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# Media in Action

**Interdisciplinary journal on cooperative media**

MEDIEN DER KOOPERATION

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# Contents

# Editorial: Introducing Media in Action and Media of Cooperation

The dynamics of contemporary media have created a fast-paced field, in which academic studies are often challenged, both methodologically and theoretically, to keep pace with current developments in media, technology and society. In our view, the question of cooperation is a crucial issue surrounding these dynamics. Digital networked media in particular can be viewed as cooperative platforms, enabling people to work together, share experiences and information about their lives, and interact with each other. This is, however, not a new phenomenon: the media have always been vital for connecting individuals, groups or whole societies. Likewise, cooperation is a fundamental feature of all human endeavours. The journal *Media in Action* aims to explore how to connect the two observations that (1) contemporary digital media are prima facie media of cooperation and (2) media and cooperation have been tightly enmeshed long before the digital age. This question lies at the core of this interdisciplinary journal on cooperative media and it unites the scholars in the Collaborative Research Centre (CRC) 1187 *Media of Cooperation* at the University of Siegen.[1]

The journal will cover interdisciplinary approaches and discussions, offer insights into the current research on selected issues and provide a growing corpus of papers spanning historical and contemporary analysis of cooperative media. We share a common ground in emphasising that cooperative media should be studied "in action". This practice-based view highlights the inherent dynamics between media and cooperation as situated processes of co-construction and mutual creation. This may sound like common sense, but even the obvious can become controversial in its

everyday detail. Separating telecommunications from interaction, information from social relationships and signal transmission from questions of cultural empowerment was much easier before the social media of digital networks turned their fusion into both a resource and a topic. It is the consequences of this fusion that we will address and explore in the coming issues of this journal.

The journal will bring together diverse fields, disciplines, theories and methods. In particular, we seek to highlight the theoretical and methodological challenges that emerge by joining forces to study media of cooperation from heterogeneous fields and disciplines, spanning Media Studies, Anthropology, German Language and Literature, History, Sociology, Political, Educational and Computer Sciences. Each discipline has one or more distinct approaches to understanding and studying media, cooperation and practices. The scope of this journal mirrors this diversity in a productive manner. It serves as a locale where research from a variety of scholarly backgrounds is collected and shared. Last but not least, it provides a permanent space for keeping up to date with the overall development of our aim to understand contemporary media as cooperative media in action. Consequently, the journal *Media in Action* will then itself serve as a medium of cooperation.

*Media in Action* will consist of two issues per year. Whenever possible, we plan to organise the contributions around key topics, providing the individual issues with a comprehensive and focussed discussion. To this end, we have decided to encourage different formats within the journal. The main contributions will be original research articles in the first part of the journal. These will be followed by focus topics, typically based on workshops or conferences organised by members of the CRC *Media of Cooperation*. Some issues will also feature guest editors responsible for specific focus areas, even devoting whole issues to a special topic. The remainder of the journal will include shorter reports of the CRC's activities and contributions from guest researchers. This first issue is a good example for this structure.

This issue starts with a programmatic research article by Erhard Schüttpelz about **Infrastructural Media and Public Media**, addressing the basic ideas of the CRC *Media of Cooperation*. He observes that practice theory cannot be reduced to the mere study of practices. Instead the theoretical programme of practice theory demands that practice is given priority over all other theoretical entities. Based on research in social informatics and the concept of boundary objects by Susan Leigh Star, cooperation can be defined as mutual creation of joint goals, means and processes with or without consensus. Infrastructural media are made by and for cooperative work procedures. They are the sources of public media that give rise to both anonymous and private communication. Thus, the traditional research that analysed media production, distribution and reception separately, will have to be replaced by an approach that historicises them together. Digital media are an unprecedented fusion of administrative and public media. Against the background of a revised historiography, current digital media and their practices appear much more plausible and their prospective potential can be estimated in greater detail.

This issue's focus topic, the **Fundaments of Digitisation**, explores the beginning of the "era of digitisation" in the 1960s to 1980s. These decades are seen as a threshold for digitisation before the "digital take-off" took place. These years, when digital media of cooperation and bulk data processing were still in their infancy, saw the emergence of ongoing debates around data security, privacy protection, data management and technical changes. The focus topic illustrates that current debates on digital media of cooperation can be traced back many decades. It offers the reader a practice-based view on early digital demands for data management, on the conditions for privacy and regulation of digital media cooperation and on media competition for the same type of cooperation.

This issue closes with a short report by Michael Lynch, who was invited by the CRC as a Mercator Fellow in June 2016. He looks at **Media of Cooperation: Ethnomethodology, GPS, and Tacit Knowledge** based

on his insights and discussions with the scholars in Siegen. Many of the themes debated during his stay focused on how embodied practices in specific social environments relate to instructional devices and representations of the relevant practices. Referring to his own study on GPS devices, he shares his thoughts on the concept of tacit knowledge and its relationship to technology.

Now we have introduced the journal and this issue, meet the editorial team. Kathrin Englert is a sociologist with a special interest in the transformations of both work and the state as well as in the processes of co-construction of the internet and society. She is currently serving as a co-investigator in the research project "Un-/Desired Observation: Surveillance Society and the Social Field of Media". Lene Faust is a scientific coordinator for the CRC. She is a social anthropologist whose research focuses on memory cultures in Italy. In particular she researches fascist memory practices in transgenerational family environments and with regard to mechanisms of social and political identity construction. Sebastian Gießmann is a media historian and theorist specialising in the evolution of digital payments. He acts as a junior research group leader and organises the "Workshop and Lecture Series on Practice Theory". Christian Henrich-Franke is a senior researcher in Economic History. He is the principal investigator in the project "The Culture of Telecommunication Standardisation" which focuses on the standardisation of the Integrated Services Digital Networks (ISDN) in the 1970s and 1980s. Claudia Müller is an assistant professor within the study area "IT for the ageing society" in the department of information systems. She follows a praxeological and participatory approach for designing assistive technologies used by the elderly. Her projects aim to support and enhance social inclusion, mobility and autonomy of elderly people in order to strengthen their quality of life and health status in old age. Cornelius Schubert is a sociologist specialising in Science and Technology Studies. He is the principal investigator in the project "Visually Integrated Clinical Cooperation" which studies new imaging modalities for cooperative tasks on a neuro-

surgical ward in a Siegen hospital. Ehler Voss is an anthropologist specialised in media, medicine, and religion. He works as a scientific coordinator within the CRC and is researching the relation between human mediums and technical media in Europe and the US from the 19th century until today.

We, the editorial team, are more than pleased to invite you to browse through and read this first issue of *Media in Action.* We hope you will enjoy reading further issues.

Yours
Kathrin Englert, Lene Faust, Sebastian Gießmann, Christian Henrich-Franke, Claudia Müller, Cornelius Schubert, Ehler Voss

## Notes

1 www.mediacoop.uni-siegen.de

## Research Articles

# Infrastructural Media and Public Media

Erhard Schüttpelz

## 1. The Challenge for Media Theory

When Marshall McLuhan turned the medium into a scientific message, the cooperative nature of media was at the centre of his theoretical intervention:

> The use of the term "mass media" has been unfortunate. All media, especially languages, are mass media so far at least as their range in space and time is concerned. If by "mass media" is meant a mechanized mode of a previous communication channel, then printing is the first of the mass media. Press, telegraph, wireless, telephone, gramophone, movie, radio, TV, are mutations of the mechanization of writing, speech, gesture. Insofar as mechanization introduces the "mass" dimension, it may refer to a collective effort in the use of the medium, to larger audiences or to instantaneity of reception. Again, all of these factors may create a difficulty of "feedback" or lack of rapport between "speaker" and audience. There has been very little discussion of any of these questions, thanks to the gratuitous assumption that communication is a matter of transmission of information, message or idea. This assumption blinds people to the aspect of communication as participation in a common situation. And it leads to ignore the form of communication as the basic art situation which is more significant than the information or idea "transmitted. (McLuhan 1954: 6)

Sixty years later, the impetus of this passage has lost none of its currency: the scientific challenge to overcome the blindness that prevents

a consideration of "communication as participation in a common situation," and doing so in referring to "a collective effort in the use of the medium" through which a communicative form is first of all constituted as a "basic art situation." The great achievement of classical media theory as presented by Edmund Carpenter (1960) and Marshall McLuhan (1964), and onward to Paul Virilio and Friedrich Kittler (both 1986) lay in the unmistakeable proof that the technical conditions and elements of modern mass media and telecommunication media were adopted from infrastructural inventions. Those infrastructural inventions first emerged from the increase of requirements of cooperative work in industry and industrial research, the governmental and commercial bureaucracy, and the military.

A study of the history of media inventions confirms that all present technical media stem from special cooperative techniques and media practices, which only became universal techniques and public media through a contingent process of conversion. On that road, they were often enough delayed or impeded. All media are cooperatively developed conditions of cooperation and have evolved as such.[1] In comparing different media as well as the history of their invention and usage, this generalization suggests that media theory and social theory should not be viewed separated.

