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CAN PORTALS CALCULATE?

- A STUDY OF PUBLIC E-SERVICES IN EDUCATIONAL MARKETS

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Abstract

The relationship between the individual and the state is more often than previously mediated by public e-services. An emergent phenomenon in this respect is the various forms of devices supporting choice of education that are provided through portals. The question dealt with in this article is: How do portals containing different devices support choice in educational markets? Two portals run by national public authorities in Sweden concerned with educational issues have been chosen as material for the analysis. A first conclusion is that the devices integrate a sequence of advanced calculations, which aim to contribute to a choice of education. Secondly, we can distinguish between a mechanical and a pedagogical character of integration. A third conclusion is that the devices connect the objectives of government authorities with choices in educational markets and are therefore part of public policy implementation. Finally, it is argued that the seemingly simple procedures for calculation might affect people's entire lives, a fact which adds an ethical dimension to the design of this kind of public e-services.

Keywords: Electronic Government, public e-services, the principle of symmetry, Actor-Network Theory, calculation

1. Introduction

In the middle and late 1990s, government authorities in many countries began using the Internet as a means for public service provision. Increasingly, Internet-based web portals were used to provide general information about government activities or functionalities by which the public might obtain strictly defined services [Wimmer and Tambouris, 2002]. In this article we focus on portals for one specific area of public service provision: education. Examples of such portals are to be found in Great Britain [Watts, 2002], in the US [Schneider, 2001], in Sweden [SOU, 2001; Ranerup, 2004] as well as in other OECD countries [Grubb, 2002].

During the 1990s, politicians introduced marketisation arrangements or 'quasi-markets' to control the provision of public key services like education in Sweden and in many other Western countries [Ferlie et al., 1996; OECD, 1994], and portals are important for the functioning of these markets. Providers from the private and voluntary sectors of society were invited to introduce new service concepts and to compete with public service providers in the new markets. The citizens were expected

to choose between different service concepts offered by providers in the market. It was argued that the citizens needed support in order to make choices [Grubb, 2002; Levacic, 1994], and in the mid-1990s the Internet was defined as a means to offer such support [Schneider, 2001].

There are numerous studies of how portals contribute to choice in commercial markets (e-commerce) [Gosain and Zoonky, 2001; Hayne et al., 2002; Maas, 2003]. These portals are often based on the implicit assumption that buyers want the cheapest product or service and therefore look for support in finding the provider that offers the optimal alternative. Consequently, in these portals the focus is usually on the price of the product or service. In contrast, there are a limited number of studies of how portals are used to organise the meeting between citizens and providers regarding educational services [Schneider, 2001; Ranerup, 2004]. Also, more direct forms of computerized support for various kinds of choices provided through public sector portals are rare but emergent phenomena. For example, Johnson [2005] suggested a design of support to be used by US citizens for choice in social housing projects. Ranerup [2006] showed how computerized support is introduced to contribute to citizens' choices in premium pension reform in Sweden.

An important characteristic of quasi-markets is that the services are free or heavily subsidized at the point of delivery, and, consequently, the price is not important to the citizen [Le Grand and Bartlett, 1993]. Therefore, and also due to the complexity of the options available and the personal grounds for choice, other more qualitative intentions and objectives must be involved in decisions in these markets. Against such a background, technological devices used to support choice in quasi-markets can be expected to be more complex [Grubb, 2002; Levacic, 1994] compared to devices used in traditional e-commerce. A further reason for this is that they are part of the technology introduced by the state and therefore mediates the relationship between the state and the individual. In other words, this kind of portals is part of Electronic Government (E-Gov).

In his research based on Actor-Network Theory (ANT) [Callon, 1986; Latour, 1987], Callon [1998] pointed out the crucial role of technology for the functioning of markets. Callon et al. [2002] argued that the Internet can be seen as a premium example of technologies that have important roles to play in today's markets. This point of view was further elaborated by Callon and Muniesa [2005] in their discussion of e-commerce. With reference to e-commerce, they argued that there are a multiplicity of practical forms of confrontation between buyers and sellers. In a similar manner in quasi-markets, technological devices provided through portals can be expected to organise the meeting between the citizens and the providers of e.g. educational services. Callon and Muniesa [2005] make the case that detailed analyses of this type of devices in markets are to be welcomed but that such studies are rare.

