PGP portal.

Provenance is a central concept in the technological action frame of PGP and it is defined as *"[...] the process that led to [a] piece of data"* (PGP07: 2; *PGP09: 4*). Structures of provenance are therefore thought of as tools of transparency that reveal the way social scientific data is created, the context of the data, the data collection methods, the analytical process that produced the data, the assumptions made about the data, the conclusions reached from the data and the dissemination of the data (Edwards et al., in review: 6; PGP07: 2; PGP17: 6; PGP09: 5). PGP is built in order to make social scientific evidence available to policy-makers and we saw above that an important assumption in the technological action frame that gives meaning to the portal is that social science rests on rules of evidence that need to be transparent. The decision to establish structures of provenance is an attempt to translate this assumption into concrete digital choices and the structures are seen as tools through which the policy-maker can capture important details about the production of relevant data-sources. Such details could, for instance, be a list of interviewees in a qualitative study or the coding steps taken by the researcher to extract information from the interviews. In short it is argued that structures of provenance must *"[...] provide support for the creation of audit trails to allow evidence to be*

assessed/validated [...] (PGP17: 3). Such a transparency is ultimately argued to improve the quality of policy conclusions (Edwards et al., in review: 6-7; PGP07: 3-4).

The structures of provenance and transparency form the basis for the tools of argumentation-support that PGP offers their users. The link between provenance and argumentation is made clear in the statement that structures of provenance *"[...] must ultimately include mechanisms for creating policy arguments and options from evidence base [...]"* (PGP17: 3). The rationale is that transparent structures of provenance will allow policy-related arguments to be tracked and evaluated by policy-makers (PGP04: 5). Such systems of argument support are central to the rationale behind PGP and it is explicitly stated that *"[...] argument schemes [...] seem to offer an appropriate method for construction and validation of [policy] arguments"* (PGP17: 13). When explaining the character of the argument schemes and providing arguments for their usefulness the PGP documents are relying heavily on inter-textual references to Floris Bex´s idea of using argument schemes as representations of stereotypical patterns of human reasoning that can be formulated as rules and understood by a machine (Bex et al., 2003: 133). Examples of such rules could be "if a researcher presents statistical evidence for φ is a prima facie reason to believe φ" or "if there are more researchers believing φ than non-φ then it is a prima facie reason to believe φ". The rationale behind creating automated tools of argument-support is that such generalized argument-schemes can help policy-makers assess the strength of conflicting arguments, reveal sources of doubt in the evidence and make the underlying assumptions in the argumentation explicit (Bex et al., 2003: 156-161). The algorithms and metadata behind such schemes is a digital choice that is guided by the social intentions and technological actions frames around EBP, but it is also – as we will see later - subjected to limitations in the way computers process semantics.

The third part of the evidence framework is the creation of metadata and ontologies as the basis for provenance and argumentation. Metadata and ontologies are, for instance, necessary for creating structure in audit trails and make them ´machine-readable´. Metadata is defined as computer-readable data about data that is used to describe resources and to facilitate the understanding, use and management of data (PGP17: 4). Metadata can for example be the classification of a social scientific conclusion as ´valid´. The conclusion is a piece of data and the attribution of ´validity´ function as metadata that ascribes a certain quality to the conclusion. An assumption behind the digital choices in PGP is that structured metadata can be comprised into ontologies that *"[...] provide a formal specification of the concepts in a domain and the relationships between them" (PGP13: 2)*. An example could be that if a conclusion has a ´p-value of 0.05´ it is by definition ´valid´ and we saw this way of thinking about relations between entities of data in the description of RDF triples and the semantic web above. This kind of structured metadata is at the heart of the PGP infrastructure (PGP13: 1) and it is a way of translating the social intentions of the technological action frame behind the portal into concrete digital choices. Semantic ontologies ensure that the inputs have the kind of relations and structure that is needed for machine-readable information. An example of this relation could be that the class of ´statistical conclusions´ *necessarily* has an attribute called ´p-values´. The unstructured ´web 2.0´ element in the classification is that the individual p-value is left open (PGP17: 5). The hard semantic ontologies thereby come to function as a ´conceptual scaffold´ for the folksonomies (PGP19: 2).