Looking back at the period of classical media theory and the media history that emerged from it, however, we see that neither has provided a stringent theorization of the cooperative infrastructures from which modern mass media and telecommunication systems emanated and in which they could be consolidated, despite and perhaps also because of classical media theory's critique of a functionalistic reduction of the media. The initial premises of the shared foundational phase of communication departments and media studies, and especially some of their shared dichotomies, would reveal themselves as theoretically domineering well into the new millennium, in as much as their common generalization seemed to define the totality of technical media:

1) the separation of "production" and "reception" adopted from the theory of mass communication;
2) especially the categorical separation between telecommunication and interaction that, beginning in the early 1960s, theorized social face-to-face interaction from a space within proximity and without telecommunication and even "without media" (see Leeds-Hurwitz 2010). Media theory and telecommunication, however, were marked by an "ineluctable absence of interaction", an idea that was generalized for the use of all technical media (see Luhmann 1986);
3) but also a separation between a mathematical notion of "information" and physical-technical "matter" that has retrospectively emerged as an intentional separation of universalized information theory from its official and confidential applications (Hagemeyer 1979; Roch 2009). Still, this notion found its way all the more effectively into the establishment of cybernetics and system theory, leading up to the reception of neo-cybernetics in recent decades (Pickering 2007);
4) furthermore, the conception of telecommunication, cognition, and mass-media as consisting of "black boxes", whose automatisms can be manipulated through input or following a given output, and whose modules are meant to be configured as prostheses (Harrasser 2013) or as something that can be cognitively improved by substitution (Crowther-Heyck 2005).

Since the triumph of digitally networked media in their application to ongoing media practices and organizational forms, the strength of these four basic theoretical motifs has been proven, both as a source of distortions and as a cause for continuous theoretical and empirical weaknesses. The most influential media theories and models of communication of the past and our introductory courses were not established in order to characterize the infrastructural techniques whose innovations led to modern media and which bring forth current media practices (Beniger 1989; Yates 1989). They were not designed to characterize the cooperative con-

stitution and processing of modern and non-modern media, nor to understand the processes of interactive and collaborative computerization, whose triumphal march began in the 1970s—a process that would have an enduring impact on the new permeabilities between production, distribution, and reception (Schmidt 2015a). The networked computer is no Turing machine, and neither is the Internet; and a media theory of interactive and collaborative computing has only been rudimentarily developed to date (Schmidt 2015b). Since the 1980s, a reconceptualization of those dimensions of media that, to this day, remain inadequately explored in the framework of both media and social theory has unfolded in three separate research branches. It is only recently that these research branches have begun to interconnect:

- in the research on science and technology within the international field of Science and Technology Studies (STS), with branches focusing either on contemporary or historical issues in their continuing discussion of modern infrastructures (Schabacher 2013a);
- in a wide range of ethnographic studies within the field of qualitative media research, dedicated to the cooperative constitution of media "on site" and incorporating ideas of STS (Larkin 2013); and
- in practical and theoretical work on interactive and collaborative computing, focusing on design questions in so-called Computer Supported Cooperative Work (CSCW) (Schmidt 2011) and other developments concerning human-computer interaction (Woods et al. 2005).

In any case, it is true for all three of these areas of research and their increasingly intense exchange that their focus has not been on generalizations emerging directly from media studies and theory, and that some of the most illuminating research on media has even been done without an explicit concept of media. Hence, some of the most empirically well-grounded research on analogue and digital screen-media in control rooms

as well as other coordination centres has been undertaken in the framework of "Workplace Studies" and "Studies of Work" (Bergmann 2006) and in studies of "Distributed Cognition" and "Cognitive Ergonomics" (Hindmarsh / Heath 2000; Hutchins / Klausen 1996; Woods / Patterson et al. 1998). These fields of research have indeed discussed cooperative objects and artefacts that, upon closer inspection, have turned out to be cooperative media (Heath / Hindmarsh 2000), and it is in those discussions that their requirements of cooperation and their procedural forms have been defined with unmatched precision, but with slightly differing terminologies. With a few exceptions, Science and Technology Studies, too, have dispensed with an explicit concept of media, for decades describing media with the vocabulary of cooperatively identified "inscriptions," to be precise: the infrastructures of instruments of inscription (Sismondo 2004). One of the great exceptions is the description of modern media and laboratory artefacts from the standpoint of their standardisations, which Bruno Latour called "immutable mobiles" (Latour 2006) — a concept that has been broadly received both in international and German speaking research. The same applies to Latour's notion of "centers of calculation" (Rottenburg 2002) as a complement of the "immutable mobiles", for this terminology emerged in direct engagement with the media theory of its time. However, there was a certain delay in opening the theoretical discussion in STS and media studies via this prominent exception (Döring / Thielmann 2009).

The cooperative constitution of digital media has been most succinctly spelled out in the realm of "computer supported cooperative work": quite simply, when the relevant task is described as CSCW, then computerized media used at the workplace are defined as work-supporting cooperative media. Meanwhile all media research in the social and cultural sciences with a focus on the contemporary has found itself forced to come to terms, in its own way, with the basic constitution of digitally networked forms of work as it was first defined by CSCW. This is because, at present, not only every form of work but also all forms of everyday media network-

ing contain their portion of work-supporting cooperative media or have been organized with their help. More than a decade ago, Jörg Bergmann succinctly summarized the challenge facing media research as follows:

> With the progressive digitization and miniaturization of information technology, media have penetrated all of society's functional systems; modern everyday life can no longer be conceived without them. Without media communication and coordination, all modern transportation, transaction, and product-distribution systems would quickly collapse; today, imaging procedures are part of everyday activity in medicine, engineering, and the technical sciences; over the past years, the authorities responsible for social control have [...] undergone an unprecedented medialization; and organizations increasingly rely in their functional procedures (documentation, communication, development, etc.) on the most disparate forms of media-based transmission and storage. But however much medialization has penetrated broad fields of professional activity and the working world, the degree of attention this process has received in media research so far has been remarkably low. Not the least of the reasons for this is that, as a rule, media usage in the working world is completely different from the reception of entertainment media. Although stockbrokers, surgeons, journalists, and pilots do look at a "monitor," this monitor is not a "television screen". They do not receive pre-set programs but rather use information transmitted in media form for the successful execution of steps of their work. Here, media are a resource for professional work and their analysis only makes sense by taking this context into account. Except for ethnographical audience research, traditional methods of media research are not attuned to such decentring. (Bergmann 2006: 391f.)

The necessity of a form of research that can do justice to the ubiquitous medialization of our institutions, organizations, and areas of work as Jörg

Bergmann describes it, has meanwhile been recognized by all relevant strands of the social and cultural sciences, albeit with manifest methodological difficulties and terminological reservations. Moreover, the necessity for the invoked "decentring" has increased further—as now, it is not only everyday work and all the events organized by work, but everyday life in general, with its public and intimate spaces and procedures that is affected. The earlier often derided turbulence that the task of "defining your concept of media" tended to spark in discussions of media theory has now arrived in all the social and cultural sciences, disciplines that can no longer evade the challenges of their own media research and, thus, find themselves in the quandaries of media-theorizing their own procedures and findings. On the one hand, the greatest challenge appears to lie in the social- and media-theoretical conceptualization of the research field as outlined by Bergmann: its ubiquity. But also, on the other hand, in the difficulty to estimate the historical depth or newness of ongoing media developments. Are we here actually facing an *increasing* medialization through digital terminals, or do their functional practices only make explicit what was already medialized in other ways? Across all the above-mentioned disciplines, a socio-technical re-assessment of the digital present and its historical classification and reconstruction has become a steady desideratum. This is also apparent in various modalities of the basic concept including "medialization," "mediatization" (Hepp / Krotz 2014), and "mediation." The "decentring" of media research Bergmann diagnoses demands a "re-centring" that connects media and social theory, a process that should unfold through three interventions:

- through the introduction of a concept of *cooperation* that either renders more precise or replaces the concept of "communication";
- through a historicization that makes possible an understanding of the interaction between "entertainment media" and "transportation, transaction, and product-distribution systems," or more generally, between media *publics* and medialized *infrastructures*;

– and through a intertwining of media theory and social theory via the perspective of *practice theory*. In the following, the necessary relation between practice theory, the concept of cooperation, and media research will be outlined step by step.

