Matthew landscapes. Segmentation and concentration in reward systems visualized

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Abstract

Professionals can be rewarded in different ways. The most common type of reward is provided by the market, that is, by successfully selling one's products or services to consumers. In professional fields dealing with the production of knowledge, art, et cetera, market success is usually just one type of reward for professionals and not necessarily the most important one. Especially recognition by peers and financing by the government is important here. Because governments tend to use several schemes for allocating money to a particular sector, we usually deal with systems of rewards.

This paper visualizes and examines the system of rewards for visual artists, installed by the Dutch national government in the period 1984-2005. Because this system includes several subsidy schemes involving different stakeholders in the allocation of subsidies – consumers, institutional experts and artists themselves – we expect it to be segmented, viz., different types of schemes will favour different types of art and artists as hypothesized by Diana Crane ('Reward systems in art, science, and religion.' *American Behavioral Scientist*, 19 (1976), 719-734). In addition, I expect that the Matthew Effect, introduced by Robert K. Merton (*Science* 159 (1968) 5, 56-63) will be operative, which predicts a concentration of rewards among a small group of artists, because notably the institutional experts and artists involved in the allocation of subsidies will take previous awards of subsidies as a sign of artistic quality.

Introduction

This paper presents a visualization of a reward system. The reward system consists of a set of subsidy schemes for visual artists in The Netherlands in the period 1984-2005. The visualization shows both the concentration and segmentation of the reward system and how the system develops over time. It was developed for the evaluation of visual arts policy as a part of a research project commissioned by the Dutch Ministry of Education, Culture, and Science and executed by a bureau for policy research (IVA Policy research and Advice, Tilburg, The Netherlands). It's main aim is to communicate results on the structure and dynamics of the subsidy system.

First, this paper discusses two sociological theories on reward systems that tell us what to look for. Next, it describes the Dutch policy scheme for the visual arts and its dynamics. Finally, the ideas and methods behind the visualizations are explained and we present and interpret the visualizations, focusing on segmentation first followed by the concentration of rewards.

Theoretical background

In his seminal paper on reward systems in science, Robert K. Merton introduced the Matthew Effect (Merton 1968), viz., the tendency of rewards to accumulate, referring to a statement in the gospel of Matthew (XXV, 29): "For unto every one that hath shall be given, and he shall have abundance: but for him that hath not shall be taken away even that which he hath." Merton showed that the awarding of a Nobel Prize to scientists increased the probability of receiving other types of rewards, such as research grants. This is partly due to the tendency for people to focus their attention disproportionately on scientists who received Nobel prizes (Merton 1973: 443-444). As a result, grants are more easily given to Nobel prize winners and new achievements tend to be attributed to them rather than to their collaborators. Success produces success. A strong Matthew Effect produces a winner-take-all situation (Frank and Cook 1995).

In addition, we should take into account the prestige of the organizations granting the rewards. As in the example of the Nobel Prize, rewards and the organizations awarding them vary with respect to their prestige. Organizations may try to increase the prestige of their rewards by selecting the same beneficiaries as more prestigious rewards (de Nooy 2002). Even if they are not meant to serve the absolute top in a particular field, it is very rewarding and tempting to include them among their beneficiaries. This is another explanation for the Matthew Effect.

Diana Crane elaborated the idea of a reward system and extended it beyond science to the production of other types of symbolic goods or services, viz., art and religion (Crane 1976). She argued that we should distinguish between material rewards, e.g., money, financing, and symbolic rewards, e.g., awarding prizes. She hypothesized that the diversity of the symbolic production and the rate of innovation depends on the type of people allocating the material and symbolic rewards: the market (consumers), bureaucrats, or the creative producers (innovators) themselves.

In our case, the rewards are subsidy schemes for visual artists in The Netherlands, so the reward system is basically a subsidy system. Following both Merton and Crane, we will investigate two phenomena in this reward system. According to Merton, we expect a tendency to concentrate rewards among a small group of artists. According to Crane, we expect a tendency for rewards to serve different types of artists if different types of people are involved in the allocation process. This is hypothesized to yield a segmentation of the artists according to types of rewards.

Note that the two tendencies may have complementary or opposite effects. If both effects are operative and more or less equally strong, one should expect rewards of similar type to cluster because they address the same type of artists and the Matthew Effect raises the probability that a beneficiary of one reward will be considered a more likely candidate for similar other reward. If, however, awards radiate their symbolic value to all types of people involved in the allocation process, that is to say, if symbolic rewards are part of a strong and general group process, the Matthew Effect is substantially stronger than the segmentation effect and all rewards will tend to focus on the same artists. This matter is very relevant to policymakers who devise and evaluate reward systems because addresses the question whether it is necessary to design and implement different policy or subsidy schemes to reach different types of artists.

It is to be expected, however, that the concentration and segmentation of rewards will not just depend on the Matthew Effect or the types of people involved in the allocation of the rewards. Formal criteria specifying which artists are allowed to apply for a particular subsidy or how often they are allowed to do so, also affect the degree of concentration and segmentation in the reward system. Thus, policymakers can fine-tune a subsidy system and raise or lower the concentration and segmentation.