The role of technology for the functionality of quasi-markets can be related to a central discourse in Information Systems (IS) research on the relationship between humans and technology. In IS research, different socio-technical views on the relationship between humans and technology are often taken as points of departure [Orlikowski and Iacono, 2001]. An increasing number of IS researchers [Doolin and Lowe, 2002; Hanseth, 2005; Orlikowski and Iacono, 2001; Walsham, 1997] have recommended ANT as a way of treating technology in an informed manner.

A central aspect of ANT is its emphasis on the principle of generalised symmetry regarding humans and technology [Callon, 1986; Latour, 1987; Callon and Latour, 1992]. This principle tells us that humans and technology must be treated equally in an analysis. In an investigation of fundamental features associated with the meeting

between citizens and providers in educational markets, this view opens up for an alternative type of discussion about the role of technological devices provided by portals in educational markets. It could be argued that a major advantage of the symmetry principle is that it helps to avoid the usual focus on humans in markets. More importantly, it might well serve as a theoretical and methodological basis for a close analysis of how technologies contribute to educational markets as instances of E-Gov.

As a basis for the following discussion, two cases of portals run by national government authorities in Sweden, the Swedish National Agency for Education and the National Labour Market Board, will be investigated. Thus, through a close analysis of the technology, the study will deal with the following issue: How do portals containing different technological devices contribute to choice in educational markets?

2. Theories, Controversies and Markets

2.1. The Principle of Symmetry in a Critical Perspective

The principle of symmetry was made popular by Bloor [1976]. From the standpoint of the sociology of science, he argued that both true scientific claims and false ones should be treated in a symmetrical way in researchers' descriptions of the construction of scientific facts. The idea was further developed by Callon, who named it the principle of generalized symmetry [Callon, 1986]. Since then, the principle of generalized symmetry has been an issue in IS research as well as e.g. in organisation theory [Czarniawska and Hernes, 2005] and Science and Technology Studies (STS) [Callon, 1986; Latour, 1987]. Our intention in this section is not to give a full or even a partial account of the discourse associated with this principle. Rather, our aim is briefly to set the stage for and to motivate empirical descriptions based on the principle of symmetry. In the context of IS research, the principle of symmetry and its appeal is described in the following telling way by Rose et al. [2005a]:

> In contrast to this diminution of the role of technology, a central tenet of actor network theory is an assumption of general symmetry between the technical and social worlds. No a priori distinction is made in the treatment of human and non-human actors such as IT (here often referred to generically as machines). Rather, the aim is to identify the configuration of the alternative heterogeneous networks of actors (comprising both humans and non-human actants) and the way in which they influence the development and stabilization of forms of technology. Its appeal for IS researchers wishing to avoid determinism, but also to take technology seriously [Monteiro and Hanseth, 1996] may therefore be evident [Rose et al., 2005a, p. 138]

However, other authors must be included in a critical discourse on different aspects of the principle of symmetry. There is a critique with moral undertones emphasizing the uniqueness of humans when it comes to the capacity of being held responsible for actions [Suchman, 2003]. Also, in symmetrical accounts there might be a risk for total disregard of the social consequences of technical choice [Walsham, 1997]. An answer to these arguments might be that moral and political issues should be debated from a solid empirical base, and here ANT has much to contribute [Walsham, 1997].

A further point of critique was formulated by Collins and Yearly [1992] and Yearly [2005] who argued that the principle of symmetry in most cases only leads to

conservative descriptions in prosaic case studies written from the point of view of humans. For example, in the classic ANT study of the scallops in Brieuc Bay by Callon [1986], the creation of symmetry between fishermen and scallops is in the hands of the human analyst or researcher, which undermines the analysis. The chief problem with this approach seems to be that humans have to represent non-humans [Collins and Yearly, 1992]. This is so because the analysis is largely human-centred, giving little room for non-humans [McLean and Hassard, 2004].

We accept this challenge and want to give the principle of symmetry a chance. The main reason for this is our belief that the concept itself is especially relevant in the context of choice in quasi-markets, giving fair attention to technology in markets [Callon and Muniesa, 2005]. In this manner, the closer relationship between the citizen and the state mediated by public portals in educational markets is closely examined.

2.2. The Principle of Symmetry in Context

The principle of generalized symmetry was used in the theorizing of markets by Callon [1998]. He pointed out the importance of technologies for the functionality of markets. One aspect of technologies, pointed out by Callon, is that they have the potential to contribute to calculation and eventually to exchange in markets. As point of departure for the discussion about the relationship between calculation and technologies in markets, Callon [1998] uses a model that describes calculation in three phases: a. sorting out a limited number of products and/or services, b. comparing these products and/or services, and c. summarizing the result of the comparison into a ranking list and choosing one of the alternatives. In line with this, Callon and Muniesa [2005] further developed this broad model of calculation, emphasizing that it might involve quantification as well as qualitative judgements.