## 2. Media Practices and Practice Theory

An enduring insight from early German media studies is that even the seemingly most stable modern media should be considered "historical interludes" (Zielinski 1989), i.e. that, at least indirectly, the practices that enable their transient or long-term technical and institutional consolidation need to be explored. This perspective has gained depth since the triumph of digital networked media: in order, for instance, to render plausible an app, but also all discoveries tied to interactive computing, it becomes absolutely necessary to prioritize cooperative media practices over the media techniques and stabilized media constituted through them, with all the practical misappropriations that can, in turn, emerge from such a practical priority. Which practice theories should media research revert to in order to reorganize the relation between "media" and "media practices", and what can a particular media theory contribute to praxis theory? Even just a few years ago, the two seemed hardly reconcilable. The first "practice turn" in the social sciences (Schatzki / Knorr Cetina / Savigny 2001) had no direct impact on media studies although the recruitment involved partly came from STS, some of whose main themes had turned out to be genuine topics of media history: for example, telecommunication's "large technological systems" (Hughes 2012) and the enduring topic of laboratory instruments and their inscriptions, both of which have remained favourite topics in German media studies. But not only in Germany, an enduring anti-sociological impulse tied to post-structuralist theorizing and the paradigm of discourse analysis impeded a systematic engagement with research that, in its own way, had moved from classical sociological references to unorthodox sociotechnical variables and controversial symmetrizations between social and

technical, human and non-human forms of agency. In addition, discussions in the wake of classical media theory (from McLuhan to Kittler) tended to consider the "status quo of the technical development of media" as an independent variable, whereas all the "messages" and "practices" of media should be treated as dependent variables, i.e. in their dependence on the status quo of the development of media technology. Studies of media appropriation and of the reception-behaviour of mass media consumers (Morley 1980) first appeared to be a mere instantiation, then a form of resistance within this relationship of variables. Only in the wake of the speedy triumph of digital media over the period of a few years would the results of this research be transformed into an all-penetrating symmetrization of "media" and "practices" (Couldry / Hobart 2010).

Therefore, the fulfilment of the promise of classical media theory seems to have happened in a more than paradoxical fashion: technology's new status quo has effected not only a shifting of the force-field of media practice but media theory itself has turned out to be a limited or expandable practice. The German-language discussion regarding the categorization of the relationships between media and "cultural techniques" has fortified this insight (Krämer / Bredekamp 2013; Siegert 2013). Since then, the relations between independent and dependent variables of media theory have once again become a matter of debate: Based on which practices and media practices do we reconstruct the consolidation and stability of media? And which practice theories should be preferred in research on ongoing media developments?

In the ongoing praxeological boom in cultural studies, the social sciences, and some areas of engineering, too, it makes sense to distinguish between a genuine "practice theory" and research on practices. For several decades, research on practices and the theoretical programme of practice theory have supplemented each other without becoming conflated. The strength of practice theory should lie in its capacity to prioritise practice over all other theoretical variables (Schmidt 2015c). To this end, it can proceed as abstractly or speculatively as any other theoreti-

cal approach. While research on practices can help prepare the groundwork for any theoretical programme without such an orientation, it must prove its point, as it were by definition, in meticulous and adequate descriptions of concrete practices. Research on practices and the impetus of practice theory only become congruent when a sufficient number of documented practices are called upon to explain the constitution of non-practices, f.i. patterns, artefacts or structures. At the moment, this congruence of research on practices and the agenda of practice theory remains an exception. Cultural patterns, technical "scripts," social structures, and behavioural dispositions (like "habitus"), dispositifs and media understood as dispositifs, all of these entities are drawn upon in the daily business of theory formation to *explain* practices. And when their own practical emergence is meant to be discussed, they are generally only extrapolated as the *consequences* and *effects* of such practices (f.i., Reckwitz 2003). In contrast, explicit methodological efforts to represent and derive social and cultural entities (e.g. entire institutions and institutionalized media) from their practices alone have remained rare and are often only undertaken in essayistic forms. Particularly helpful for a media history and ethnography oriented toward practice theory, is the theoretical discussion of practical knowledge or of "skills," in recent years partly developed from STS and from both anthropology (Ingold 2000; Schüttpelz 2015) and socio-informatics ("communities of practice") (Lave / Wenger 1991; Wenger 1998). The international theorizing of "skills" and their impact on media research is generally compatible with the German term "Kulturtechniken" ("cultural technologies"), with the qualification that the international research-literature on skill emphasizes "apprenticeship", "enskilment," and the cooperative exercise of technical and artistic capacities and has provided much more thorough research on these aspects (Goodwin 1994; Sterelny 2012a).

In both diachronic and synchronic research, the heuristic priority of media practices over the entities constituted by them requires a particular reflexivity: concerning the media practices that are manifested in

the relevant documents, and in both the historical documents assembled and scrutinized for research, and the ethnographic documents that are constituted by research itself. For research on ongoing media practices, a central question remains how to assess the impact of participatory observation becoming part of the field of research, be it by collaboration, by volunteering, by participation or by observation. How can non-predicative knowledge and habitualized behavioural forms be theoretically articulated? Which theoretical implications does the concept of participatory observation, an idea central to anthropology, produce through its emphasis on an intersection between researching (media-supported) and researched (media) practices? These methodological considerations provide the context for the epistemological question regarding the consequences of a position informed by practice theory for the objectives of research. Can an object defined as "an ongoing accomplishment", i.e. practice, be pinned down with methods that deny their own processuality or "ongoingness"—or are there scientific procedures that for their part strive for such a reality and mediate between art and science (Mohn 2002)? And which form should a digital archive take that understands the research process as an "ongoing accomplishment" and makes it available as such?

Last but not least, the challenge of practice theory points media research to its own practical origins in various disciplinary forms of socialization and both objectively and personally risky changeovers. Since the nineteenth century, media have been planned and built on the basis of engineering and basic research in the natural sciences; at the same time, they have been shaped by socio-technical collectives, organized partly with the help of applied social sciences, and they are articulated, interpreted, and framed as a distinct "semiosphere" of circulating signs and linguistic manifestations in the humanities and cultural studies. In this way, media consistently participate in all three of the scientific formations of modernity, repeatedly drawing methodological and practical competencies from these formations, which encounter one another in a

turbulent and only temporarily consolidated middle - the medium. What we know about media depends on the practices that meet in that middle (or muddle), and on the practices of making them meet.

## 3. Media of Cooperation

It seems obvious that if, for many years, not only media studies but also academic research on media in general have lacked a concept informed by practice theory for denoting media's cooperative constitution, then the most effective term that could change this situation is "cooperation". All media are cooperatively created conditions of cooperation, a fact that lies at the heart of their raison d'être. In other words, they are media of cooperation.

What is cooperation? For decades, this question was both sharpened and distorted through abstract theory models, particularly from game-theory, whose dichotomies and reductions have been losing their persuasiveness for some time. In interdisciplinary and anthropological research on cooperation, empirical studies of cooperation that explore the full virtuousity of human and technical cooperation, including in the realm of media-supported research on linguistic and media practices, have meanwhile achieved prominence. These studies have avoided distorting the cooperative capacity by setting up premature oppositions (Bratman 1992; Goodwin 2013; Marshall 2010; Sterelny 2012; Strübing / Schulz-Schaeffer et al. 2004). And as mentioned before, a subsidiary realm of computer science, inspired through other ongoing approaches in practice theory (for instance "activity theory" and ethno-methodology) had a head-start in defining the formative difficulties and requirements of digital programming through the concept of cooperation, namely as CSCW (Schmidt 2011) at a very early stage. For our purposes, "cooperation" can be defined as the *"mutual making of common goals, means and processes."* The etymological connection of "media" to "means" and "middle" points to these common means and processes as characteristics of media; in other words, in line with their etymology, above all as "means

and middle," media contribute shared processes for cooperation of every sort and have stability even when common goals are lacking.

This foregrounding of cooperation in turn underscores a concept long-since anchored in science and technology studies and adjacent research fields but which has only been discussed in respect to media theory for a few years: the concept, coined by S. L. Star, of the "boundary object" (Star / Griesemer 1989). The concept emphasizes the conditions of "cooperation without consensus" and their shaping by media. Two characteristics in particular enable cooperation without consensus, equally characterizing modern work media of work and digital platforms, but also all historical media practices since the invention of writing: on the one hand modularity and modularization (the "overlapping boundaries" of wholes and the "repositories" and stacks of parts); and, on the other hand, incompletion and supplementability (for instance through administrative "forms" with gaps for inserting new parts; or through an "ideal type" whose realization as a new whole demands substantive modification) (Star 2015). The boundary objects originally mentiones by S.L. Star are all media of work that continue to be in extensive usage; and already while the term was being coined, this concept facilitated the shaping of new digital "information infrastructures" (Star / Bowker 2002) in socio-informatics.

From a media theoretical point of view, the concept of the boundary object helps us to more precisely define what constitutes the cooperatively processed artefacts of digital and analogue media practices—namely a combination of context-dependent plasticity and context-independent robustness. In Star's words, boundary objects are "plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites" (Star / Griesemer 1989: 393). When this common identity is endangered, the required robustness can also be affected. Meanwhile the socio-technical limitations of design have repeatedly been asserted for digital working tools and media, both making shared media objects flexible

(Bechky 2003) and making them overly flexible and, thus, robbing them of their function:

- Either because through their digital fluidity and constantly actualized versions they forfeit the robustness necessary for an unproblematic change of contexts (Bailey et al. 2012; Slayton 2013);
- or because they forfeit their practical verifiability through a patchwork consisting of diverse simulations (Gusterson 2005);
- or because the local alignment between two places (for example in multi-local work streams through monitor work) no longer succeeds without explicitly establishing consensus, in this way suspending the technical premises for friction-free cooperation without consensus (Hinds / Bailey 2003).