The Dutch subsidy scheme for the visual arts

Since World War II, the Dutch national government has supported visual artists because they are supposed to be important to society and the market of demand and supply is supposed to fail here. Initially, government support for artists was driven by social security motives (BKR, Beeldende Kunstenaars Regeling, Scheme for Visual Artists). In exchange for works of art, artists could get a benefit at regular intervals. In the 1980s, the government turned away from this social security type of policy because it was open-ended and the number of users increased sharply (Ministry of Education 2006: 117-118). This policy scheme was replaced by a differentiated set of subsidy schemes, subsidizing visual artists from different angles and involving different kinds of people allocating subsidies, that is, deciding on grant applications or on commissions and purchases (Figure 1).

●	*Consumer's choice:*	
	Interest-free loans for art buyers (RSR)	1984-2005
●	*Institutional purchases:*	
	Purchases by museums (MA)	1984-1987
	Purchases by museums, temporary scheme (MA_TASR)	1984-2005
	Purchases by the national government (RA)	1984-1992
■	*Institutional commissions:*	
	Art and business(KenB)	1985-1997
	Art commissions for schools (KO)	1998-2000
	Bureau for art commissions (PBK)	1985-2005
	Ministry of Housing and Construction (RGDperc)	1987-2005
	Extended scheme for art commissions (VO)	1988-2005
	Peer's choices:	
●	*Fees for artists:*	
	Compensation for professional expenses (BKV)	1987-1994
	Basis stipends (BS_I)	1994-2005
	Basis stipends (BS_II)	2001-2005
	Production subsidies (ProdS)	2002-2005
■	*Stipends and grants for artists:*	
	Other individual subsidies (OIS)	1984-2005
	Work grants (WB)	1988-2004
▲	Starter's stipend (StartS)	1988-2005

Figure 1 - Overview of the Dutch subsidy system for visual artists, 1984-2005.

One subsidy scheme is oriented towards the people who buy contemporary visual art. If Dutch citizens buy contemporary art at a selected art gallery, they can borrow the money needed for the purchase from the Dutch government without obligation to pay interest; the subsidy scheme pays the interest. In this scheme, the allocation of subsidy is based on consumer demand. Although not all galleries are included, we may assume that the

scheme reflects demand on the market of contemporary art. In the figures, this subsidy scheme is represented by a red ellipse and it is labelled RSR.

The second type of subsidy scheme reflects institutional demand: purchases by museums (blue ellipses, labels MA, MA (TASR), and RA) and commissions by the State or its agencies, which are usually related to new infrastructure or buildings (blue boxes, labels KenB, KO, PBK, RGDperc, and VO). Here, professionals working at museums or governmental agencies decide which artistic work to purchase or commission. Art work is usually commissioned for specific sites both for decorating the interior of public buildings and for the public space, e.g., new urban districts, squares, or roundabouts. Especially art works for public space is usually not purchased by museums because they do not fit the standard exhibition spaces.

Finally, a third type of subsidy scheme uses experts from the arts, especially artists themselves to decide on grants, stipends, and fees for visual artists or projects proposed by artists. In this case, the peer group decides on the allocation of rewards. In contrast to the other types of subsidy schemes, artists must apply for subsidy, so we distinguish between granted applications (green) and rejected applications (yellow). Seven subsidy schemes have been operative in the period 1984-2005, which can be divided into three subsets. The first subset contains direct subsidies (fees) to visual artists for covering basic expenses of the profession, which initially reflected the governmental concern with social security of artists (green and yellow ellipses, labels BKV, BS_I, BS_II, ProdS). The second subset consists of stipends or grants for specified projects (green and yellow boxes, labelled OIS and WB), while the third subset contains one subsidy scheme, viz., stipends for starting artists (triangle, label StartS).

Several subsidy schemes are operative only in part of the period. Some schemes were replaced by new variants, e.g., BKV was replaced by BS_I, which was later replaced by BS_II. We are looking at a dynamic reward system and it is interesting to see how new or adapted subsidy schemes are initially positioned with respect to older schemes and how their positions develop afterwards.

Segmentation

We have 16 subsidy schemes and 21,013 visual artists received subsidy or applied for subsidy (stipends and fees) in the period 1984-2005. In all, 105,142 grants or applications have been registered and for almost any grant we know the amount of money involved. We can conceptualize this data set as an affiliation or 2-mode network. If a larger number of artists are affiliated to two subsidy schemes within a period, the overlap between the schemes is more substantial and the segments or constituencies that they serve are less differentiated. To visualize the degree of overlap between subsidy schemes, it is quite natural to locate the subsidy schemes in a plane (or higher dimensional space) such that the distances between schemes express the degree of overlap with respect to their clientele.

There are several options for determining the optimal positions. One could use the well-known spring embedder algorithms (Fruchterman and Reingold 1991; Kamada and Kawai 1989) but the size of our network requires a long time for these algorithms to converge and the network's peculiar structure (the subsidy schemes have very large

degree) yields very dense concentric circles of artists centred around the subsidy schemes that do not adequately express the overlap. Therefore, another technique has been used, viz., correspondence analysis (Greenacre 1993; Greenacre and Blasius 1994). This is a very fast scaling technique with the additional advantage that it will yield more or less the same result when it is applied to datasets that do not change much, which is very useful when a series of snapshots must be compared over time. Correspondence analysis requires the network to be connected (Weller and Romney 1990: 72) but this requirement is satisfied here.