Looking at FEED we see a similar process of translating social intentions and the technological action frame of ´interactive deliberation´ into digital choices. This translation involves the design of a user-interface that provides citizens and other social actors with a set of tools to retrieve relevant information, to interpret data and to browse associated relevant dialogues and debates about a given issue at a specific moment in the policy-making process. Examples of these tools are forums, petitions and different forms of visual multimedia sources and e-maps. At the top-level of the FEED architecture these are the tools that are assumed to ensure informed stakeholder-participation in decision-making (FEED01: 3; FEED05: 8: FEED06: 16). Beneath the interface level lie a range of digital choices that help shape the form of deliberation and interaction that is possible. The most important choices relate to the way in which different user-groups and different stages of deliberation are classified and comprised into a so-called ´deliberation ontology´. This ontology enables the computer to distinguish between different types of deliberation in order to point out relevant knowledge for the specific kind of user that is using the portal in a specific moment in the policy-process. A citizen, for inatsnce, needs different types of information at the beginning and at the end of the process because the two temporal moments are different situations with different conditions of influence (FEED06: 23). The same is true for an NGO and an ordinary citizen at the same moment of the process because they have different possibilities for action. Such spatial and temporal classifications of user-types and types of situations are at the heart of the FEED infrastructure.

4.2 Technological limitations & the virtual acts of balance

The analysis in two previous sections has painted a picture of a more or less smooth translation of social intentions into digital choices in both PGP and FEED. This section will blur this picture by emphasizing that these choices and the resulting infrastructures are also influenced by limitations in the socio-semantic approach to classification. It will be argued that there is a constant need for the initiators of the portals to balance the social intentions outlined above with technical limitations in the way computers – and especially RDF triples - can (and cannot) process semantic information. The point is that such limitations have an equally important influence on digital choices and technological action frames and this means that the portals should be seen as co-produced by social and technical influences.

Starting with PGP we can see the dialectics between social intentions and technical limitations in the way many of the public documents present its final design as a solution balancing these influences:

We originally envisaged [data sharing tools] as being driven by an underlying ontology. However, from the start users expressed a fear of ´being trapped in the ontology´, due to the contested nature of many social science concepts [...] We therefore aim to maximize the users´ freedom by keeping the tools open-ended by supporting dynamic evolution of metadata and integrating ontologies with folksonomies (PGP01: 1)

This piece of text presents the design of PGP as a solution to a problem of balancing a tension between the hard structure of the ontologies needed to make evidence machine-readable in RDF triples and the freedom of classification needed in the social sciences. The social scientists that were supposed to provide data to the portal simply argued that the proposed semantic ontologies were ill suited to capture concepts in the social sciences. The reason given was that social scientific concepts are often imprecise, tentative and therefore hard to model in an ontology that requires hard structures in the classification. This technical limitation is a problem that is explicitly addressed in more than one of the documents (eg. PGP01: 1; PGP02: 2; PGP13: 3). The details of the solution to this problem illustrate the way technical limitations influence the digital choices in a portal. The following extract gives a picture of the proposed solution by the initiators of PGP:

[Our approach is to] integrate unstructured user contributions (tags) into a structured framework (ontology). We believe that it provides social scientists interested in the Grid with a flexible and open-ended means of describing resources whilst at the same time providing a context for those assertions through more structured concepts (PGP02: 2).

This is what was referred to as a ´conceptual scaffold´ above and the goal of this solution is to create an evidence framework that can *"[...] provide descriptions while at the same time giving users freedom [...]"* (PGP05: 1). The ambition of providing descriptions requires ontologies that are structured enough for the computer to process whereas the concepts in the social sciences require a certain amount of freedom. Figure 3 Illustrates how the relation between these aspects of PGP is presented in linguistic chains of equivalence and difference in the documents. It is a central outcome of the empirical analysis and it illustrates that the technical solution in PGP is meant to strike a balance between structure and freedom.