Cooperation without consensus in media practices thus has interlocking social and media-technical boundaries. If they are crossed, tests and controversies emerge, and the different paths for gaining consensus take centre stage. The more illuminating the concept of "boundary objects" for media theory becomes, the more it will be necessary to research cooperative media not only in their balanced "middleness" but in all pacified and non-pacified conditions "with and without consensus", and to include the disturbances of all forms of media cooperation (Kümmel / Schüttpelz 2003). This undertaking must especially prove itself in an effort to bring together the two traditional research areas within communication theory and media theory: infrastructure and public.

## 4. Infrastructures and Publics

The media technological arrangement of infrastructures is based on shared means, procedures, and processes. In many respects, the immediate and more distant goals of the people involved are left open, or can only be defined to the extent that shared means and processes can be consolidated through boundary objects. In public media, we find an

invocation of consensus and dissent, together with the heterogeneous spheres which enable the successful recourse to the scaling of concerns (Boltanski / Thévenot 1991) and to normative but pluralized forms for the establishment of a public good. Publics battle out issues that very quickly refer to their own media staging (Marres et al. 2013) and only attain their full density and volume through this recursive constitution, becoming louder by self-reference. Whereas infrastructures often sink into a deceptive invisibility, from which they only step into the limelight through repair and maintenance or major disturbances (Potthast 2007). Nevertheless, these heuristic oppositions between infrastructures and publics are never final, for the process of establishing and forming media infrastructures and other infrastructures itself catalyses controversies and initiates the quest for public consensus (Nelkin 1979). And public media, too, are based on many forms of infrastructural cooperation that neither presume a substantive consensus or even have to explicitly omit it, for the sake of guaranteeing procedural agreements.

What is the nature of the interrelationship at work here? In general, modern infrastructures and media publics are intertwined through shared proportions and scales (Müller et al. 2010). This shared scaling of media publics and technical infrastructures has been well researched in some respects, particularly when it comes to the history of traffic system for persons, goods, and media (Morley 2011; Schabacher 2013b). However, this research never produced more than a theoretical outline of the shared social and technical scaling at play here (Joyce 2009; Ribes 2014). The intertwined scaling of local, regional, national, and international infrastructures and publics points to their common emergence in the framework of a historical interchange including a corresponding development of media, for only the comprehensive strengthening of modern transportation and media infrastructures made possible the development of a universal "public" into a first-rank collective singular. Corresponding to this conjunction, the concept of "publishing" and the vocation of the "publisher" were only generalized in the early nine-

teenth century, in a framework of regional, national, and international infrastructures of distribution, whose scaling corresponded to the reach of each addressed public (Johns 2009a). This shared scaling on the part of modern publics and infrastructures demonstrates that, upon closer inspection, what is at work here is not a series of independent developments but two aspects of a historical interchange that has yet to be researched.

In addition, it becomes clear that for the past two centuries, both media infrastructures and other infrastructures have emerged that have tended to form monopolies and repeatedly prompted a public discussion of their centralized regulation, governance, and breakup (Henrich-Franke 2009). Past and present media publics have rested on the organization and institutionalization of infrastructures whose operators either enable publics or who prevent them through censorship, hidden operations, or shutdown (Galison 2004). Hence the relationship between infrastructure and public is not only governed by the rather easily recognizable shared scaling of range and of network densities but also by the reconfiguration of economic, political, military, and ideological organizations of power, a process that will continue to play itself out within institutional negotiations and compromises about publics and infrastructures—including the enactment or impeding of egalitarian users' rights. Especially the history of globalization and intercontinental entanglements (Epple 2012) has, in harmony with this perspective, taken a standpoint that links the development of infrastructures and publics within the framework of a "logistic history" (Mann 1986; 1993). Thus, there are good reasons, not only for the history of modernity but also for media history in general, to explore publics and infrastructures at their "interfaces". As suggested above, this exploration can invoke classical media theory, which likewise focused on the technical basis and infrastructural heritage of public media. So far, however, the theoretical discussion has in no way developed by systematically interconnecting or even systematically fine tuning the two concepts. While theories of "publics" continue to be informed by the research

literatures of social philosophy and of the social and political sciences, the theorizing of "infrastructure" is mainly grounded in research of the history of technology, in Science and Technology Studies, and in macro-history. Both strands, through their shared emphasis on practice theory, have, however, begun to reveal clear parallels and intersections. Within a single generation, the literature on infrastructure has moved from the macro-perspective of Large Technological Systems and their system builders to the grounding of a micro-perspective involving basic cooperative activities of "infrastructuring" (Pipek / Wulf 2009). And the long-lasting discussion of what Habermas termed the "structural transformation of the public sphere," taking place with, following, and against Habermas (1962), has increasingly focussed on examining heterogeneous processes and spaces of public dissemination and of their particular publics, including the necessary references to an unrestricted, universalized, or particularized "public" (Bosse 2015). The approximations of research on the processes of "infrastructuring" and "publishing", of negotiating infrastructures and of "making (something) public" suggest that defining their interfaces via practice theory will be possible (Potthast 2007; Simone 2004).

## 5. Public Media

When we relate the concept of a public sphere to media publics that are conceived and formed as the "cooperatively created conditions of cooperation" in establishing public dissemination, we need a definition of the concept of the public sphere which allows us to highlight pluralised and cooperative processes of the formation of a public. A relevant and current intervention is provided by the term "issue networks", coined by Rogers and Marres (2005). Such issue networks are formed through a shared grappling with "issues" but are also capable of moving past any traditional catalysts and organizational forms (Kraft 2006).

John Dewey's characterisation can be taken as the historical starting point for such a definition of media publics. Although he still uses the

term in the singular, his comments still hold strong currency today. "The public," he writes,

> consists of all those who are affected by the indirect consequences of transactions, to such an extent that it is deemed necessary to have those consequences systematically cared for.…Since those who are indirectly affected are not direct participants in the transaction in question, it is necessary that certain persons be set apart to represent them, and see to it that their interests are conserved and protected. (Dewey 1927: 15f.)

In this pragmatic definition, Dewey is referring to political publics and their often highly traditionally conceived questions of representation. At the same time, his "matters of concern" can be easily generalized so that every public occasion for discussion and every controversy can be considered in terms of the formation of its sub-public, and every such public in terms of the formation and specialization of its controversial issues. Recognition of the overflowing nature of the objects of discussion and issues at play here and a concomitant pluralization of publics has meanwhile also been integrated into deliberative concepts of the public. In a retrospective foreword to his *Structural Transformation of the Public Sphere*, Jürgen Habermas thus writes as follows: "The corporatively organized opinion-making potentially leading to responsible decisions can only do justice to the goal of a cooperative search for truth to the extent that it remains *permeable* for the free-floating values, themes, contributions, and arguments of an *environment* of political communication." (Habermas 1990: 43) And he explicitly describes it as "a mistake to speak of the public in the singular," pleading for a perspective that "from the start onward takes account of competing publics and thus considers the dynamics of communicative processes excluded from the dominant public sphere." (Habermas 1990: 15)

Both the notion of an ineluctable plurality of publics (which, meanwhile, has been widely accepted) as well as the idea of a pluralization of recourses to a "common good" (Boltanski / Thévenot 1991) remain central for a theorizing of the public sphere. The concept of plural "spheres of justice" (Walzer 1984) and the critical questioning of the modern interplay of exclusivity and universalism, too, are highly significant. In the framework of media theory, to speak with Marres (and with Dewey), what needs to be underscored is the temporalization of public "issues". On the one hand, these issues may generate their own particular "issue networks" and paths of decision-making, which allow a transcending of every previous path. There will, however, always be media and well-operating media agencies that consistently cater to a number of issues and "issue networks". For this reason, it would be mistaken to equate the concepts of issues and issue networks with an optimistic scenario of always possible egalitarian participation. The capacity for controversy of a sub-public itself remains a controversial matter; and every demand for and practice of egalitarian participation will encounter existing hierarchies, professional organizations, and agenda-setting institutions (Baringhorst 2014). Dewey's redefinition of the "public" led him directly into a debate with Walter Lippmann about the capacities and incapacities of democratic media representations (Peters 2005). Moreover, this definition is connected to the modern invention of public relations, with its media agencies that force even actors and organizations from civil society into an infrastructural alignment or symbiosis:

> Consequences have to be cared for, looked out for. This supervision and regulation cannot be affected by the primary groupings themselves….Consequently special agencies and measures must be formed if they are to be attended to; or else some existing group must take on new functions. (Dewey 1927: 15f.)

