

Association for Information Systems AIS Electronic Library (AISeL)

ECIS 2000 Proceedings

European Conference on Information Systems
(ECIS)

2000

Webbing and Embedding a Vision: An Exploratory Study of Culture and Information Technology in a Business Community

Ellen Christiaanse
University of Amsterdam

Vanessa Dirksen
University of Amsterdam

Follow this and additional works at: <http://aisel.aisnet.org/ecis2000>

Recommended Citation

Christiaanse, Ellen and Dirksen, Vanessa, "Webbing and Embedding a Vision: An Exploratory Study of Culture and Information Technology in a Business Community" (2000). *ECIS 2000 Proceedings*. 98.
<http://aisel.aisnet.org/ecis2000/98>

This material is brought to you by the European Conference on Information Systems (ECIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in ECIS 2000 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

Webbing and Embedding a Vision: An Exploratory Study of Culture and Information Technology in a Business Community

Ellen Christiaanse

Vanessa Dirksen

University of Amsterdam

Department of Information Management

Roetersstraat 11, 1018 WB Amsterdam

Abstract- This paper addresses the relationship between technology framing and new organizational forms and cultural artifacts embedded in information infrastructures such as intranets. Intranets can be viewed as important carriers of culture of organizations. New, young, web-based organizations provide interesting cases for exploratory research in this respect.

I. INTRODUCTION

Theoretically anchored in social construction [1] and duality of technology theories [2], this exploratory study has as its main goal to investigate the manner in which the entrepreneurial, team based, open spirit of The Vision Web (TVW) as an organization is reflected in the design of its intranet [3]. The paper first discusses the broader theoretical embedding of the study and then briefly discusses the approach of the study. In the following section, the business community under observation will be described, followed by a description of the company's use and design of its intranet. Furthermore, we will reflect on current dilemmas the company is facing with regard to the preservation of its culture while continuing to grow exponentially and internationally. In line with these reflections and dilemmas, we will conclude with addressing our next steps and questions for future research of this longitudinal research effort in the field of the interaction of IT and culture.

II. INTERACTION OF IT AND CULTURE

A. Cultural Construction and Framing of Information Technology

The focus of the proposed study is determined by the idea derived from the Social Construction of Technology (SCOT) [1] that holds that technology should be reflected upon as if it were a social construct. Extending this approach, the Cultural Construction of Information Technology (CCIT) [4] proposes to study information technology (IT) as part and parcel of the culture in which it is developed or designed, i.e., as a cultural artifact [5]. This approach represents for us in the first place the realization that IT is value loaded [6]: the cultural values and social practices of the context in which it was designed and developed are embedded in the information technology. We explicitly refer to the field of research as the *interaction* of culture and IT, underlining the fact that a cultural construction of information technology should be

less defined from the point of view of technology and more from the point of view of culture to begin with.

Central to this study is the conviction that broad cultural beliefs and social practices¹ create and reinforce patterns and ways of seeing the technology - or, 'frames of meaning'.² This 'cultural framing' affects their relative working for we hold that the way in which people interpret an information technology defines the way in which they use (or not use) it. Hence, the main objective of the proposed research is the explication of the various interpretations, of the different groups of people, of one and the same technology, from the perspective of culture.³

The specific cultural framing of technology not only enables and constrains the use of IT, it even has a transforming impact on the technology in use. This idea of agency is derived from Orlikowski's Duality of Technology [2] [7]. Apart from the fact that the cultural framing of technology affects its deployment (or, use), one should also account for the possibility that the interaction of people with IT to some extent also influences, and possibly transforms, the specific culture. Hence, "technologies serve as both the products and producers of distributed cultural meaning" [5]. It should be noted, however, that this study attempts to extend this notion of agency with "the script of expectation statements since it is directed towards "[h]ow story-lines may structure action before the fact and how *prospective structure* emerges" [8]. Thus, not only are we to investigate how people perceive the information technology but also what they expect of it in the long run, that is, what expectations they 'inscribe' in the tool.

An investigation of the interaction of culture and IT entails an investigation of what groups of people can be discerned according to their (cultural) framing of the information technology. The technology in use can turn out to convey different meanings to the different people involved with it. By contrasting, then, the technological frames of meaning of the users and the designers of a specific information system we are able to detect to what

¹ Extending the concept of 'technological frame of meaning' of Bijker and Law (1992) to the way people account for the phenomenon 'technology' seen as influenced highly by their 'cultural background'.