In the present article, the concept of calculative devices [Callon, 1998] is used to describe technologies that aim to support the fulfilment and integration of the three phases of the model of calculation. The principle of generalized symmetry reminds us that calculation might be performed by human beings as well as by calculative devices.

2.3. Calculation in Context

In the present article, the concepts of calculation and calculative devices are applied to issues about educational and vocational choices that are normally thought of as deeply personal aspects. It is fair to say that we are not accustomed to talking about these issues in terms which are more often used with reference to the exchange of goods and services in commercial markets. Not less importantly, these concepts are flavoured with the inherently ideological rational choice theory (RCT) [Archer and Tritter, 2000b]. RCT has been questioned from many viewpoints. For example, its presupposition of stable preferences and of choice as a social rather than an individual decision etc has been much criticized. The theory has indeed been alleged to "underpin the neoliberal reforms of the public sector in much of the Western industrialized world" [Archer and Tritter 2000a, p. 1].

However, it has to be remembered that Callon [1998] and Callon and Muniesa [2005] present a very broad model of calculation. In this manner, they are not building a firm theoretical model but something that, in line with Beckford's characterization of RTC, can improve our "understanding of decision-making that preserves the rich and complex texture of social life" [Beckford, 2000]. In fact, catching this sociological dimension of decision-making in various circumstances is a prominent

rationality for studies in this tradition [Callon and Muniesa, 2005], including the empirical account in the present study. Also in line with Beckford, we argue that the concepts of calculation sensitize social scientists to the importance of the competition for advantage that functions in spheres of life normally considered to lie within the realm of non-instrumental values [Beckford, 2000]. In other words, there are processes of choice and evaluation of individual benefit also in situations of choice of education and occupation. Interestingly, professionals within the field of praxis discussed here more often than not outline models of decision-making [Law, 1999] which despite differences contain the same broad model as outlined by Callon and Muniesa [2005]. Last but not least, the thorough analysis of factual arrangements of calculation makes them public and an issue for debate. Thus, this procedure is not a way of applying an inherently political concept of calculation, hiding its political quality, but rather a way of making the organized arrangements a target for political discussion. This, it is argued here, makes concepts like calculation, defined as in the present paper, relevant when discussing concrete cases of implementing technologies that support choices regarding educational and vocational issues.

2.4. A Summary of Key Concepts

The principle of generalized symmetry: Applying the principle of symmetry means that we do not know in advance whether humans or calculative devices are the most prominent actors as regards calculation in markets. Therefore, we must treat the activities of humans and those of the calculative devices in a symmetrical way in research (see also Methodology).

Calculation: A general process that contains calculations such as the identification of alternatives, the comparison of alternatives, and a choice of alternative. Calculation might include quantitative and qualitative comparisons.

Calculative device: Part of a functionality of a portal that integrates the process of calculation into a choice in the market.

3. Methodology

There are three authorities in Sweden that dominate the development of portals in association with education. These are the Swedish National Agency for Education (SNAE), the Swedish National Board of Higher Education (NBHE), and the Swedish National Labour Market Board (AMV). Two of these are dedicated to education exclusively (SNAE and NBHE) and one deals with educational issues associated with the labour market at large (AMV). We have chosen to study the SNAE and the AMV because those authorities have introduced comparatively advanced devices to support and guide the user towards choices in educational markets. Such devices are important to study because they are part of E-Gov and therefore mediate the relationship between citizens and the state. NBHE, on the other hand, through the portal www.studera.nu only provides brief, text-based support covering general issues.

The chosen approach is as follows. With the principle of generalized symmetry in mind, we concentrate on the calculation pursued by the devices. This choice is made for analytical reasons in order to allow a detailed investigation of how calculative devices contribute to the calculation and choice of education [Rose et al., 2005b; Mc Lean and Hassard, 2004]. We have chosen not to include users in the analysis. The reason is that we want to avoid a conventional focus on the human being that uses technology to support choices of education, since such an analysis tends to neglect the principle of symmetry. Furthermore, by concentrating our analysis on the contribution

of the technology, we want to give the calculative device a fair chance to display its activities. Firstly, in the analysis the two researchers follow the activities of the device itself. This means that the calculative devices are articulated by their use of the functionalities of the two portals www.ams.se and www.skolverket.se. Of course, to some extent these calculative devices have to interact with humans, i.e. with us as researchers. Therefore, the researchers act as test pilots and describe and analyse the calculation pursued by the devices. Secondly, we follow representatives of the calculative devices in the form of humans [Pouloudi and Whitly, 2000]. In our research, we have followed system designers who construct the portals and the calculative devices. The designers are civil servants employed by the two public authorities described above. Most designers described their task as equipping citizens with tools to support their choices in the market.