In this way, the development of media publics is marked by its "publicity" or media recursivity: the issues are already drafted, prepared, and reused as media issues; and the media documents, genres, and instances of media publication themselves become causes for processes of negotiation and for possible media controversies. Niklas Luhmann has generalized this feature of all publication processes as the "autologous nature" of media reality:

> The function of the mass media would…be not the production but the representation of the public. And what is meant here is "representation" in a "contracting," reductive sense. Precisely because the "public" always describes the other, inaccessible side of the boundaries of all systems, including the mass media, and cannot be specified in the direction of particular partner systems, it is necessary to represent them in the form of constructions of reality in which all subsystems, indeed, all people, can have a part, without any obligation arising to go about it in a particular way.…As we have already noted repeatedly, this is an "autologous" concept. (Luhmann 2000: 105f.)

This version of the theme of media recursivity as recognized by Dewey, Lippman, and Bernays is well formulated but incomplete, even in the case of its digital radicalization through self-evaluations (Gerlitz / Lury 2014). One the one hand, there is no reason to limit it to the mass media of a single public; rather, it equally applies to scientific, political, artistic, and other sub-publics within the untameable heterogeneity of publication processes (Hoffmann 2013). On the other hand, it remains questionable if the constructed realities of a public generally have to turn out so autologous that they necessarily involve the absence of an obligation described by Luhmann. The media recursivity of public media does not only begin and end in the publications themselves but already takes place where they are prepared and processed (Zillinger 2013). And these locations are rarely characterised by autologous indifference but by substantive

discussions which unfold in processes of formalized and informal exchanges of opinions, and as technical discussions concerning the appropriate mode of cooperative production, both inside and outside the media realm (Rohde 2013). Yes, the self-references of "publicity" are strong, but the references of scientific, political, artistic and other forms of expertise are strong too.

For the practical processing of scientific publications, Bruno Latour has formulated a theorem that relates to the length and interlinkage of steps of publication and the simultaneity of their practical and media-related preparation: "the more instruments, the more mediations, the better the grasp of reality." (Latour 2002: 21) In other words, there is a direct connection between the stability and practical reliability of the successive and the successively intertwined steps of mediation and publication for participants, and the number and degree of complexity of those steps. Antoine Hennion has transferred this theorem to processes of artistic and mass media production, drawing attention to analogous interlinkages of mediatory steps and the actors responsible for them (Hennion / Méadel 2013), and has shown that even the most meticulous evaluation of publications fails to shed light on the practical constitution of the publishing process. For this reason, what constitutes a public's media recursivity should be considered less the outcome of an elegant theoretical reduction than a question for empirical and historical research. Before their publication and for the purpose of their publication, public media are prepared in non-public situations and from a number of interlinkages of non-public media. The emphasis of classical media theory on the self-referentiality of the mass media and its publics demands a revision that is not only oriented toward an assessment of publications but toward an ethnographic comparison of all media-related processes and mediatory steps enabling and preceding a publication. This is even more the case for low-threshold practices of digital publication (Klass 2013).

In the framework of perspectives of the History of the Book, A.I. Doyle has offered the following recent definition of the threshold for publica-

tion: "The communication of a work from one person to others with permission (perhaps tacit) to pass it on to others; which may be preceded or followed by the growth of knowledge of its existence and interest, rousing desire for further copies, consequent reproduction and gradual dissemination'" (Doyle, cited in Tenger / Trolander 2010: 6). In line with this definition (giving permission for dissemination to unknown others), pre-publications of any kind are also publications in their own right. And before publication, there is a cooperative production process that, to the extent that it takes place within a division of labour or through friendly exchange, moves forward in a manner that is both productive and receptive at once, through commentary, correction, and versioning (Binczek / Stanitzek 2010), not only of texts, but of all publications-in-the-making, music, films, websites included. Where does the public status of this production, or, put more precisely, of this simultaneity of production and reception, this mutual making of a medium for publication begin?

## 6. Media in the Mode of their Making

The original focus of media theory lay in public media and publicly accessible telecommunication services. All explicitly non-public media and media in their making were initially ignored; they still remain outside the normal usage of the English (and journalistic) term "media". Even now, they have to be specially marked, for the simple reason that they are not meant for the public. A film that is only half finished, is no "film", because there is no publication in sight; once the footage is edited and released as a "fragment", there is a "mass medium". What about the film in between? And are the office files dealing with its production part of the film as "mass medium"? McLuhan's original take on the medium as a cooperative art form came close to asking these questions, but failed to spell out the consequences.

For a long time, the most difficult case for a general theory of media was the telephone. Although it involved a standardized infrastructure and its public services, the practices of phone calls in private and

work-related spaces systematically entangle the dimensions of interaction and telecommunication, of production and reception, of information and corporeality, categories whose separation was meant to be constitutive for "media." In both land-line and mobile telephoning, interaction is a resource of telecommunication and vice versa (Laurier 2001); production is a resource of reception and vice versa; and corporeal locatedness and situatedness is part of information and vice versa (Laurier 2004).

The social and technological history of the telephone (Fisher 1992; MacDougall 2003) could have been the touchstone for an alternative media theory (and via the diffusion of mobile terminals, this has meanwhile been realised through the backdoor, so to speak [Thielmann 2014]): for a shared consideration of technical applications, of the development of technical networks, and of the socialization in tele-communicative "communities of practice." The same is the case for geo-referential media that have moved to the centre of media development through the refinement of sensor systems, spatial forms of visualization (Kolb et al. 2010), and tracking data, together with their mobile terminals. This has been even more the case for a plenitude of everyday work-related media, i.e. for all media (whether in business, the academic world, technology, entertainment, art, or politics) established for and within the organization of work processes (including the work of organizing work), and whose documents and inscriptions are not meant for publication or are used up or archived in the course of their usage (Ludwig-Mayerhofer / Sondermann 2010).

For their part, work-related media belong to an even larger group of non-public media practices that could be termed "media for making things" in as much as the term "work" does neither apply synchronically nor diachronically to all media formations in the household and family, in friendship, and aesthetic creation that can be declared and practiced as unpaid work, or even markedly as non-work or anything but work. With the present everyday world, including both its everyday activities and range of media products, being structured by numerous prac-

tices connected in a digital network, the diagnosis by Jörg Bergmann quoted above (Bergmann 2006) is made more poignant: to reiterate, that the everyday situation of media usage no longer corresponds to the basic situation framing classical mass media, not only for the world of work but also for the household, family, and for socialization (Reißmann et al. 2013), for entertainment, games, and for political debate.

Digitally networked media thus test the constitution of the everyday order of interaction (Hitzler 2010). Only a fraction of non-public, everyday media practices is destined for publication or serves as a step unto a broader public. This was the case in the past and is still a fact in the digitally interconnected present, despite the fluid borders between processing and publication that have emerged in the realm of social media and make it difficult—but so did earlier epistolary and rhetorical media practices (Marrou 1948)—to distinguish between private messages and the granting of a permission to disseminate messages to unknown third parties.

Which concepts can media research rely on to more precisely characterize, historically and intellectually, media not meant for publication, but also the relation between media operating in the context of non-public being-in-the-making and publications emerging from them?

The practical relation between "media in the making" and "public media", together with the emergence of the latter from work-centred media and makeshift media, has been extensively researched and commented on mainly in two areas only:

- in Science and Technology Studies, regarding the relationship between "science in action," i.e. science still being in the making (Latour 1987), and "ready-made science," i.e. science that has been published; between, on the one hand, planned and improvised scientific research and experimental culture and, on the other hand, official representation and publication (Collins / Pinch 2000, 1999), with media on both sides of the divide;

– and in the History of the Book, for the period between 1450 and 1800. There have been some productive intersections between these two research areas, especially in the paradigmatic studies in media history by Adrian Johns (Johns 1998; 2007; 2009b; 2012).

In the first area, STS, the concept of media has usually been absent, despite all the paradigmatic analyses of publication procedures and illuminating general observations on the relationship between work-related and public media. The concept's absence notwithstanding, an important insight has been developed here into the infrastructural mediation of work-related scientific media and publications, an insight that with some modification can be applied to other domains of the work-related world and in part to the production, distribution, and reception of mass media (Hennion 1983). Since its emergence, the field of Science and Technology Studies has served as an inspiration for broad areas of the ethnography of organisations and of "shop-floor" technology (Rammert / Schubert 2006), in that context allowing research into many work-related media (Volmar 2012). However, there is at present still one gap in the core field of STS, i.e. methodologically rigorous research on work-related and production-centred media within the social sciences (Greiffenhagen et al. 2013) and in the humanities (Martus / Spoerhase 2009).

Over the past decades, research in The History of the Book has initiated a learning process tied to STS, that has only recently been recognised in the relevant German-language research literature. Especially concerning the Early Modern period and extending to the late eighteenth century, new scholarship has repeatedly unearthed different stages and outcomes in the processing of manuscripts for book-printing as well as of both manuscript-books not meant for printing, but for circulation as cooperative manuscripts (Ghanbari 2013). Historical research on print media has meanwhile offered paradigmatic accounts of interchanges between manuscript media and their publications, and is well underway to achieve a new synthesis, partly in the framework of a fundamental re-

vision of a number of concepts and areas of study: the "print revolution" (Johns 1998) and the "scientific revolution" (Smith 2009); literary history and the history of political, religious, scholarly/scientific, and literary publics until the early nineteenth century. It will be important to develop this perspective of media history for non-print media, and to extend it into the present so that it can be connected to STS, Workplace Studies, and media anthropology, and to find the right framework of media theory.