² A term of Collins and Pinch (1982)

³ We posit the practice of IT, that is the practice of its design, use and management, as a Geertzian form of 'cultural interpretation'. This perspective acknowledges the role of the actor and stresses the need to study culture from within, reconstructing as much as possible the native's point of view by trying to distil the meaning of the world given by the people who live in it (Geertz, 1975).

extent the 'cultural' and technological (expectation) inscriptions are incongruent. We argue that the detected 'gap' in the framing holds as a plausible explanation for the specific 'success' of the information technology. One could even argue that congruence between the framing of the 'relevant social groups'⁴ would be essential for a 'perfect fit' of the tool with the organization.

B. Research Methods and Approach

The approach of the research will be organized around its four constituents. The explication of the technological framing of the various groups of people will be based upon non-standard interviews among the various users, managers and the designers/developers of the specific information infrastructure [10]. These findings are to be analyzed in the light of the other three steps of the research. The first of which is the reconstruction, according to the documentation of its design and deployment and a description of the intranet itself as well as its developmental history. This phase of the research should bring forth a description of criteria of relevance, an *ethnography*, of the information infrastructure in a socio-cultural context and the culture in a technical context.

The second phase concerns the collecting of data on the *actual use* of the infrastructure. These statistics should provide us with an insight into the amount, the characteristics and the frequency of use of the people using the infrastructure.

The third step requires both the study of archives and documentation on the goals, purpose and the prospective meaning and functionality of the infrastructure, participant observation in the business community as well as the conducting of interviews among the relevant social groups with the purpose of revealing the 'narrative infrastructure'⁵ of the technology. The objective of this step is to give an account of the 'prospective structure' as mentioned in the above. Revealing the narrative infrastructure and the observation of the consequences in terms of the subsequent *transformation* of the infrastructure inevitably requires the research to be longitudinal.

Summarizing, the cultural framing will be analyzed in the light of (1) the description of the information infrastructure; (2) the actual use of the infrastructure and; (3) the transformation of the information infrastructure.⁶

The first part of the case study, the one eventually bringing forth an ethnography of the information infrastructure, evolves around the question whether or not the information infrastructure reflects the specific organizational philosophy and structure. Ideally, the technology should reflect the structure, culture and

philosophy of the organization in order to have a maximum amount of (satisfied) users. In order to investigate this, we will, in the following section, introduce a business community with a rather distinct culture and practice.

Before reporting on the initial phase of the case study, however, it should be noted that we hold a specific view of organizational culture, that is to say, in terms of community building. We specifically speak of business communities rather than referring to the notion of organizational culture. The reason for this is that the term organizational culture in the management sciences often refers to the notion of organizational culture within the boundaries of the organization only, assuming it to be an isolated phenomenon, and therewith not acknowledging the external (cultural) influences. By using the term business community we attempt to underline the fact that "[c]ommunities have structural characteristics of which bear the stamp of specialized societies within which they form themselves" [9]. The CCIT approach accounts for this wider contextual development. Using the term community acknowledges a broader definition of organizational culture in terms of the broader cultural, social and technological context. It furthermore implies that its members have something in common with each other and hold a certain 'sense of belonging'⁷. And, when confronted with one and the same technology, these common features will come to light; the group will posit itself as a seemingly harmonious whole. This is comparable to what Cohen calls the "human construction of invisible boundaries" [13].

III. THE VISION WEB CASE

*People Meet, Minds Explore,
The Vision Unites,
Communities Are Born,
Turning Talent Into Enterprise
As One Circle Matures, a New One Comes To Life*⁸

The Vision Web (TVW) is a very young web-based organization, based in the Netherlands. The organization started in 1996 with a company called Solvision (Solutions through Vision) focusing on IT consulting services. Over the last three years the organization has grown into a web of different loosely coupled web companies called The Vision Web. Currently The Vision Web has over 350 employees with annual revenues of 90 million NFL, in several European countries as well as in Asia and the US.

The Vision Web's core-activities are directed toward project-management and consulting in ICT. TVW is involved in business consulting in Finance and Telecommunications and is organized around 5 core activities: (1) intelligent enterprise; (2) extended enterprise; (3) automated enterprise; (4) learning enterprise

⁴ SCOT utilizes the concept of relevant social groups, those who influence the creation, the demand, production, diffusion, acceptance, or opposition to the technology [9].