In our application of correspondence analysis, the subsidy schemes are in principal coordinates because their location is of primary interest (Faust 2005: 132). Furthermore, we may expect that a substantial number of artists are affiliated to just one subsidy scheme. If we would have them in principal coordinates, they would be located at the same position as their subsidy scheme (Faust 2005: 137). We took into consideration the number of years in which an artists received a subsidy or unsuccessfully applied for a subsidy (weighting) because we think that subsidy schemes sharing a frequent user overlap more than schemes sharing an infrequent user.
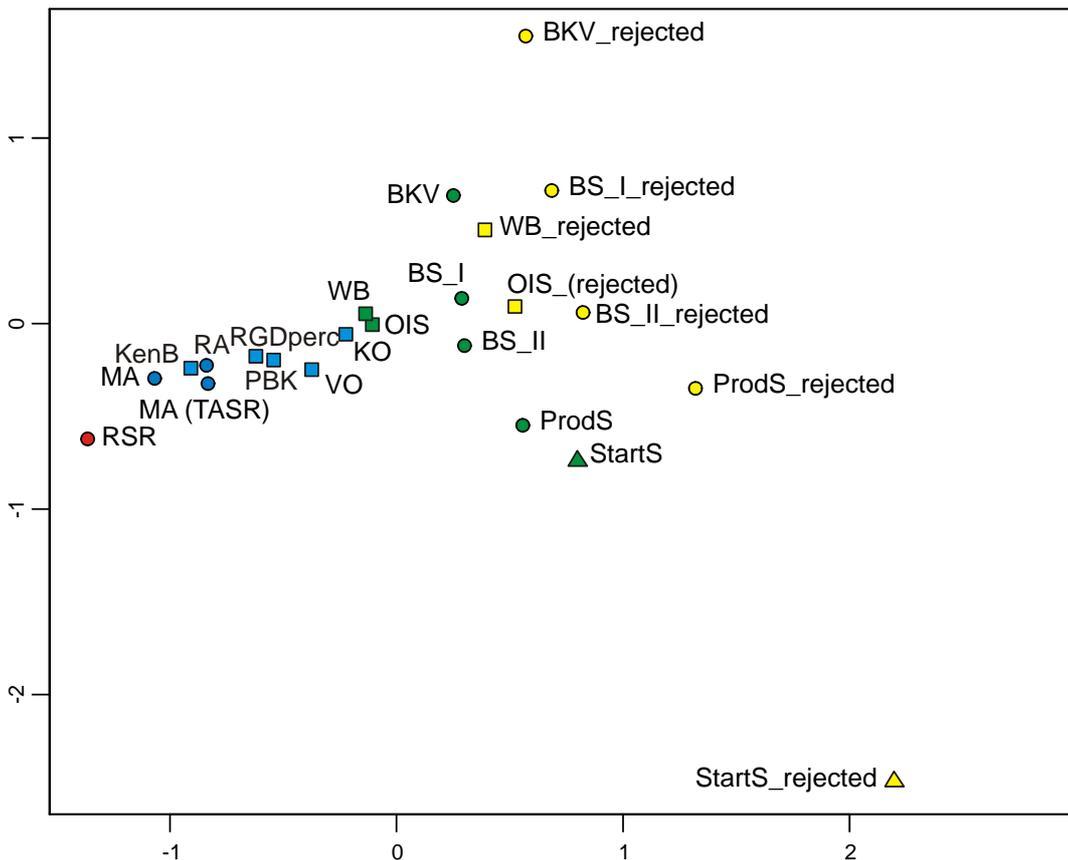

Figure 2 - Segmentation of the subsidy system for the entire period (1984-2005).

Figure 2 shows the results of the correspondence analysis of the entire dataset covering the period 1984-2005. The overall pattern shows a funnel structure: a narrow strip at the left, suddenly widening to the right. The clustering of colours and shapes immediately tells us that subsidy schemes of the same type serve comparable clienteles. Moving from left to right we first encounter the red subsidy scheme for consumers, then the blue purchases and commissions, next the stipends (green boxes) and, more to the right, fees

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(green ellipses) granted by peers, and finally the rejected applications (yellow boxes and ellipses). With the exception of the subsidy scheme for consumers, the average amount of the subsidies decreases from right to left in Figure 2, so we may interpret the horizontal dimension as the importance or size of subsidies. At the very right, applications are rejected and artists receive nothing whereas at the left, the average commission or purchase by a museum involves a considerable sum of money.