This development depends on sustained interdisciplinary cooperation, because of striking differences in the scholarly approaches involved. Nevertheless, we can already identify a number of general points that seem equally applicable to all "media in their making," which is to say for historical and current, as well as digital and analogue practices. It is no accident that the best prospects for a theory of "media in their making" are embedded in a framework of precisely those four dichotomies of media theory that have been codified since the 1950s (from various precursors) for the mass media and for telecommunications. These are the disjunctive separations:

i) between production and reception;
ii) between interaction and telecommunication;
iii) between the sending of signs and material transport;
iv) between automatisms and human skills.

These four separations sharpened the theoretical awareness of the special achievements of the mass media and tele-communicative signal processing in already standardized infrastructures, but they were and remain invalid for the processing of the infrastructures themselves, hence for the forms of work and the inventions manifest in their "infrastructuring" (Pipek / Wulf 2009); they are also invalid for media in their making, for older and more recent work-centred media, as well as for everyday interactions embedded digitally networked media. For all of these media practices, we find that:

i) The *production, distribution*, and *reception* of media in their making does not inherently unfold in separate stages. Many work processes thus often enough simultaneously contain media practices of reception (e. g. assessment and commenting), further distribution, and production or processing (of corrected, supplemented, or entirely new versions). Typical modern work media (files, forms, file cabinets) and their specific design are made for precisely these transitions (Chandler 1977; Yates 1989) and, therefore, constitute paradigmatic boundary objects (Star / Griesemer 1989).
ii) *Interaction* und t*elecommunication* do not proceed on separate tracks; telecommunication remains a part of interactive processes, and in fact one of its thematic and decision-guiding *resources*, and vice versa (Heath / Hindmarsh 2000). In addition,
iii) Being in the making, the *material and physical mobility and the mobility of signs* do not function separately. This is equally the case for the private and everyday life of photos and documents (f.i. family media), in the everyday working world, and in logistics: in the world of modern transport, material transport and sign-delivery never proceed apart, neither on a small nor on a large scale, but rather through registration processes and "labels" that move with what is labelled. In other words, things are addressed, their data is systematically delivered and is verified, all the way to the "internet of things" (Busch 2011).
iv) The *automatisms* of machines and of computers and their media are interactively processed and themselves remain part of *interactions*, with corresponding feedback effects on the connection of human and non-human processes (Schmidt 2015b).

For this reason, in every kind of non-public media in their making, from the most private media practices to large technical systems, the eight corners of the four classical dichotomies of media theory not only remain "unseparated" but are shaped in a highly-refined way; they are only

manageable and recognizable in the context of their shared shaping only. Hence, recognizing the four aspects of non-separation outlined above does not constitute a negative finding but what we positively know about all kinds of media that were initially addressed in very different interdisciplinary areas of media research. They are bound to challenge social theory as well as media theory alike:

Media in their making form communities of practice whose cooperative procedures enable a mutual *teaching and learning*. This apprenticeship and "enskilment" emerges from the needs and possibilities of a continuous reciprocal assistance, together with sequential repair and coordination of the interactive dynamic (Goodwin 2013; Rawls / Mann 2015).

The *physical anchoring* of media-related skills and the *material anchoring* of technical "extensions" take place via the same procedures and on the basis of mutual teaching and learning (Mohn / Wiesemann 2007). Techniques and technology, media techniques and media technology, all require consistently available bodily engagement, without which they would lose their functionality. In the case of modern media, this bodily engagement—for example in repair and maintenance, but also in programmers' "communities of practice" (Knuth 1974; Naur 2001)—does not transpire as a result of separation but through interconnections and mutual delegations of interaction and telecommunication, through processing and usage (i.e. production and reception), automatization and skills, signal transport and material transport (Schubert 2011). Not to forget: in their mutual making, not in their "ready-made" state of affairs.

Only in and between such "communities of practice" are *technical innovations* possible. One of their typical forms, in both the field of programming and in those of earlier media inventions, consists of what von Hippel has termed the "functional source of innovation" (Von Hippel 1988; Shinn 2005). The emergence of cooperatively developed solutions to problems initially occurs in the context of obstacles emerging in the course of work or during technical meetings between different branches, first through preliminary and later through regulated technical facili-

ties, which are first generalised as specialized technical solutions in order to be later potentially universally marketed or transformed.

Kjeld Schmidt, a specialist in socio-informatics, has established a generalisation of media theory for the realm of interactive and collaborative computing, which may allow us to situate the most enduring and most successful digital media inventions within the framework of a theory of non-public media in their making:

> What today, typically, is conceived of a "computing", namely, "personal computing", initially developed as a technology for facilitating large-scale cooperative work activities (initially air defense, later air traffic control and airline reservations) in order to deal with the problem that had become too complex to be performed by conventional means of the coordination of cooperative work, manual or mechanical. The technology of interactive computing subsequently branched out in all directions, ranging from interactive human-computer systems such as workstations, laptop computers, and smartphones, to "embedded" computing devices for the purpose of controlling machinery such as machining stations, car engines, and washing machines, in which the computing device "interacts" with mechanical or other environmental entities.
>
> Important paradigms of interactive computing applications were developed in ways that have remarkable similarities: they were built by practitioners as practical techniques for their own use or for the use of their colleagues, and later generalized. (Schmidt 2015: 156)

## 7. Infrastructural Media

These revisions in media theory were initially developed mostly in research facilities dedicated to media-supported or technically equipped work. On the one hand, this was beneficial because the relevant results were presented with the unmistakable seriousness of empirically demonstrated "work requirements". Furthermore, the work was and is

undertaken in a highly reflexive fashion as far as the methodology was concerned: as a media-supported analysis and design of media-based work, in other words as a practical analysis of media practices. Nevertheless, the concentration on media-supported work resulted in a number of shortcomings on several levels: On the one hand, as mentioned above, today all areas of everyday life have felt the impact of digital networking, whose organizational forms seemed to previously only pertain to computerized work. At the same time, however, the constitution of work processes in digital media has experienced a shift, as many media practices now exist apart from places of work and without suitable payment or financial motivation while competing or interacting with paid or unpaid work processes.

Consequently, the results are also significant for the realm of "computer-supported cooperative work": will the basic concept of work now be decentred (Schmidt 2011), or indeed must it be decentred to newly adjust or to precisely define what stands at its centre, namely "work"? Even for current work-centred media (not to mention everyday digital media and platforms) it has now become necessary to take a step back and put forward a weaker concept with a wider scope, so as to allow to do without the term of work. This would justify the introduction of the term of "media in their making" or "media engaged in mutual making" as outlined above, to encapsulate the most mundane dimension of digital and historical media practices. However, the ongoing *dissolution of boundaries* between and the relativization of forms of media work also demands a more precise *historicization* of modern work practices. In order to characterize those current media practices that unfold far away from contexts of work and elsewhere undermine traditional forms of work (especially in the realm of digital social media), it seems particularly necessary to characterize the historical emergence of the special qualities of modern media of work. It is only then that a specific linkage between infrastructures and publics becomes evident, a connecting element which has been largely neglected by researchers and media theorists alike.

Since the systematic connection established between the rail and telegraph services (Beniger 1989), modern work media, like all media in their making, have been developed in localized interaction, while at the same time enabling a form of circulation that allows for hierarchically organised changes of scale (Gießmann 2014). The key to a mediation between localized interaction and specialized scaling lies in both standardization (Busch 2013) and bureaucratization (Yates 1989), and especially in techniques of identification and registration (Caplan 2005; About et al. 2013). Only continuously wielded techniques of identification and registration (i.e. media practices) allow administrations, on the one hand, an anonymization and a cooperative processing of circulating, reproduced, and assessed documents and data (to the point of enabling statistical evaluations). On the other hand, they make possible the verifiable referentiality or "traceability" of individual procedures (especially addresses and individual "dispatch" of goods, messages, and persons, or of individual services and contracts). Since the late 19th century, modern work-centred media have thus contained a mass-media aspect, namely the anonymization and aggregation of collectively gathered data and its assessment, but based on the simultaneous establishment of a "mass individualizing" reference-building and "traceability," created via localized interactions and suitable media in their making.