⁵ The narrative infrastructure refers to the accumulation of the 'stories of expectation' [11]. As Deuten and Rip assert: "when the constitutive role of the narrative is recognized, stories become more than a tool: they shape the organizational landscape [11].

⁶ Orlikowski and Gash (1994) distinguish several dimensions of technological frames of meaning into three specific areas: nature of technology, technology strategy, and technology-in-use [9].

⁷ "Belonging is the almost inexpressible complex experience of culture [...] the feeling of belonging arises by membership of the parts and also of the whole" [12].

⁸ Source: The Vision Web Mission Statement

and; (5) process enterprise. Each of these activities has business projects dedicated to them.

The Vision Web makes it into the popular press frequently due to its innovative and creative organization principles: It has no hierarchical structure, employees define their own business projects, goals and salaries, and meet and work in the companies' "grand café". Its organizing principles are reflected in the company's specific concept of infrastructure, i.e., the physical as well as the human infrastructure, is designed in a way to facilitate innovation, entrepreneurship and creative thinking.

A. The Vision Web's Philosophy and organizational formula

TVW has a particular and outspoken philosophy, the pointers of which are: Respect and trust, individual responsibility, entrepreneurship directed toward self-development, prioritizing talent over structure, and synergy between people internal and external to the organization. The notion of role-playing is of considerable importance in TVW and reflects one of the pillars of its philosophy: People, all of them perceived as entrepreneurs, play the role that they are best at. Personal initiatives and responsibility are key [14]. The development of personal talents should not be hindered by any type of structure as one of its founders, Eddy Vermeire, summarized by saying "people are best in what makes them tick in life".⁹ By prioritizing of talents over structure the company aims to facilitate entrepreneurship and personal initiative.

The following quote taken from a The Vision Web Brochure probably describes best how the company sees its own organizing principles:

"While designing a university campus with various buildings the architect decided not to build any roads but to create a lawn in between the buildings. After a year the students had created the most logical paths and roads from one building to the other, which were paved accordingly."

The Vision Web is organized, multiplies and expands as a living, fluid web. The company has never placed a recruitment advertisement during the three years of its existence. Instead, employees bring their own network to The Vision Web organization. In their first year the average employee brings one, in the second year, two and in the third year three new employees. In doing so, they bring their own personal network to the Web (potential new employees and partners in addition to clients). This while turnover in The Vision Web has been minimal: almost no people have left the company over the last three years.

The Vision Web is a business community in which various autonomous companies, all of which operate under a different name position their services jointly in the market [14]. So, one could say that The Vision Web is a container term for a set of entrepreneurial organizations,

consisting of various micro-enterprises. Web inhabitants are free to initiate Business Projects (BPs), new innovative projects based on a business idea that is expected to be able to attract its own client base. These business projects have creative names like "Future footprints", "EYE (Extend Your Enterprise), focusing on supply chain management or Change Vision. They are typically 'inhabited by' around 10 to 15 people, dividing roles and tasks among themselves and interacting with each other through various virtual communities in The Vision Webs' intranet.

BPs can be described as temporary occasion-formations. The appearance of a BP is a result of the gathering of similar thinking employees who decide to start a new project together. They set their business targets themselves and get the necessary people with the desired expertise from within the organization as a whole. People can participate in various Business Projects simultaneously. After the realization of the BP's targets, members can disperse again and will engage in other 'occasion-formations', enacting different 'roles' within the web. One could say that The Vision Web evolves around the concept of The Vision Community (the BPs and the virtual communities) inhabited by The 'Visionwebber', using the facilities of Vision Plaza (the café, the home-office and the information infrastructure). Summarizing the following key characteristics underlying the organization of The Vision Web:

- (1) continuous change (no fixed descriptions of functions, but roles);
- (2) knowledge infrastructure;
- (3) virtual office concept;
- (4) virtual communities (the bundling of forces) and;
- (5) participation.

We will now turn to a description of their technological backbone, their intranet, the Vision Net.