The vertical dimension is mainly characterized by the distinction between rejected applications for the first scheme of fees (BKV) in the top and rejected applications for starter's stipends in the bottom. This distinction is associated with (professional) age: the applicants for starter's stipends are by definition just starting their careers, whereas the applicants of the first fee scheme tend to be former users of the social security scheme that was replaced in the 1980s. They are on average older. The distinction between different generations illustrates the transition of the subsidy scheme from a social security oriented system to a system based on artistic quality and evaluation.
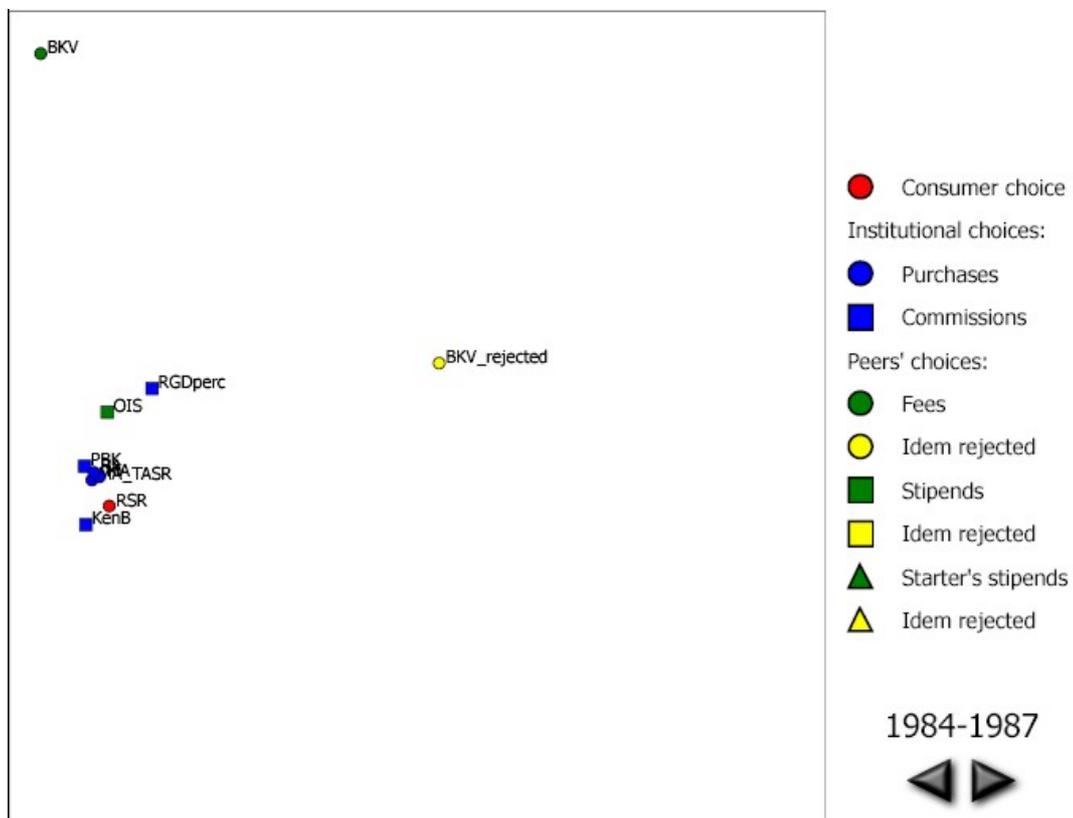

Figure 3 - Segmentation of the subsidy system in the first period (1984-1987).
Note: click on this image to open an interactive animation in Scalable Vector Graphics format. Requires Internet Explorer the latest SVG plugin from Adobe (http://www.adobe.com/svg/viewer/install/main.html). SVG allows zooming (Ctrl+left-click zooms in, Ctrl+Shift+left-click zooms out) and panning (Alt+drag). Right-click the SVG to open a menu of options. Move th emouse over a scheme to see its name.

The results of correspondence analysis for the first four years of the period (1984-1987) are shown in Figure 3. The coordinates of this picture are standardized to the maximum values over all periods. As a result, we can compare successive snapshots and interpret the movements of subsidy schemes across periods. It is highly recommended to open the

figure as an SVG picture (see the note accompanying the caption of Figure 3), so you can interactively browse through the animation.