There are thus good reasons to call this section of modern work-centred media "infrastructural media." Firstly, the relevant work-centred media and their paths of circulation presume already existing modern infrastructures of transport and supply and hitch on to them (Braun 1991; Edwards et al. 2007). Moreover, modern work-centred media are created and used not only within organisations of work but also within the *administration* of working processes (Yates 1989). At least since the "second industrial revolution," modern work-centred media—in business, technology, science, the universities, and in the realm of the mass media—have been characterised by a progressive proliferation and differentiation of administered work (Galambos 2005, 1983, 1970). Since the

nineteenth century, new media techniques have been able to count on the steady demand for more efficient ordering, transmitting, and duplicating techniques (Yates 1991) that, at the same time, guaranteed easier coordination, delegation, and registration. The proliferation of administered work since the 19th century was based on new technologies of reproduction and transmission as well as on the improvement of reference-building. It was only through the work-intensive and costly stabilization of techniques of identification and registering, that those quantitative assessments, aggregates, and variables, whose surveying and calculation—in the interplay of official and non-official programs, their avoidances, and appropriations—enabled the media history of computerization (especially in the use of censuses and life insurance [Yates 2008]), from individual data to statistical data and from computing these data to punchcards and mainframe computers.

From a technical and socio-technical perspective, the thrust in innovation of both modern analogue mass media in the late nineteenth century as well as of the digital media emerging after World War II (Haigh 2003) developed in the wake of an already ongoing proliferation of infrastructural media. This fact, very much in line with classical media theory, might provide grounds for a possible "infrastructural inversion" of media history:

> Take a claim that has been made by advocates of a particular science/technology, then look at the changes that preceded or accompanied the effects claimed and see if they are sufficient to explain those effects—then ask how the initial claim came a posteriori to be seen as reasonable. (Bowker 1994: 235)

For the case at hand, this would mean prioritizing the basis of non-public work-centred media vis-à-vis public media in both a historical and conceptual framework, in order to research the relationship between infrastructural and public media in a more systematic fashion. Apart from

American media research within the framework of business history (Chandler / Cortada 2000; John 2010; Starr 2005), however, the programme for such a media history has neither been completed nor become common currency in contemporary media research. The far more complicated history of European and non-European media has, until now, not been able to follow this paradigm. This presents researchers with the opportunity and challenge to also explore, in part comparatively, important facets of European and intercontinental media history in the realms of non-public work-centred media and their later computerization, in this way correcting the asymmetries of North American research. Where is a comparative history of European administrative media? And of their globalization?

## 8. The Longue Durée of the Digital Present

The theory and historiography of digital media is in a state of upheaval. During the 1980s and 1990s, the rise of digital and digitally networked media was marked by the promise of an epochal turn whose similarity to earlier media revolutions (especially book printing and analogue mass media) was underscored. In the work of several media theorists, this seachange, at the same time, seemed to herald an eschatological "end of the media" (Kittler 1986), annulled within the universal medium of the computer. The elements of this diagnosis, which encountered considerable scepticism in other parts of Germany (Winkler 2004), have all been modified, although, or precisely because the penetration of all areas of life by digitally networked media continues apace. An end of media development is presently no more foreseeable than an end of history. The modifications of the above-mentioned diagnosis is most apparent in the theory of computerization and of the computer, with a dictum of Michael S. Mahoney now prevailing in the "history of computing":

> The computer thus has little or no history of its own. Rather, it has histories derived from the histories of the groups of practitioners who saw in it, or in some yet to be envisioned form of it, the potential to re-

> alise their agendas and aspirations. What kinds of computers we have designed since 1945, and what kinds of programs we have written for them, reflect not so much the nature of the computer as the purposes and aspirations of the communities who guided those designs and wrote those programs. (Mahoney 2005: 119)

This shift from a history of the computing machine to a socio-technical history of computing, and from a history of invention of the Internet to a history of networking (Russell 2012) has had several consequences. Meanwhile, in order to understand the digital epochal threshold, we are helped less by an emphasis on ongoing discontinuities or a comparison with past media upheavals than by a registering of the long-lasting socio-technical continuities from which past and present "agendas and aspirations" of computerization and digital networking have drawn their effectiveness.

In a way, the perspective has been reversed. The prognosis of the 1980s and 1990s was that as a "universal medium", the computer would take control of all existing media and thus bring about an "end of the media" or at least cause their "convergence". To the extent that such a process really took place, previous media were transformed into digital formats on mobile platforms and entered into unpredicted combinations. Their media practices have taken possession of the computer and continue their own history under new and changing conditions—with the consequence for research in media history to be forced to orient itself toward other basic units and their continuities (e.g. toward a history of cooperative computing capacities and their practices and formats [Campbell-Kelly et al. 2003], instead of a chronology of computing machines). And because the individual or networked computer remains a "protean" machine only capable of definition through the features of its practical usage, the idea of the computer as a universal medium has largely lost its currency. Rather, the focus is on the emergence of steadily new computerized media practices that, because of their interactivity, networking, and mobility, can

only be examined to a limited degree in the computer itself. Current research has responded to this altered situation with a stronger and more experimental approach to the media ethnography of digital media practices, meant to explore such practices as they unfold between online and offline contexts; at the same time, with historical work on the continuities manifest in the present state of computerization.

The question of the interfaces between infrastructures and publics (see section 3.) is especially suited for addressing both the continuities and present turnarounds in computerization. This question leads to the insight that the emergence of nineteenth century infrastructural work-centred media constituted an epochal threshold signifying a transformation of modern public media which has yet to be sufficiently explored in research. Without understanding this transformation, the present period of digitally networked media, too, cannot be historically fully understood. Infrastructural work-centred media (see section 7) contain, on the one hand, localized interactive sequences with their situated "skills", "communities of practice", and "established procedures" and, on the other, standardizations and bureaucratic procedures involving an anonymization and duplication of circulating documents and data. Modern bureaucratic procedures are based on massively produced boundary objects (Star / Griesemer 1989), especially forms; the reports they produce can be in the mode of internally circulating media or media available to the outside world, extending from handwritten notes to printed and published editions. But because of the underlying media of identification and registration, the process of anonymization and duplication at play here remains reversible: all participating individuals, administrations, and work procedures are meant to remain legally accountable (Vismann: 2000). Much of the appropriation of new media technology is aimed at generating or restoring the manageability and legal accountability of interactive procedures, for example in the financial realm both around 1900 and at present (Preda 2007). Individual references to specific persons, things or deliveries are lost in statistical aggregations, but

they are maintained to make each transmission accountable and traceable, and statistical and data aggregations rely on their existence. It's a prestabilized harmony of identification and aggregation, registration and computing, forged not in heaven but in our modern institutions and organisations.

Even modern mass media themselves are not only administered but also produced via administered work. Both the establishment of modern administrative media and the form of production of mass media have thus been characterized by a double nature comprising a step-by-step transformation of localized work-centred media up to the point of publication, and by identification and registration techniques and administrative steps subject to legal control. For modern mass media, this documentation reveals clear parallels with other bureaucratized domains of working life, which have, however, only rarely been researched in the framework of "production studies" (Powdermaker 1950; Hennion / Méadel 2013), especially principal-agent-relationships and their contracts and accountabilities. For nearly a century, infrastructural work-centred media and public mass media and telecommunications media seemed to occupy two different worlds or faces of a planet, and only one side, the face turned toward the product, the audience and the public service, was treated as the "world of the media." A medium only became a medium by being a means of mass communication—in short, a mass medium—in publicly accessible form, while research of its non-public production and socio-technical being-in-the-making remained in darkness.

The genealogy of digitally networked media only becomes historically more plausible when infrastructural media and public media are seen in their historical correlation; this is particularly the case for the all-penetrating presence and digital ubiquity of techniques of identification and registration. The socio-technical foundations for digital media and computerization consisted of a production of documents and data that could be rendered anonymous and collective, but based on referential techniques of identification and registration (Deibert 2009; Engemann 2003;

Haigh 2003; Schröter 2004). In line with this double nature, over a few short years, digitally networked media became capable of integrating all past mass media, in order to develop new mass-media practices along this path. However, this development came at the price of a fully infrastructured organisational form, whose history and prehistory was largely unknown and seemed innocuous enough because of our ignorance. From the outset, the basis of digital networking consisted of techniques of identification and registration, without which, for instance, neither the digital administration of addresses, the legally monitored delivery of goods and digital mail, nor digital financial transactions and the mail-order business would have become possible. This foundation and its consolidation through sensor systems and databanks results in the four classical dichotomies of media theory only pertaining to digitally networked media on a case-by-case basis—which is to say no longer being able to signify an essential definition of developing media practices. They are pertinent:

i) most prominently in the case of the separations between production, distribution, and reception that could be easily undercut (Ochsner et al. 2013) or cooperatively undersold in the framework of the Internet's end-to-end-architecture (Gillespie 2006);
ii) just as strikingly in respect to the invalidity of the dichotomy between interaction and telecommunication, annulled through both sensor systems and media technologies and practices of a mobilised referentialities of place, time, and person; an "explosion of place" (Graham 1998) that would have signified no surprise for either media in their making or for infrastructural media, but that came as a big surprise for all expectations concerning an "overcoming of time and space" or "space-time compression".
iii) equally effectively with respect to the annulment of the dichotomy between delivered information and referential objects and persons, on the same basis (Busch 2011), extending to the possible personalization of every delivery and the cleverness of our "filter bubbles";

iv) and regarding the postulated separation of physical skill and automatisms that, both for users and programmers, has shifted into the opposite of a mix composed of stabilizable skills and instable semi-automatisms (Gaver 1992; Vincente et al. 2001).