Further, eighteen semi-structured interviews were conducted with the system designers. The first round of interviews was conducted between September 2001 and February 2002, the second round between September 2002 and January 2003, and the third between November and December 2003. The questions concerned not only the history of the portals, their respective functionality and implementation processes, and controversies about these processes, but also their anticipated and actual forms of use. These interviews offered an overview of the design process and the intentions behind the technological devices.

4. Quasi-Markets for Education in Sweden

The description starts in the early 1990s when the Swedish educational system was reorganised. We want to point out two characteristics of these reforms that are of importance to our description. Firstly, in Sweden almost all primary, secondary and higher education as well as a large proportion of adult education is financed through taxes, and the services provided are free at the point of delivery. Traditionally, the schools were regulated through political decisions and detailed national regulations of e.g. the curricula. During the 1990s, detailed regulation was abandoned in a series of reforms, and markets were introduced as a means for the politicians to control the provision of educational services [Government Bills 1988/89:4; 1991/92:95; 1995/96:222]. The construction of educational markets can be described with two characteristics. One is that the responsibility for decisions regarding the content of services is decentralised to schools. The other is that the citizen is supposed to choose between these service concepts. A consequence of the introduction of markets is, therefore, that the citizens need information, e.g. about providers and options available.

Secondly, in the early 1990s, two groups of designers, one at the SNAE and the other at the AMV, started to use computers to support citizens in their choice of education. At first, this attempt was limited to providing databases on CDROM containing information about different occupations, later transformed into an online database with open positions [Wiberg and Grönlund, 2001]. In the mid-1990s, the potential of the Internet as a means for providing support in educational markets was gradually acknowledged. However, the official attitude towards the Internet at AMV was cautious because of the supposed risks that too much information was made available directly to clients or users instead of being channelled through guidance professionals [Mjörnheden, 2001]. The official attitude changed, and by the end of the 1990s the Internet was defined as the primary means of contact with citizens. In contrast, since the mid-1990s the SNAE had started to use the Internet for the publication of information about the authority. In 1998, a primitive device was

launched offering access to all sorts of information about education. This was a direct forerunner of the calculative devices discussed in this study. So, two groups of designers, working at the SNAE and the AMV, respectively, started to harness the Internet in general, and portals with associated devices in particular, which could be used in the process of making choices in educational markets. This also meant that since the late 1990s up until the autumn of 2006, two portals (www.ams.se and www.skolverket.se) containing calculating devices have been in existence. With the principle of symmetry in mind, we will now look into how calculative devices contribute to choices of education in educational markets.

5. The Swedish National Labour Market Board

One major goal of the Swedish National Labour Market Board (AMV) is to promote the employability of Swedish citizens in the labour market. One way for the authority to improve employability is to educate the labour force so that the educational standard matches the requirements of the labour market. In the second half of the 1990s, the portal www.ams.se was set up and since then is continually developed through the introduction of new devices. For example, the portal contained a database that covers all publicly financed education in Sweden. This database is huge and contains more than 10,000 courses.

5.1. A Device Contributing to Choice

The designers might have been satisfied with introducing the database with information about education. However, the designers at AMV also wanted to support the visitor's choice of education in a more elaborate way. Most system designers had backgrounds as guidance professionals. According to their experiences, many visitors had rather vague ideas of what type of education to choose or whether to take part in further education. Some visitors did not have specific requirements which might help them to choose their education. One designer describes her experiences from working with guidance issues in the following way:

> I think there are many of people who don't know enough about working life positions and education for different reasons. First, working life is complicated and changes quickly, so it's not possible to ask one's parents. Second, there are large groups coming from a background where discussions about education are absent. These groups automatically exclude all options that would include a longer period of education. There are immigrants who don't know enough about the working life and educational options in Sweden to be able to make choices about education and to exploit their potential. And the choices of education that are tied to gender can be dependent on an information deficit. (Our translation).