In the 1984-1987 period, segmentation is due only to the first scheme of fees for visual artists (BKV), which extended the previous social support system. Institutional and consumer choices are highly clustered, indicating that they serve the same artists to a considerable degree. In the 1988-1990 period, several new schemes based on expert evaluation (stipends) were introduced (Figure 4 or click on the triangular button in the bottom right corner of the SVG picture). Most of them are positioned near the schemes based on consumer and institutional choices; they do not serve a clearly different group of artists. It is interesting to see that the rejections for these stipends and grants are situated near the successful applications for fees (BKV). There is a substantial number of artists who receive fees but are refused stipends, which indicates that receiving a stipend or grant is more difficult than receiving a fee. One new scheme based on peer selection, however, does mark a new segment, viz., the stipends for starting artists (StartS). This scheme really broadens the scope of the subsidy system.
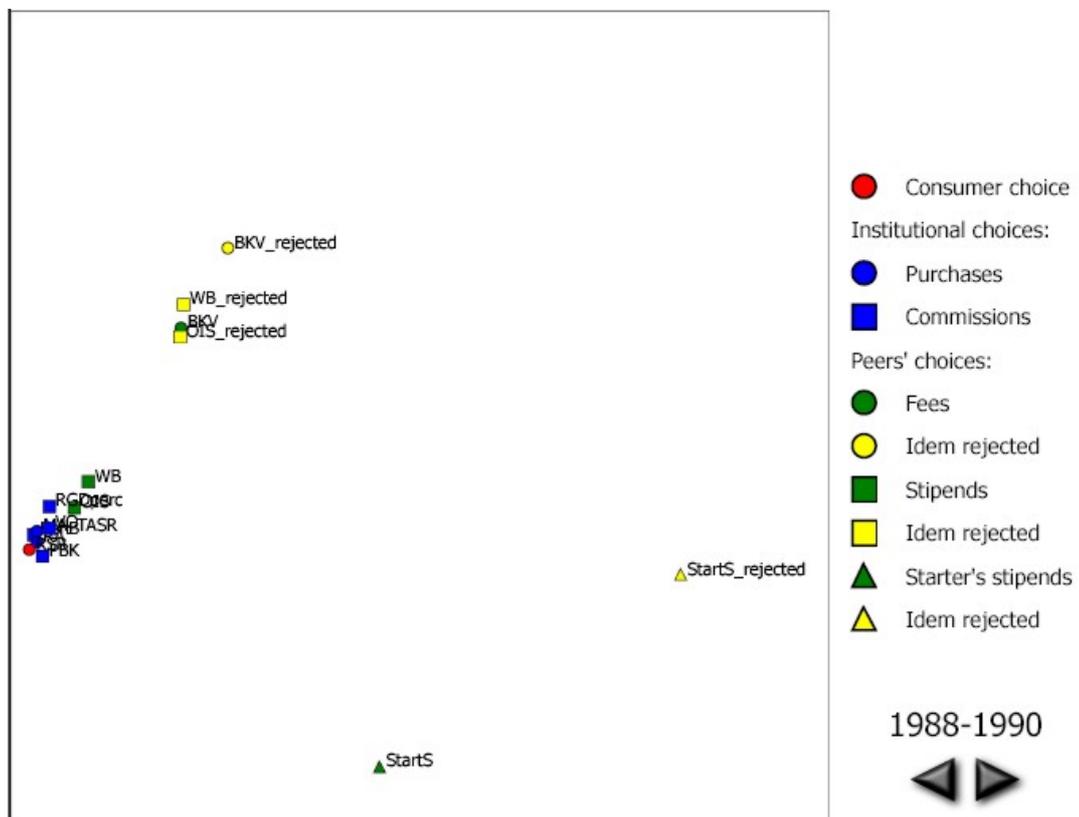

Figure 4 - Segmentation of the subsidy system in the second period (1988-1990).

In the next period, 1991-1993, we see the stipends for starting artists move to the centre, that is towards the other subsidy schemes (Figure 5). A centripetal force is operative here, as predicted by the Matthew Effect: rewards increasingly select 'winners' of other rewards. We will see this happen again in a later period (2000-2002 to 2003-2005). In addition, the gap between grants and rejections (yellow) is widening. It is getting more difficult for artists to enter the reward system. The periods 1994-1996 and 1997-1999 do

not display interesting movement. In the periods 2000-2002 and 2003-2005 (Figure 6), the introduction of a new subsidy scheme (ProdS – Production Subsidies) spurs a development that is similar to what happened after the introduction of the starter's stipends (Figure 4). Initially, production subsidies are clearly separated from the main cluster of subsidies; it is located near the starter's stipends suggesting that they are awarded to young artists, e.g., after their starter's stipends. But in the next period, it moves quite a distance towards the core subsidy schemes. The centripetal force is again operative.
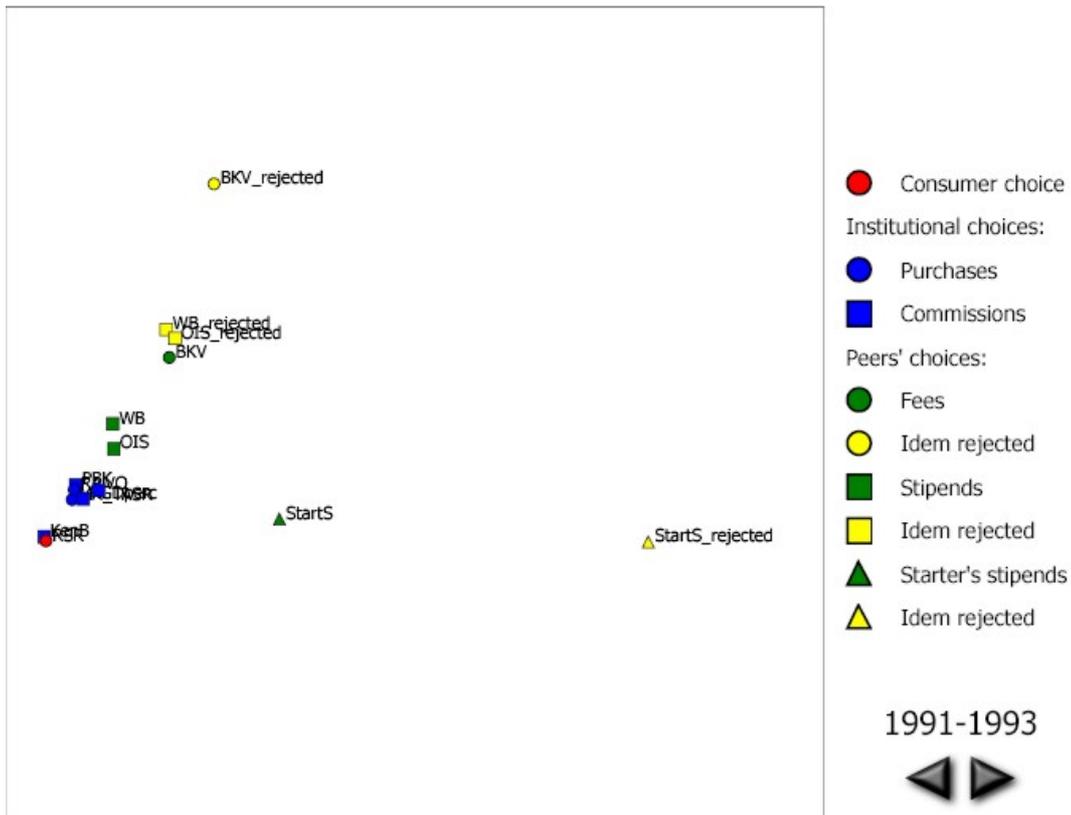