B. Technology in The Vision Web: The Vision Net

The infrastructure of The Vision Web is designed and built according to its philosophy, values and culture. This is visible both in the physical work environment, the café, as well as in its information infrastructure. We claim that, to a large extent, the device, or the technology can be viewed as a personification of the particular the business community. The 'embeddedness' of the company's culture in the intranet structure is visible in various features of the Vision Net.

Key to TVW is the open disclosure, sharing and availability of information embedded also in the design of the Vision Net. Entailing not only the provision of operational and management information, but instead making the storage and access to company assets available to all Visionwebbers: The storage and accessibility of assets (plans, reports, presentations and the like) –in *The Vision Memory*–, the stimulating of individual and group-learning –in *The Vision Communities* – the alignment of information –in *The Vision Channel*– [14]. On the whole, the Vision Net is characterized best as a collection of the

⁹ Excerpt from a personal interview (winter, 1998).

various web-based applications, the most popular of which are summarized in the below:

Remarkable are three similar applications, known in the web as 'Who is who?', 'Gold Diggers' and 'Adventure Land'. 'Who is who?' contains knowledge-profiles of all employees; reporting on their field of expertise and relevant personal details. The 'Gold Diggers' is used to ventilate employee's ambitions and presents the details of their availability. It gives data on when they are available for others and what projects they would be interested in doing. The last mentioned, Adventure Land, is "an application in which Visionwebbers present the individually spotted commercial opportunities" [14].

Another component of the intranet is Livelink. "This is a web-based application that provides comprehensive, off-the-shelf collaborative knowledge management for organizations of any size" [15]. It enables the development and ordering of knowledge at three levels of the application: the Enterprise Workspace, the Project Workspace and Personal Workspace. The Enterprise Workspace is the "central repository of the enterprise in which information can be browsed, searched, retrieved and uploaded" [14]. The Personal Workspace is a Visionwebber's own Livelink environment, to customize for optimum productivity. It is a personal workspace containing a Visionwebber's personal files and projects.

The intranet facilitates, furthermore, the development of virtual communities. "They do not just represent a repository of knowledge such as Livelink, but enable also meetings in real-time ... " [16]. According to one of the Vision Net developers "the TVW virtual communities are 'inhabited' by people who share a certain interest or knowledge. They represent a cross-section of the organizational structure, consisting of people from the various web companies and BPs. They come and they go".¹⁰

Other components of The Vision Net are performance and opinion surveys and related databases. An example of these is the Balanced Score Card (BSC) showing results of the degree of satisfaction about information exchange, profit, return on assets and the balance of personal and business life of every web company separately. Apart from the BSC, there are various result-analyses for every micro-organization and Business Project, that is, the analysis of the their own results on a monthly basis and reports on the expectations and ambitions for the coming months, accessible for all Webbers.

IV. PRELIMINARY FINDINGS AND REQUIRED FUTURE RESEARCH

A. *Ethnographic findings*

Even though the research conducted as yet is still exploratory, the following issues can be extrapolated from the case:

The manner in which TVW is setting up its intranet(s) clearly reflects their cultural beliefs. Examples given of

this are the 'Adventure Land' and 'Gold Diggers' applications to reflect the mobility of Visionwebbers in the organization and the room there is for individual initiatives and entrepreneurship. Employees of TVW can create their own projects, put them on the Vision Net and find the right people to work with. Webbers can find projects that match their interests and capabilities from their homes, being connected to the intranet.

Another aspect of the organizational culture reflected in its intranet, is the quality and type of the information sharing provided by the intranet. The fact that salaries are openly provided on the intranet for every employee (including the management team) is a clear sign of the open culture of TVW culture. The 'Who is Who?' application showing all employees with their skills, capabilities and weaknesses provides room for open discussion of people's next steps and projects. The changing coach-roles across the community enable everyone to share knowledge and skills with other members.

Finally, the Balanced Score Card with parameters incorporated like ratio between private and work life balance are clear reflections of the caring and supportive nature of the web.

B. *Subsequent phases of the case study*

In the above we reflected on the preliminary findings of the first phase of the case study. To specify briefly the subsequent three constituents of the study, in this section we will pose their respective research questions.