This is the background to the development of a calculative device intended to further support the choice of education. Here follows a brief description of a version of this device that a visitor to the AMV portal encountered in the autumn of 2006. In the portal of the AMV this calculative device was found under the headline "Choosing an occupation" (*Att välja yrke*). The authors of the present article, now in a role as test pilots, enter this calculative device in order to follow what happens there.

First, the device asks the visitor to create a personal, interactive space that is called *Your Page*. When the visitor enters Your Page, the following words appear on the computer screen: "User name" and "Password". To be able to continue, the visitor

must choose a user name and apply for a personal password. After having signed in, Your Page gives the visitor access to a personal interactive space. The visitor is informed that he or she can store information about himself or herself, such as personal interests and information about educational options and professions.

a. The device creates a coherent interest.
The device now asks the visitor to take a test of interest. This test consists of 120 questions to be answered by the visitor. The following are some examples of questions to be answered by the visitor: Would you like: To take blood samples and to dress wounds?; To look after animals?; and To look after sick people? There are four optional answers to each question and they are: Not at all, to some extent, to a great extent, and very much. The visitor can, for example, choose the alternative "very much" for these and similar questions. After having answered 60 questions, the visitor can push a button and the device generates her profile of interest. The test contains 15 predefined fields of interests such as "animals/plants", "guard/protect", "tend/treat", "advise/support". When one of the researchers takes on the role as visitor and answers the first 60 questions, these four fields get some points, but when summarized by the computer the "tend/treat" field gets the largest number of points. Therefore, the option "tend/treat" dominates the visitor's profile of interest and the test requests the visitor to store the result on Your Page.

b. The device compares the interest with descriptions of occupations
The device now leads the visitor to an activity that compares the generated profile of interest with a number of predefined descriptions of occupations. These descriptions have previously been developed by the AMV, and the designers have stored them in a database. The result of the comparison made by the device is that a number of categories of occupations show up on the screen. If the visitor chooses one of these, e.g. "Healthcare", a number of occupations connected with this category such as "Occupational therapist", "Ambulance driver", "Medical doctor", and "Psychologist" are displayed on the screen. The visitor is requested to compare these occupations and to choose e.g. the Psychologist alternative and is then requested to store his or her choice in Your Page.

c. The device compares occupations with available educational options
The choice of e.g. the "Psychologist" profession leads the visitor to another calculation performed by the device. If the visitor chooses the option "Psychologist", 21 educational options are displayed on the computer screen. What meets the visitor here for the first time is a list of a limited number of schools or universities that offer relevant education for the occupation chosen. The visitor can now compare educational alternatives e.g. with regard to geographical location and decide on one alternative. The visitor's final choice can be stored on Your Page. Finally, the device offers links to the portal of the school or university that organises the education. The visitor can now proceed and contact the provider of education and this might eventually enable him or her to become a psychologist and after that to enter the labour market.

6. The Swedish National Agency for Education

One major goal of the Swedish National Agency for Education (SNAE) is to promote life-long learning among Swedish citizens. In the mid-1990s, the SNAE established the portal www.skolverket.se containing information about the educational system

and news relating to the agency's function as a national public authority. It offers information and devices that are useful in the choice of education. The portal also gives access to the database, developed in conjunction with the AMV, that contains information about most programmes of public education available in Sweden. However, we are going to present a calculative device that we have followed from its beginnings as a prototype in early 2000, over its subsequent implementation in an associated project in 2003 (www.vux.goteborg.se), through to its introduction in the portal at SNAE in 2005: "Choose and plan" (*Välja och planera)* .

6.1. A Calculative Device Contributing to Guidance and Choice

As in the AMV case, the designers at the SNAE wanted to provide an advanced calculative device designed to guide and support the choice of education. In the following excerpt, a system designer summarizes what they wanted to accomplish:

> What I am working with is to provide a kind of support for the choice of education. The point of departure is that the visitor should create an action plan, and we want to provide different forms of support for the visitor to make this plan. (…) We are talking about a three-step model that all people would be able to use. The first step is to try to describe one's situation; the second is to describe what one wants to obtain; and the third is to ask questions like: Is it possible to do it like this? It could be a compulsory-school pupil who asks questions like: At the moment I am going in this school and I want to go in another school; how can I accomplish that? (…). Exactly the same model can be used for an adult pupil with experiences from a number of different jobs. However, it will be a more thorough analysis of the three steps. (…) The end result would be an action plan, which can be stored in a personal Portfolio. (Our translation)