Figure 5 - Segmentation of the subsidy system in the third period (1991-1993).

With respect to segmentation, we may conclude that centripetal forces are operative in this reward system. Most subsidy schemes tend to move to the centre, so the segmentation among them diminishes. This is probably due to the fact that getting rewards (esp. from experts in institutions or peers) is interpreted as a sign of artistic quality by the experts and peers granting other subsidies, as predicted by the theory of the Matthew effect. The only rewards that continue to stick out (a little) and serve a distinctive segment are schemes based on consumer choices and a scheme that is formally restricted to starting artists. Hard criteria such as the artist's exact phase in a career seem to be required to counteract the centripetal forces of the reward system.
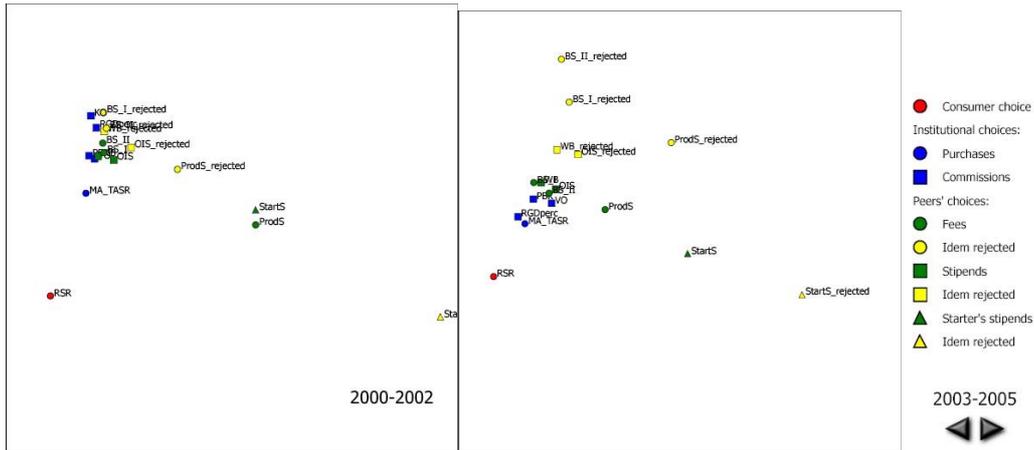
Figure 6 - Segmentation of the subsidy system in the last two periods (2000-2002 and 2003-2005).

Benefits

For further investigation of the Matthew effect, we must pay attention to the total amount of money that artists retrieve from the subsidy schemes over the entire period. With over 20,000 artists, however, it is not feasible to show each artist in a graphic display because that yields an indiscriminate cluttering of points. However, the artists have also been positioned in the correspondence analysis; they are scaled in standard coordinates. As a consequence of this type of scaling, the plot is asymmetric: we may only compare the position of a subsidy scheme to the location of all artists but not to the position of a single artist (Faust 2005: 132). This very well suits our approach because we do not intend to display individual artists. We may use their standard coordinates and we only have to find a clever way of representing groups of artists.

Because we weighted the correspondence analysis by the number of times artists received or asked subsidy, artists that benefited more from a subsidy scheme are located more closely to the scheme than artists that profited less. In other words, artists that benefit more or less equally, are located at more or less the same position. As a consequence, we can group artists at more or less the same position and only show their average benefits. When we regard their (average) benefits as the height associated with the spot they occupy in the two-dimensional map, we get a landscape, which is easily interpreted visually.

First, we must translate the irregularly spaced network of height values into a regularly spaced grid with height values for all cells in the grid. This requires interpolation of heights for cells for which no height data is available. In our example, this concerns locations in the correspondence map for which there are no artists, hence no received (average) amounts of subsidy. While standard statistical packages such as SPSS do not provide this functionality, the open software suite R does. We used the Akima package and applied linear interpolation on a 60 by 60 grid forcing the edges of the landscape to have zero height by presetting the heights to zero in the cells at the edges.