As mentioned in the second section of this paper, the second constituent of the study is directed toward the intranet in use. The most important question arising here is: How are the different groups of people represented on the intranet? A recent survey held on the intranet among 60 respondents showed that 63% of the respondents uses the intranet on a daily basis.¹¹ Combining this finding with certain characteristics of the respondents, such as their age, might possibly show a correlation with a division in generation. Despite the fact that the older generation Webbers may possess more working experience, expertise and probably a more comprehensive personal network than the younger employees, the younger Webber could turn out to be the more 'successful' and active Webber after all. Coming from traditional organizations, and therefore being used to traditional organization structures and ways of working together, the older generation Webbers could encounter difficulties with the openness of TVW and the subsequent use of the intranet where the younger Webber would be less constrained in the developments of his or her talents. Monitoring the 'surf behavior' of the Webber, i.e., the navigation patterns on the intranet, could as well show certain applications to be more popular amongst certain groups of people.

The third constituent of the study comprises the transformation process of the intranet. It is our contention to investigate here to what extent the tool is transforming the organization and to what extent the organization can be

¹⁰ Excerpt from an interview with a Vision Net Development team member (January, 2000)

¹¹ Source: survey, Vision Net.

held responsible for transforming the tool. Since the organizational philosophy of 'openness' and 'anarchy' is embedded in the intranet, with the supposed purpose of sustaining and enhancing the philosophy even more ['webbing'], we suspect the organization to be the prime mover with respect to this transformation process. We have reason to believe that the tool follows in the first place the organization and not the other way around.

The cultural framing of the intranet and the explication of its various interpretations, ultimately, should be directed toward finding out what groups of people can be distinguished according to their specific framing of the technology. For example, the cultural framing of the intranet might prove of diversity in ascribed meaning of the intranet by different groups of people. This variation in perceiving the technology could, for example, be in terms of its function. For instance, one could hold the function of the intranet mainly as an information, communication, distribution or transaction device [17].¹² This variation or 'sharedness' in meaning [18] across the various groups of people of TVW could possibly be ascribed to a difference in background, e.g., in terms of scientific tradition¹³ [18] [19] and generation¹⁴ [4].

C. Current Dilemma's

As a consequence of the success of the network-approach to expansion and the attraction of new employees, TVW is growing exponentially. This extensive growth of the company posits an inevitable dilemma for the organization, i.e., as one of the founding fathers of TVW expressed his concern, "[h]ow would it be possible to preserve the own and unique web-formula [20]? The more people enter the organization, the more conventional ideas are, also, imported in the organization. Another one of the founders of TVW expresses a similar concern: "The biggest problem we are facing at the moment is the fact that we do not have enough people with an understanding of the story around our philosophy, let alone to diffuse it to the rest of the organization" [21].

Given the entrepreneurial values and the autonomy of the micro-organizations and the expansion of the company as a whole, creating and sustaining a sense of belonging is of utmost importance in The Vision Web community. Since the intranet plays a key role in transferring the culture and preserving the sense of belonging, future research should also be directed toward the ways in which the tool will continue to serve as a carrier of the culture, a 'bonding mechanism'.

The success of The Vision Web formula is also reflected in the subsequent growing number of international

establishments of TVW. With the expansion of the company abroad, the problem of 'cultural alignment' arises. This issue concerns the variation of socio-technical landscapes. Since the deployment of a technology, in this case an intranet, will always take place against the background of these existing socio-technical landscapes, micro-, meso- and macro- cultural alignment is necessary for a successful implementation of the same technology in another national context.

D. Concluding Remarks

Apart from directing our attention toward the four main questions posed in the above, future research should entail, also, the investigation of how TVW can preserve its distinct philosophy and enhance the feeling of 'belonging' with the use of the intranet. Another challenge in our research is to tackle the problem of how technologies initiated and developed in a certain locality could be found valid when transposed to another context [22]. For this reason, we consider it essential to extend the notion of cultural framing to the way 'cultures' perceive technology at the various levels, i.e., the individual, organizational and societal level, underlining the fact that structures of meaning are historically and culturally influenced.

The open way the intranet is evolving, instead of being consciously designed, is fully in accordance with The Vision Web's organizational culture. Business projects are fully responsible for their own information sharing. There are no pre-arranged structures or routines designed to make knowledge available to the rest of the organization. There are no central authorities deciding what should and what should not be made available, instead the web regulates itself.¹⁵ The Webbers pave their virtual paths in their Vision Net, by trial and error, (in) efficient and (in) effective but collectively the web is learning and innovating and spinning off new (intranet based) knowledge to share it with its customers and start new business projects out of the knowledge obtained.