Some of the designers at the SNAE had worked as guidance professionals managing a broad spectrum of issues in educational and careers guidance. However, since the early 1990s they had been involved in efforts to create general computer-based support as a first step, and in activities to make use of the Internet in guidance as a second step. As guidance professionals in Sweden, they regarded themselves as belonging to a tradition of being advocates of the individual. The designers or guidance professionals expressed an intention to create a device that the visitor could use in order to learn how to deal with the requirements of the new educational markets. According to the designers [Mjörnheden, 2003; Hirasawa and Brag-Yhland, 2005], the point of departure for the design of such a device was pedagogical theory and especially a model proposed by Law and Watts [Law and Watts, 1977]. The original model focuses on creating self-awareness, opportunity awareness, as well as a capacity to make decisions and manage the transition to working life. The extended model [Law, 1999] contains similar phases and activities but emphasizes the importance of openness and understanding. The designers wanted to transform this model into a device that was available on the portal. A brief summary of the activities of this device is now presented. As in the previous description of the device provided by the AMV, the authors serve as test pilots.

When a visitor first enters the device, he or she is asked to create a *Portfolio* and after that faces a page headed: "You have now created a Portfolio". This is followed by a text announcing that in the portfolio the device stores e.g. educational plans, results from exercises, and completed applications. The device now asks the visitor to

create a plan for his or her education. The visitor proceeds, hearing beautiful music and watching beautiful pictures displayed on the computer screen. Thereafter, the device asks the visitor to go through a number of exercises aiming to construct a plan for future educational choices. The device asks the visitor to prepare himself or herself to deal with the following three statements: 1. Here I am today, 2. I want to achieve this, and 3. These are the steps I should go through to reach my goals. In our interpretation, the device is going to teach the visitor how to deal with these three statements.

a. The calculative device teaches the visitor how to summarize experiences and desires

With reference to the statement "Here I am today", the device asks the visitor to answer a number of questions. The visitor is first requested to make a list of his or her previous formal education and to store it in the portfolio. The device also asks the visitor to proceed to an exercise of a different character. Its aim seems to be to stimulate the visitor's fantasy, to enable him or her to leave the restrictions and problems of daily life behind, and to follow his or her dreams for a while. All in all 92 pictures of various scenes, like wooden boats on beaches in the sunset, old aeroplanes doing loops, and bridges over water, are displayed on the screen. The device encourages the visitor to choose pictures that illustrate statements one to three above. The visitor is asked to give reasons for his or her choices of pictures, and the device stores the pictures and comments in the portfolio.

After that, the device continues its exploration of the first statement "Here I am today" and invites the visitor to describe his or her personal experiences using the following five categories: personal values, personal characteristics, skills, interests, and personal network. The device asks the visitor to describe the categories in his or her own words or, alternatively, to consider a number of statements that are displayed on the screen. Examples of statements regarding personal values and experiences are: to work out-doors, to know many languages, or to work flexible working hours. The device stores the visitor's descriptions in the portfolio.

b. The calculative device teaches the visitor how to construct a coherent interest

After having made a structured description of both formal and informal experiences and dreams the visitor is expected to be prepared to deal with the statement "I want to achieve this". The device asks the visitor to define his or her individual goals. In this section of the procedure the visitor encounters a number of questions and arguments about how to formulate goals such as "Why should I formulate goals?", "When and where can I formulate goals?", "What are the usual obstacles?" and "Can I change my goals?" The device provides examples of different types of long- and short-term goals. Examples of short-term goals are to go to South Africa and study flowers on the Table Mountain or to become a medical doctor. The activities performed by the device seem to aim to teach the visitor how to summarize his or her documented experiences into goals. Thereafter the visitor is encouraged to set up a list of what he or she thinks is important with regard to an educational option. The visitor can formulate the list himself or herself or choose between different intentions or claims provided by the device and displayed on the screen, e.g. an intention to study abroad or to study in the evenings. The device asks the visitor to evaluate and rank these claims by using a quantitative scale from one to five. The device summarizes the list, displays it on the screen, and stores it in the portfolio. The device requests the visitor

to summarize the descriptions himself or herself into a coherent interest that should be defined in short-term and long-term goals.

c. The device teaches the visitor how to create a plan of action
When the visitor has formulated goals, he or she is expected to proceed to the third statement above, "These are the steps I should go through to reach my goals". The device asks the visitor to create a plan of action. According to our interpretation, the plan is expected to enable the visitor to realise his or her short-term goals. The activity performed by the device is to teach the visitor how to make a priority list that the device can store in the portfolio. Examples of activities that are expected to be specified in the personal plan of action are to explore the options about how to finance education or to contact a guidance professional. The visitor's experiences, goals and plans are stored in the portfolio. Thus, the device structures, completes, and stores a plan of action.