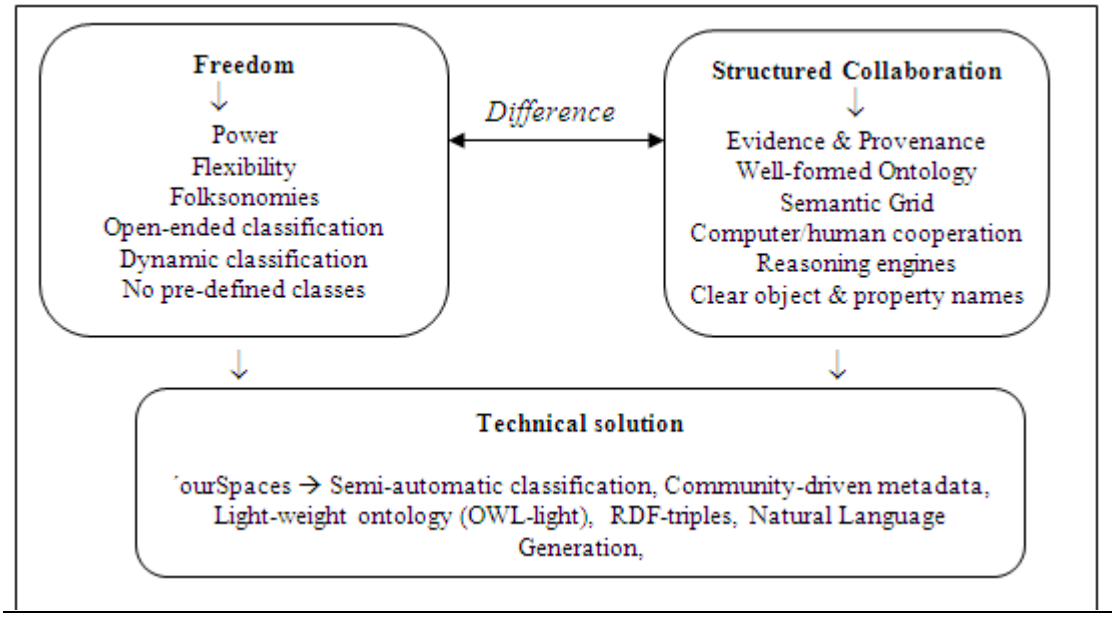

Figure 3: Chains of difference and equivalence in relation to 'freedom and structure in PGP'

An important observation in figure 3 is that the word ´freedom´ is presented as standing in a linguistic chain of equivalence to words like ´power´ and ´flexibility´, which clearly have positive connotations (PGP01: 3). The social influence of the group of social scientists is evident in the way this chain is built and it is impossible for the initiators of PGP to leave that influence out of the design. The demand for more freedom is dealt with by translating ´freedom´ by letting the users tag content and establish so-called folksonomies that are not constrained by pre-defined classes. The reason behind this digital choice is that folksonomies give the users the demanded flexibility in relation to the way they want to conceptualize the world (PGP01: 3-4).

Freedom and folksonomic tagging is presented in a linguistic chain of difference to semantic ontologies and the kind of ´structured collaboration´ on provenance and argumentation schemes they make possible. These aspects of PGP are central to the technological action frame and if they are to function it is necessary that the proposed folksonomies do not stand alone as the main mode of organization (PGP02: 1&5). They are simply too ´noisy´ to build structured argumentation schemes upon. Therefore, the linguistic chain of equivalence that is associated with the ambition of structured collaboration puts emphasis on the importance of integrating the flexible folksonomies into more structured and machine-readable metadata that is coded in a consistent manner. These linguistic chains of equivalence and difference illustrate how technical limitations can influence the design of VTKMs as well as the technological action frames they are embedded in. The conflicting values stemming from user preferences and technical limitations simply have to be compromised in the designs and the frames

The fact that the semantic capability of the computer is seen as an influential player is evident in the following sentence:

The system has the linguistic knowledge, and the user knows what the surface realization should be; together they can generate a new lexicon entry (PGP01: 3).