Now that we have a grid of heights, we can use several standard techniques for visualizing the landscape representing the amount of money that artists received from the subsidy schemes. One option is to add contours to the plot of subsidy schemes. When we also add a colour map expressing altitude, we obtain a map that is familiar to hikers.

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Figure 7 shows the result. We can spot the peaks, the steep and gradual descends, and the vast and barren plain where artists received nothing (outside the contour marking level 1).
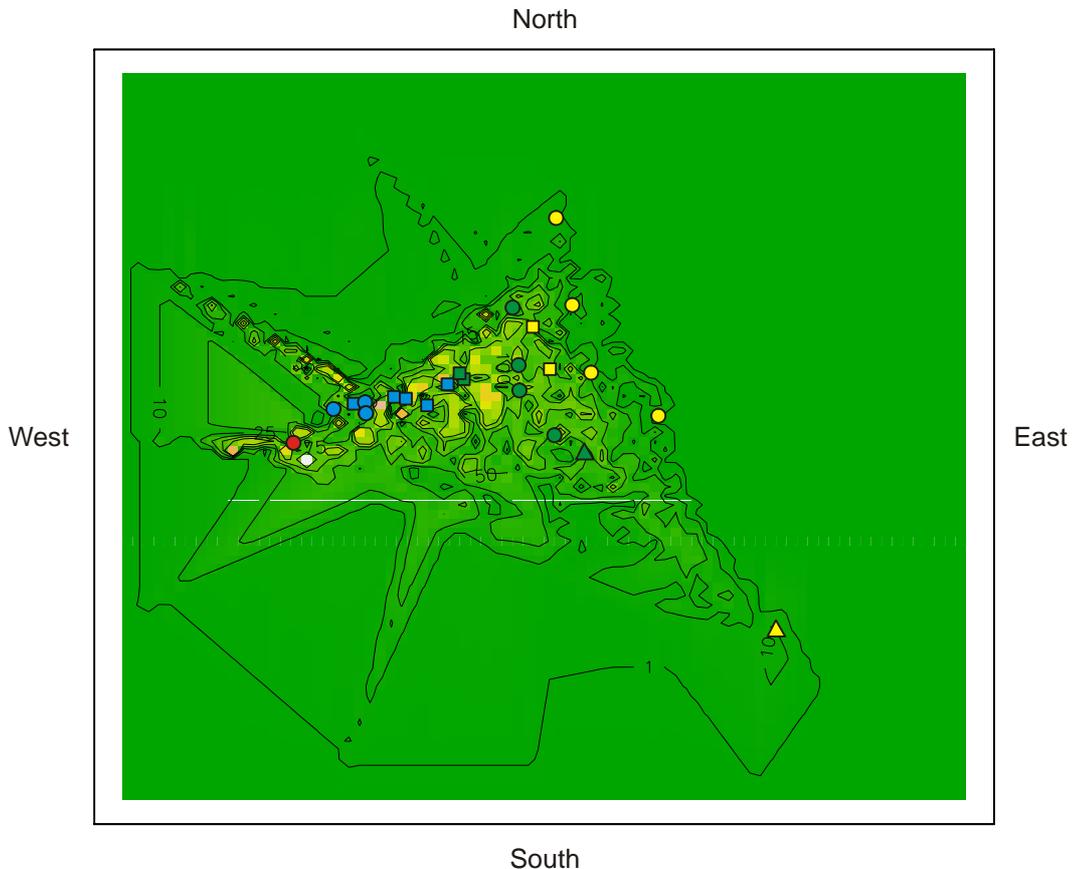
North

South

Figure 7 - Benefits (total amount * 1,000 euro) from subsidy schemes as a map, 1984-2005.

As an alternative, we can render a 3D landscape from the height data (Figure 8). No hiker's eyes are needed to inspect this landscape. The high peaks and steep slopes communicate a very high concentration of subsidies, which is confirmed by the concentration ratio (Gini index = 0.83): few get a lot, many get little or nothing. We can see individual peaks – the highest are found near the stipends – but they are chained into a ridge and they are not separate massifs, which we should expect if the reward system is clearly segmented.