The completed plan of action supports a new set of activities performed by the visitor, namely to identify and compare educational options and finally to choose one of these. The device provides a link to the database containing educational options in the portal of the SNAE and to other portals where the visitor can find more information about educational options. Through the link, a device is provided that enables the visitor to sort out available educational options and to evaluate these by using the plan of action. After that, the device encourages the visitor to make a choice of education. The visitor is now prepared to compare schools or universities and to choose one of them.

7. Calculation in Educational Markets

7.1. The Calculation of Coherent Interest and Choice

The two calculative devices and their respective calculations that aim to contribute to choice in educational markets, have been described in sections 5 and 6. It is argued here that a first type of calculations was aimed to help construct a coherent interest. The devices singled out an object – an interest – from its context – a visitor's personal experiences and dreams. The object in our cases is the interest that consists of the selected personal experiences and preferences of the visitor that might be of value when creating a choice of education. In Table 1 the calculations of the AMV device that contribute to the formulation of a coherent interest are summarized.

Calculations carried out by the device:	
	a. Sorting out a number of work-related fragmented preferences through visitors' answers to a limited number of automatically generated questions. Answers are stored.
	b. Summarizing automatically the answers to a profile of interest. The profile is stored
	c. Comparing automatically the

	profile with descriptions of occupations in the database and sorting out a limited number of suitable occupations. Descriptions of occupations are stored.
Calculations not carried out by the device:	
	a. Answering predefined questions
	b. The final choice of occupation

Table 1. The construction of a coherent interest by the AMV device.

In Table 2 the calculations regarding the construction of coherent interests of the SNAE device are displayed.

Calculations carried out by the device:	
	a. Sorting out visitors' preferences by displaying a number of predefined pictures and questions. Selected pictures are stored.
	b. Generating and storing answers and written comments based on pictures and questions.
	c. Giving visitors examples of how written comments can be transformed into short- and long-term goals. Descriptions of goals are stored.
Calculations not carried out be the device:	
	a. Choosing pictures, answering questions and writing comments
	b. Formulating short- and long-term goals and a plan of action.

Table 2. Description of calculations performed by the SNAE device

The calculations organised by the devices first contributed to the creation of interests in the form of a tentative occupation, as in the AMV case, or short- and long-term goals, as in the SNAE case. Furthermore, these coherent interests could be used by the devices to organise a number of calculations in order to contribute to a choice of education. In our interpretation the calculation of choices in AMV and SNAE were quite similar. Consequently, they are displayed jointly in Table 3.

Calculations carried out by the device:	
	a. Comparing the occupation (AMV) and short-term interest (SNAE) with educational options from a database.
	b. Sorting out a limited number of educational options. These are stored.
	c. Displaying detailed descriptions of a chosen option. These are stored.
Calculations not carried out by the device:	
	a. A final choice of education

Table 3. The contributions of the AMV and SNAE devices to the choice of education.

7.2. Calculations Made by Devices – A Comparison

There were both similarities and differences between the calculations that were made by the two devices. As for similarities, both devices contribute to the construction of interests and to choices (Tables 1-3). They also have a similar procedure regarding how they contributed to the choice of education. A major contribution of the two devices is to integrate the process of calculation into a final choice.

As for differences, it seems that the character of integration of calculations differed between the devices. The device of the AMV to a large extent automates the integration between calculations. After entering the device the visitor has to follow a strictly formalised track that leads automatically to a point where the visitor is requested to make a choice of education. In contrast, the SNAE device has a pedagogical character that aims to teach the visitor how to integrate calculations in a way that prepares for choice. The result, we argue, is a much more open process, in which the visitor is expected to formulate goals and to describe intentions.

Therefore, we may conclude that the devices integrated similar types of calculations, but we can distinguish between a mechanical and a pedagogical character of integration. The devices also served to integrate the calculations in another way. Throughout the whole process of calculation, the calculative devices automatically stored the results from calculations. In AMV this was carried out by

Your Page and in SNAE by the Portfolio. These storage activities can be seen as contributing to the integration.

When it comes to the issue of integration, however, it should be pointed out that the visitor does not necessarily have to follow a sequence of calculations suggested by the devices. The visitor can choose to join just one or a few calculations that are available. Hence, it is possible for the visitor to create a sequence of calculations of his or her own. However, to describe how visitors actually use the devices is beyond the scope of this article.