The system and the subject play equal roles in this sentence and the system is spoken of as a grammatical subject that exhibits properties of knowledge-creation and plays an autonomous role in helping the human subject in the search for knowledge. This kind of nominalization can be found in many of the documents and ´the system´ clearly plays an active role in the framing of the project (eg. PGP05: 6). This emphasis on the active role of the computer is characteristic of a computerization movement and considering the weight given to the system in the documents it is evident that there is a need for technological structures above the level of folksonomies. The balance between freedom and structured collaboration must result in an interface that can function as a *"[...] bridge between the Semantic Grid and social science"* (PGP05: 2). The main point to take away from the analysis is that the social and technical shores that this bridge connects are equally influential in shaping the technological action frame and digital choices of the PGP portal.

Turning to the analysis of FEED we can see that the initiators of this portal find themselves engaged in similar balancing acts. It has already been argued that social intentions of citizen empowerment and deliberation are influential in shaping the infrastructure of the portal, but the design is also subject to technical influences. Because of its reliance on socio-semantic web-technologies and the ambition to automate parts of the information-flow there is a need to structure the classification of data in a somewhat top-down fashion. This is done through the construction of the abovementioned ´deliberation ontology´ that imposes a specific logic on the process of deliberation that the users can engage in. This semantic aspect of the ontology separates different users and deliberation-stages into unambiguous classes that can be distinguished by a computer. This top-down classification is central to FEED because it enables the computer to organize the kind of access that specific groups of users have to specific information at specific moments of the deliberative process. The ambition is to make the computer-system ”aware” of the distinct user groups, their interests and the stages of deliberation they want to engage in. The idea is that if such classifications are consistent it enables the system to automatically judge some forms of information as being irrelevant to certain users with certain questions at certain deliberative stages (FEED05: 12-13: FEED03: 7-8; FEED04: 6-8). The system decides the contextual ´relevance´ on the basis of the information provided to the user. This semantic ambition, however, needs to be balanced with the social intentions of citizen engagement, which is ultimately a bottom-up philosophy of democracy. This balancing act is also quite explicitly stated in the claim that FEED *“[...] will tackle both the social and IT challenges for achieving cross societal deliberation on common issues based on state of the art technological paradigms for content federation”* (FEED02: 9).

The analysis so far shows a similar tendency in the two cases which is that the semantic limitations of the computer eventually shapes the technological action frames and digital choices in combination with the social intentions as outlined above. The section below will take this as the point of departure when discussing the models of policy-making that socio-semantic VTKM offer and how the technical ontologies connected to the semantic web comes to carry with them deeper ontologies as well.

5 RQ 2: From web-ontology to deep ontology

The analysis has so far been focused on providing an answer to RQ1 above. It started out by highlighting the way social intentions shape the technological action frames and digital choices of PGP and FEED and the previous section emphasized how these frames and choices are part of a balancing act in which technical limitations in semantic ontologies also play an essential role. This section will focus on ways in which these limitations in web-ontologies carry with them deeper social ontologies in the philosophical sense of the word. The importance of bringing this reflection to the fore is underlined by the fact that the documents in PGP stresses that this is *not* the case:

Ontologies for computing scientists are datamodels representing a set of concepts within a domain [...] and the relationship between those concepts [...] and should not be confused with the term ´ontology´ which, for the social scientist, refers to what can be accepted as facts, and what the world must be like for knowledge to be possible [...] (PGP07: 4).

From what has been written up until now it is clear that the ontologies in the PGP infrastructure are modelling relationships between concepts but this does not mean that they do not carry with them deeper ontologies as well. If EBP is to be facilitated by the technical infrastructure of PGP it is for example a necessary condition that politics, logic, intentionality and science is of a specific kind. The point is that technical web-ontologies are conditioned upon ´facts´ about these concepts and his makes the distinction between technical ontologies and philosophical ontologies blurry at best.

Let us start by looking at the concepts of ´politics´ and ´logic´ and remember that the success of the PGP infrastructure depends on the possibility of subjecting all policy-related data to automated tests of validity and consistence. This requires the existence of logical and computer-readable rules for assessing this validity and this technical requirement is reflected in the following ontological assumptions about rationality in both policy-making and argumentation:

To facilitate argumentation we are developing tools which will aid policy stakeholders [...] in using evidence to construct arguments for and against policies. These arguments will be incorporated into an argumentation framework, which consists of a set of arguments and the attack relations between them. The argumentation

framework will allow policy makers to explore a system of conflicting arguments [...] and determine how particular arguments are attacked and defeated (or not) by other arguments (PGP02: 3; PGP04: 5).