Bearing the transforming impact of the business community on the technology in mind, will the same tool, The Vision Net, when implemented in different cultural contexts, develop in a quite distinct way from the 'national intranet'? Will the Vision Net become, in the long run, a web composed of various intranets, each reflecting their own cultural context?

REFERENCES

- [1] D. Mackenzie and J. Wajcman, Eds., *The Social Shaping of Technology: How the Refrigerator got its Hum*, Milton Keynes: Open University Press, 1985.

¹² The same survey as mentioned before showed that 85% of the (60) respondents hold the intranet to be an essential tool for internal communication (source: Vision Net).

¹³ Sahay and Walsham (1996) consider in their study of the implementation of GIS in India the scientific tradition to be an important aspect of the context responsible for generating the 'sharedness' in meaning, the rather homogenous technological frames of meaning.

¹⁴ The notion of generation, according to Hagendijk, refers to the 'historical positioning' of people in society in relation to the 'life-cycle' of technological artifacts.

¹⁵ A discussion which was started in one of the newflashes in December 1999, on a popular TV program was quickly killed by people responding that this was irrelevant and was collectively costing them money. Someone even put up a calculation what the costs of it were.

- [2] W. J. Orlikowski, "The duality of technology: rethinking the concept of technology in organization," *Organization Science*, vol. 3 (3), 1992, pp. 398-427.
- [3] J. Damsgaard and R. Scheepers. "Power, influence and intranet implementation: a safari of South African organizations," in *Information, Technology and People* vol. 12(4): pp. 333-358, 1999.
- [4] R. P. Hagendijk, *Wetenschap, Constructivisme en Cultuur*, Amsterdam, 1996.
- [5] G. L. Downey, "CAD/CAM saves the nation? Toward an Anthropology of Technology," in *Knowledge and Society: The Anthropology of Science and Technology*, D. J. Hess, 1992, pp. 143-168.
- [6] A. Pacey, *The Culture of Technology*. Oxford: Basil Blackwell, 1983.
- [7] A. Giddens, *The Constitution of Society*, Cambridge: Polity Press, 1984.
- [8] H. Van Lente and A. Rip, "Expectations in technological developments: an example of prospective structure to be filled in agency," in *Getting New Technologies Together: Studies in Making Sociotechnical Order*, C. Disco and Van B. der Meulen, Berlin/New York, 1999, pp. 203-229.
- [9] S. Sahay, M. Palit and D. Robey, "A relativist approach to studying the social construction of information technology," *European J. of Information Systems* vol. 4 (3), pp. 248-258. 1994: 252.
- [10] S. Sahay and G. Walsham, "Social structure and managerial agency in India," *Organization Studies*, 18 (3), pp. 415-444, 1997.
- [11] J. J. Deuten and A. Rip, "Narrative infrastructure in product creation processes," *Organization*, in press, 1998.
- [12] A.P. Cohen (ed.), *Belonging: identity and social organisation in British rural cultures*, Manchester: Manchester University Press, 1982.
- [13] A.P. Cohen, *The Symbolic Construction of Community*, Chichester: Ellis Horwood, 1985
- [14] Th. Punter and F. Koster, "Programmaplan: the Vision Net 2000: the nervous system of The Vision Web", unpublished, January 5th, 1999.
- [15] <http://www.opentext.com>
- [16] "Description Virtual Community EC", unpublished, 1999.
- [17] A. Angehrn, "Designing mature Internet business strategies: the ICDT model," *Eur. Management J.*, vol. 15 (4), pp. 361-369, 1997.
- [18] S. Sahay and G. Walsham, "Implementation of GIS in India: organizational issues and implications," *Int. J. of Geographical Information Systems*, vol. 10, no. 4, pp. 385-404, 1996.
- [19] D.A. Alexandrov, "The historical anthropology of science in Russia," *Russian Studies in History*, Fall, pp. 62-91, 1994.
- [20] J. de Moor, Untitled, *Visionwebbers*, unpublished, 1999.
- [21] E. Van Mieghem, Untitled, *Visionwebbers*, unpublished, 1999.
- [22] J. Golinski, *Making Natural Knowledge: Constructivism and the History of Science*, Cambridge: Cambridge University Press, 1998.