7.3. Implications for Design

The outcomes of this study have several implications for design. We have concluded above that the calculative devices implemented by the public authorities do things like sorting out, summarizing, comparing and storing. At a surface level this seems to be a trivial result, since these activities can indeed be characterized as fundamental tasks for computers. Nevertheless, it is important to remember that the designers in the two cases aim to create a computerized support procedure to guide the individual towards a complex decision like the choice of education (see sections 5.1 and 6.1). Also, this support is a far step from the databases with occupations which were the first instance of computers being used in educational and careers guidance in the 1980s. A first implication for design is therefore that what we have detected are calculations which in their fundamental parts are similar to all computerized processes but profoundly different in that they connect reflections and choice on the part of humans with the educational market and subsequently also the labour market.

Secondly, these calculations initialize and summarize reflections about personal preferences but also about the choice of education and occupation. In this manner they might serve to organise an extended planning process during an individual's life regarding education and similar issues. In this way, we could say that these seemingly simple computerized operations are part of calculations that aim to create long-term planning, drawing maximal benefit from individual capacities and preferences.

There is a third, more straightforward implication for design related to this ambition towards extended planning by means of technology. The utilization of these facilities in long-term processes would mean that the special facilities for saving plans and decisions (Your Page and the Portfolio) will play vital roles during an individual's life. However, a pragmatic implication is that these cases contain examples of how individuals are part of attempts to connect them more permanently to public authorities and, perhaps more often, to commercial companies. This would mean that personal information is kept in an increasing number of places resulting in managerial and integrity problems for the individual.

7.4. Implications for Electronic Government

As we have seen above, our analysis of the technological devices of the two portals has uncovered calculations by devices regarding the choice of education. These are, if nothing else, very personal issues. Also, the calculative devices are not only about simply showing available options when it comes to education and occupations. They are also based on a more or less implicit model of making educational choices. It could even be questioned whether public authorities should go beyond providing neutral information about options. The offering of any type of calculative device might raise the issue of responsibility on the part of the authority vs. the individual citizen when the device is used by the individual with a not very positive result

[Statskontoret, 2007]. Thus, this kind of device, when provided by public authorities, might rightfully be considered controversial and worthy of further studies.

Last but not least, the two portals for choice of education serve as tools in the implementation of public policy with the intention of influencing citizens' actions. In the two cases discussed here, the fundamental goal in public policy implementation was employability in the case of the AMV and promoting the goal of lifelong learning in the case of the SNAE.

Nonetheless, in a sense authorities have long been using different kinds of tools to influence citizens' behaviour in public policy implementation. Such use by public authorities of different types of tools to affect individual citizens' behaviour as a part of public policy implementation is not a new phenomenon [Hood, 1983]. Hood especially groups advice, information and persuasion together as a specific category of tools. In the cases discussed here, there is an element of all these aspects but implemented in a form that was unknown in the 1980s; a computerized support aimed at citizens and provided through public portals. The new thing here, the present authors argue, is the attempt to create calculations that involve the citizen with technology in a more extensive manner. However, as mentioned previously, there is a difference between the two cases when it comes to the character of the device introduced, that of the AMV being of a more automatic and that of the SNAE of a more open pedagogical character. Despite this, they can both be characterized as attempts to impose calculative practices and ways of thinking on citizens as a part of public policy implementation.

8. Conclusions

This research has been pursued in order to answer the following question: How do portals containing technological devices contribute to choice in educational markets? Our analysis shows that the devices perform and integrate a number of calculations, such as sorting out, summarizing, comparing, and storing, which contribute to choices in educational markets. However, we have distinguished between a mechanical and a pedagogical character of integration. These experiences draw attention to the extensive attempts at creating facilities for saving plans and choices resulting in potential managerial and integrity problems from the viewpoint of the individual. The devices also serve as tools in public policy implementation and are therefore viable parts of E-Gov. Throughout our analysis we have applied the principle of generalized symmetry in an effort to show what contributions technology makes without considering such technology subordinate to the human actor.

In our description we have followed the technology and the designers who create these devices. However, a limitation of this study is our decision not to follow the visitors to the portal as a part in our effort to avoid placing humans at the centre of the description. We have argued that in many studies of decision-making the focus is on the human decision-maker. The risk with the procedure chosen is, of course, that the description will be biased in favour of technology. In order to compensate for that risk, we have reported from our own experiences as test pilots when trying out the devices. It is also important to note that we do not know much about how real visitors use and interact with these devices. Thus, this issue is relevant for further studies.

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