Political arguments are here seen as entities that can be attacked and defeated on the basis of structured evidence and the proposed argumentation schemes are built to test the consistency of such arguments in an automated fashion. This clearly suggests that ´politics´ is a phenomenon that is associated with formal and rational ´logic´ and this assumption about the rationality of political arguments is a necessary basis if the semantic web-ontologies are to make any positive contribution. The decision to break the discipline of argumentation down into machine readable bits is a classical characteristic of a computerization movement because it creates a room of manoeuvre for computers to play a central role in the future of policy-argumentation. The importance of making this room for computers is essential in the documents and it indicates how the technical limits of what computers can do shape the digital choices and the deeper ontologies about political reasoning in the technological action frame. Ethical discussions about bio-ethics will for example fall outside the ontological picture of ´politics´ that is built into the technical infrastructure.
From this discussion of ´politics´ and ´logic´ we turn towards the implicit ontologies about ´Science´ and ´intentionality´ because the design of PGP carries with it an implicit ontology of scientific intentionality as well (e.g. PGP06 & PGP11). A necessary condition for the tools of provenance and argumentation-support to function is namely that social scientists are able to encode the true intentions behind each step in the way they have analyzed their data:

As part of our approach we are proposing a framework for capturing the scientist´s intent (based on rules) so the formal representation of the intent can be used to reason about the workflow (PGP06: 5).

The deep ontological assumption behind this extract is that scientific intentionality is a logical phenomenon that can be formalized and subjected to rules (PGP11: 8-9). Intentionality is thought of as consisting of rules such as ´if the regression analysis has a p-value less than 0.05 then the hypothesis about x is verified´. This is, according to the documents, what human intentionality consists of and this way of thinking about social science and its data is again a result of a balancing-act between social and technical influences:

The main challenges are to represent scientist´s intent in such a way that [...] it is meaningful to the researcher, e.g. providing information about the context in which an experiment has been conducted so that the results can be interpreted [and] it can be reasoned about by a software application (PGP14: 2; PGP16: 3-4)

This comment assumes that it is possible to represent metadata connected to intent in a way that is meaningful to the researcher *and* can also be captured by software applications. This is furthermore connected to the assumption that good science *"[...] requires that results and experiments are repeatable and verifiable"* (PGP03: 2: PGP06: 2). Repeatability requires clear intentions in each steps in the research design and this way of thinking about social science is ultimately rooted in the philosophy of the natural sciences and in quantitative research (PGP03; PGP06; PGP09).

The documents pertaining to PGP, however, assume that qualitative researchers are able to encode the details of their analytical steps as well. The only challenge mentioned in the documents is the following: *"[How] receptive will qualitative researchers be to formally recording the analytical/interpretative process?" (PGP07: 5).* There is an underlying assumption saying that interpretative processes can be formally recorded and that the intellectual work that is undertaken in processes of interpretation is transparent to the qualitative researcher herself. The question is just whether she is willing to record it. Looking at the way qualitative research is actually practices this is a dubious assumption but it is a necessary assumption because of the technical limitations in the reasoning software.

The connection between technical web-ontologies and deep ontologies is also present in FEED and this connection can be illustrated with the following extract that indicates how the documents pertaining to FEED speak about user-roles as a naturalized phenomenon:

[T]he different categories of end users [...] are refined by clarifying their nature and statutory role [...] not all categories of users have the same level of access to the functionalities of the system but according to their needs, nature and role in the deliberation process utilize specific capabilities of the system (FEED02: 8)

The needs of specific user groups are assumed to be determined by their ´nature´ and ´statutory role´ and this assumption legitimizes the strict classifications of user-interest that is required for automated deliberation ontologies to function. By *"[creating] generic roles for the user groups […]"* on the basis of this naturalized classification the road is paved for computer-readable interests (FEED05: 22). The metadata used need to be consistent to be machine-readable:

The semantics, i.e. the meaning, of the data is formally represented, is understood, so that a competent agent can algorithmically interpret it, reason and derive new data out of it. This is profoundly related to formal reasoning and ontology engineering, and it is obvious that reasoning can only be performed by exploiting ´semantic´data. (FEED05: 7)

Since this naturalization of users is connected to the ability of the computers to handle the information-flow it comes to constitute a central part of the technological action frame in FEED and it illustrates once again that technical web-ontologies are co-evolving with deep ontologies in FEED as well.