In addition, we see a plain containing artists whose applications have been rejected. They did not secure entrance to the reward system. Especially at the side ('ridge') of the stipends and fees (at the East), that is, the subsidies granted by peers, we see a rather abrupt transition from plain to mountain. Awards and rejections co-occur among artists, probably because there is no limit to the number of applications an artist is allowed to submit. Fees and grants consist of fixed amounts of money so getting one or more of them results in a stepwise accumulation of money. The exception here is the starter's stipends scheme. Here, we notice a gradual rise from rejected applications for starter's stipends to the central massif, indicating that rejected artists constitute quite a separate group but some of them still manage to get money from other subsidy schemes.
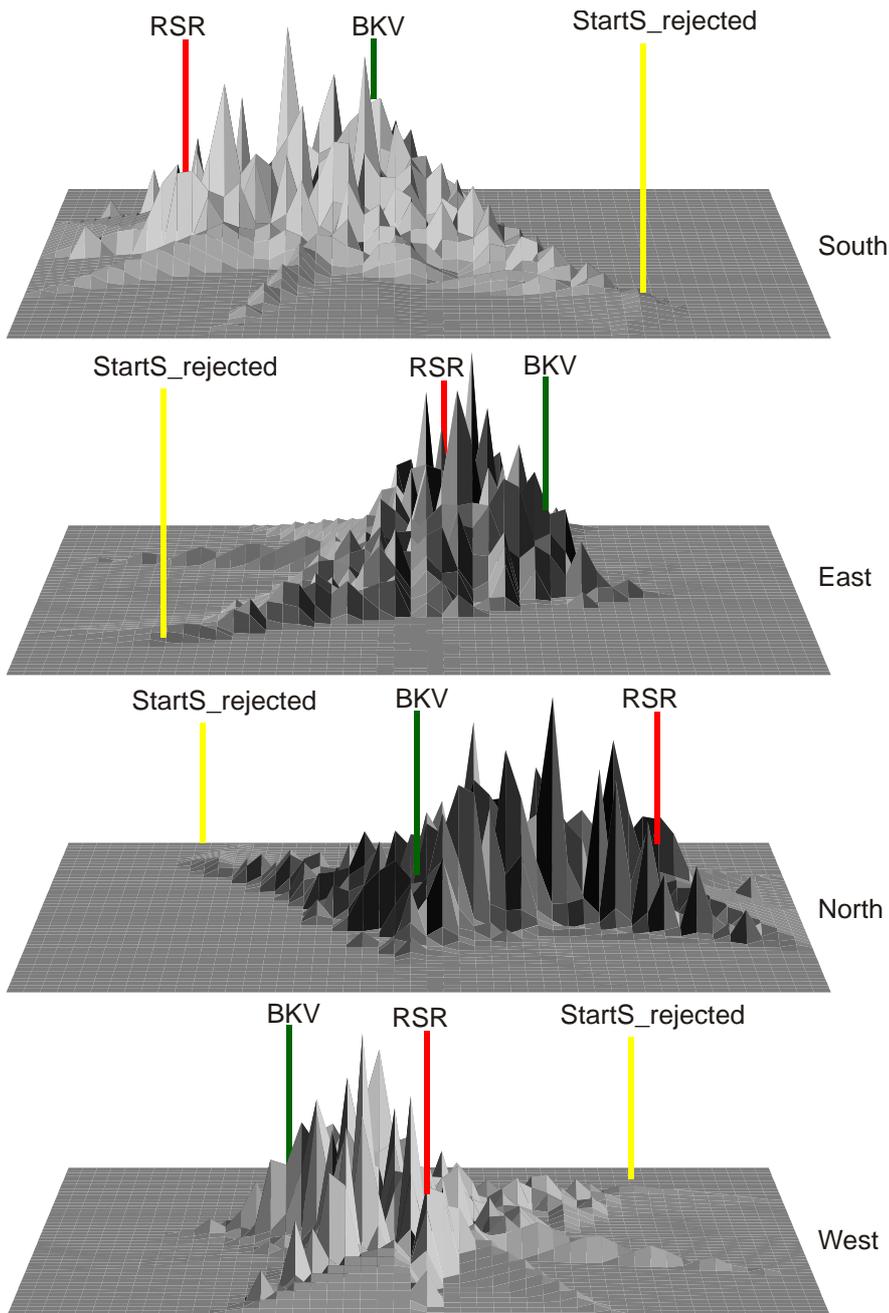
Figure 8 - Benefits (total amount of money) from subsidy schemes as a 3D landscape, 1984-2005.

Conclusion

The dynamics and outcomes of the Dutch reward system for visual artists are a rather long term and complicated process. It is very difficult to survey the structure and dynamics of this reward system by the people involved in it. Visualization helps to detect and communicate the structure and dynamics of the system. Two-dimensional scaling techniques, such as spring embedder algorithms and correspondence analysis, are well-known and they are used often to produce maps that are quite easily surveyed and interpreted by the eyes. In this paper, we introduced three-dimensional representation of affiliation networks as a landscape for visualization of an affiliation network with a large

number of cases in one mode. The resulting picture is intuitively appealing but we should note here that the interpretation of a correspondence map is not as straightforward as one should expect (Faust 2005).

The reward system of subsidies for visual artists in The Netherlands is characterized by centripetal forces. In the course of time, subsidy schemes increasingly serve the same group of authors. This can be explained by the so-called Matthew effect, which results from the symbolic value of subsidies. Awards are interpreted as signs of artistic quality, rejections as signs of insufficient artistic quality, hence more awards for an artist signifies higher artistic quality, which increases the probability of being selected for more rewards. Segmentation, that is, the extent to which subsidy schemes serve distinctive groups of artists, is only maintained if the use of a subsidy scheme is formally restricted to artists with particular objective characteristics (stipends for starters) or if non-experts are involved in the allocation of subsidies (consumer choice). Otherwise, the centripetal tendencies of the Matthew Effect dominate.

With these results, one may wonder whether it is efficient and transparent to have several subsidy schemes involving institutional experts or peers. Why not have one if they increasingly reward the same artists? Or should a government change the entire system every now and then in order to restructure the reward system?

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