6 Outro

This paper has presented a discourse analysis of the official documents pertaining to the Policy Grid Project and FEED that were chosen as cases of analysis because they are paradigmatic examples of the kind of Virtual Technologies of Knowledge Management that have recently been launched by the UK and EU. These characteristics imply that they provide a useful "window" through which to ponder the development of technologies for ´e-governance´ and the emerging interrelations between socio-semantic web-ontologies and knowledge-based policy-making.

The documents pertaining to the two portals were analyzed through the lens of concepts derived from the body of literature known as Social Construction of Technology (SCOT) and the analysis illustrated how the design of the portals is influenced by intentions of relevant social groups as well as technical limitations in the way computers can process semantic information. This co-production was described as a ´virtual act of balance´ and on the technical side it was argued that socio-semantic web-ontologies carry with them deep ontologies that can potentially shape the way policy-makers understand phenomena like ´politics´, ´logic´, ´intentionality´, ´interests´ and ´freedom´. If socio-semantic portals are going to play a significant role in knowledge-based policy-making it is simply necessary that such phenomenons are formalized to such an extent that at least some automated analysis becomes possible.

These findings echo a classic SCOT interest in the origins of technological designs and in the way flexibility in design is subjected to ´closure´ due to multiple socio-technical influences. This interest is concerned with providing empirically grounded reflections on technological development, but as Langon Winner (1993) has argued such SCOT-based reflections run the risk of leaving out of focus the consequences of the stabilized designs and the voices of marginalized groups that have not been influential in shaping the design. In Winners view this makes SCOT analyses agnostic as to taking an evaluative stance towards, for instance, the direction that VTKM and knowledge-based democracy should take (Winner 1993). This is to some extent true with regard to the first part of the analysis of this paper, but the latter analysis of the connection between web-ontologies and deep ontologies at least suggests a need to reflect on the outcomes of the identified acts of balance and ask normative questions about the connection between semantic ontologies and knowledge-based democracy. This work is briefly initiated by arguing that policy-making and science must be conceived of as practices that can be formalized if socio-semantic VTKM are to aid these fields. The next step for future research in this direction of inquiry would be to accomplish a more normative discussion of the pros and cons of formalized politics and the trade-offs between structure and freedom in information retrieval. One possible interpretation is that formalized rules can be productive if they succeed in ´freeing up´ space for a more thorough engagement with messy ethical issues[2]. Another interpretation is that such rules run the risk of masking normative questions as technical challenges.

This normative discussion could productively be related to work within the field of naturalized epistemology. This is a strand of philosophy that argues for conceptualizing knowledge as the outcome of a cognitive apparatus which determines the way we form concepts about the world and the way we compare things (Kantorovich & Ne´eman 1989). In the sub-field of evolutionary epistemology it is argued that such

[2] Thank you to one of the anonymous reviewers for suggesting this line of interpretation as a possibility.

apparatuses are a result of natural selection and they are therefore seen as reflecting the nature of the human and the environment in which he lives. VTKMs could also be interpreted as cognitive apparatuses that select problems and solutions in the real. But instead of seeing them as outcomes of natural selection it would be more sensible to see them as outcomes of ´balancing acts´ that reflect technical limitations and social intention in the environment in which they are to function. This theoretical move towards naturalized epistemology would allow for discussing policy-argumentation and knowledge-based democracy in relation to the ´cognitive structure´ of VTKMs and to conduct the normative discussions about their consequences – discussions that Winner claims SCOT refrains from.

No matter how we decide to deal with these questions it is necessary to be transparent about the way technical constraints are influencing the way we define central concepts like ´politics´, ´logic´, ´intentionality´ and ´Science´. Technical limitations in ´the system´ play a role and the idea that the medium through which information is synthesized can be frictionless is based on a distinction between medium and message that fails to accept the important co-production by social intentions and technical limitations when discussing VTKM.

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