Despite these four revisions, now commonplace in the research literature under various fashionable designations, classical mass-media separations between production and reception also evidently exist on the Internet. In its first popular years, the Internet world appeared—partly on the basis of an orientation and maintenance dominated by academic values of egalitarian accessibility—as an optimized mass-media infrastructuring that promised a transparent formation of publics, together with increased market transparency. For the time being, the conditions for this mass-media infrastructuring have been maintained, albeit in a context marked by the steady erosion of the interim assumptions of transparency, equality, and anonymity. The mass-mediality of the Internet has unfolded on the basis of its bureaucratic setup: with the meanwhile generally known dangers of data mining that has become inter-operable and of the permeability of a security architecture that has been weak from the start in face of interested third parties who have turned out to be technically and institutionally superior.

In hindsight, and in the midst of this most deeply problematic media world—our present and its future—the mass media of the past and present appear in the light of their historical fragility and improbability: as public enclaves or, more precisely, as institutionally guaranteed or illegally realized exclaves only maintainable through technically and institutionally standardized practices of separation between interaction and telecommunication, production and reception. This practical "infrastructural inversion" (Bowker 1994: 235) of media history and historiography offers good reasons to newly study the intercontinental history and the present of the institutional and technical guarantees that facilitated anonymization and equalitarian participation, dis-identifica-

tion and un-registration in the epoch of earlier mass media—in order to restore them in an unknown media future, if possible and if it's not too late.

## Notes

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Thematic Focus

# Fundaments of Digitisation

# Data Politics. The Early Phase of Digitalisation within the Federal Government and the Debate on Computer Privacy in the United States during the 1960s and 1970s*

Benedikt Neuroth

In June 1974, Frank T. Cary, chairman of the board of I.B.M., wrote an article suggesting principal guidelines for data protection. Above this article in *The New York Times*, a caricature depicts a magnetic tape recorder with huge tentacle arms squeezing a person below (Cary 1974: 31). The image is rather dramatic, for the tape reels appear as eyes and the person in the grip of the tentacles is struggling for air. This chimaera of monster and machine represented a dystopic vision of computers taking control over personal data and individual privacy. About eight years earlier, Representatives in Congress attributed the metaphor of a "monster" or "octopus" to a proposed National Data Center that was intended to centralise statistics within the federal agencies and allegedly would contain large amounts of citizens' personal data, as *The New York Times* reported in July 1966 (Robertson 1966: 24; Westin 1967: 319; Regan 1995: 71ff.). In both cases, critics referred to the computer metaphorically as a creature that had gone out of control threatening personal privacy. Later in 1974, Congress passed the Privacy Act covering issues of data protection. Against this backdrop, the key question arises of how the implementation of computers in the public and private sectors, namely digitalisation, shaped the privacy debate.

This paper describes how computer technology was implemented, how an awareness of computer privacy arose and how politics addressed

the problem. It will demonstrate that digitalisation had a significant impact on the privacy debate. In the first section, I will provide an introduction to research and terminology relating to privacy and digitalisation. Secondly, I will describe the implementation of computer technology and electronic databanks for the processing of personal data by the federal government in the United States during the 1960s, drawing on primary sources of the Lyndon B. Johnson Library (LBJL). The principal legislation was the Brooks Bill. The third section covers the debate at the time on how computers would affect individual rights and the proposed solutions. It focusses on studies in which researchers analysed the functioning of databanks at a time when these computers were still "Media in Action". In the fourth section, I will focus on the politics of the Office of Management and Budget (OMB), formerly Bureau of the Budget (BOB), Executive Office, concerning Automatic Data Processing (ADP), based on sources from the National Archives in College Park, Maryland (NA-MD). "Data politics" in the title of this paper refers to the competing interests and claims linked to the value of information and to the peculiar relationship between transparency, efficiency, and confidentiality. Concerns for the individual's privacy were raised as soon as personal data was processed with electronic computers. In this paper, I argue that digitalisation and the debates about its social impacts on personal privacy were twin siblings.

## 1. Research and terminology relating to privacy and digitalisation

In this section, I will discuss the concepts of privacy and digitalisation, and highlight why the 1960s and 1970s were a significant period in shaping these concepts. The concept of a right to privacy dates back to the late 19th century and the often-cited article by Samuel Warren and Louis Brandeis on intrusive reporters. Seventy years later, in 1960, William Rickenbacker, an editor of the *National Review*, boycotted the US census, stating it was an "unnecessary invasion of my privacy", but lost the case

at a federal appeals court (United States v. Rickenbacker, 309 F.2d 462, (2d Cir. 1963); Brenton 1964: 12). In statutory law, the Freedom of Information Act (FOIA, Public Law (P.L.) 89–487) contained provisions for the protection of personal privacy. Yet computers had no impact on the privacy debate before the early 1960s (Westin 1967: 298ff.). Legal scholar Alan F. Westin was one of the first contemporary researchers to study this issue, focussing on the relationship between "the computer and privacy" and the concept of "data surveillance" (Westin 1967: 321, 158). In 1971, Arthur R. Miller examined "cybernetics as an instrument for surveillance" (Miller 1971: 38ff.). It was during the 1960s and 1970s that conceptions of privacy significantly changed from "intrusion" (Long 1967) or "invasion" (Brenton 1964) to self-determination and control. For instance, in 1967, Westin defined privacy as "the claim of individuals, groups, or institutions to determine for themselves when, how, and to what extent information about them is communicated to others" (Westin 1967: 7). Likewise, Miller later wrote: "an effective right of privacy is the individual's ability to control the circulation of information relating to him" (Miller: 1971: 25). The advent of the computer was one of the decisive factors in changing conceptions of privacy.

More recent political and legal research on privacy has often explicit normative implications. For instance, Daniel Solove argues that privacy concepts from that time fall short in the information age and proposes to "rethink longstanding notions of privacy" (Solove 2004: 2). Priscilla Regan analyses US legislation from the 1960s to the 1990s and argues that privacy has a "social importance" (Regan 1995: 212ff.). James Rule et al. ask: "How much personal record-keeping is desirable?" (Rule et al. 1980: 7). This paper explores privacy in the context of digitalisation with a historical perspective. In recent years, historians have researched the social history of the computer (Danyel 2012; Frohman 2015; Gugerli / Mangold 2016). Jon Agar for instance explores why computer privacy became an issue in the United Kingdom in the late 1960s (Agar 2003: 343ff.). It is a challenge for contemporary history to decide on how to characterise and

break down the different phases since the advent of the computer. From a technological perspective, the history of the computer can be traced back to an earlier date, for instance to the invention of punched card data processing by Herman Hollerith in the late 19th century and to the development of the electronic computer during World War II. However, Martin Campbell-Kelly and William Aspray point out that in the 1950s "the computer race had scarcely begun" and the industry's growth was "insignificant" (Campbell-Kelly / Aspray: 20ff.; 79, 130). It was in the 1960s and 1970s when the use of computer technology increased significantly.

The number of computers rose in the 1960s and 1970s with the federal government as a major buyer. According to statistics issued by the National Bureau of Standards (NBS), the federal government in 1966 owned about 3,000 computers counted in Central Processing Units (CPUs). By 1970, the number of CPUs had risen to 5,000 and to 11,000 by 1977. In comparison, the overall number of CPUs nationwide was about 60,000 by 1970 respectively 300,000 by 1977 (Gray 1979: 12ff.). This rapid growth was partly due to so-called minicomputers representing about two thirds of computers in the United States in 1977 (Gray 1979: 49f.). Government institutions held a large portion nationwide, but during the 1970s the number of CPUs in the United States grew faster than the number of government CPUs (Gray 1979: 54f.). Within the government, the share of computers was unevenly distributed. In 1966, about two thirds of the machines or roughly 2,000 were owned by the US Department of Defense (DOD), whereas the National Aeronautics and Space Administration (NASA) and the Energy Research and Development Administration (ERDA) employed several hundred. Other agencies only had a couple of computers (Gray 1979: 22ff.). The numbers show that the government played a crucial role in this technological field.

To describe the impact of the rise of computer technology, historical research could use "digitalisation" as an analytical term. At the time, a distinction between analogue and digital computers was made, but analogue computers or punch-card equipment could be integrated into

digital systems. Accordingly, in 1961, an executive order on the acquisition of ADP equipment set a preference for electronic digital computers: "Analog computers are covered only when computers of this type are being used as equipment peripheral to a digital computer" (BOB 1961: 1). Generally speaking, in contrast to "analogue", the term "digital" refers to a numeric, discrete and discontinuous description of information (Loleit 2004: 204). The term "computerisation" was used since the 1960s, for instance when Westin stated: "There is no way to stop computerization." In 1967, the *Saturday Review* magazine published a special issue on the potential of a "New computerized age" (Westin 1967: 326, 314). Altogether, the term "digitalisation" seems appropriate to analyse the social implications and conflicts that arose with the implementation of computer technology. Consequently, this paper describes the 1960s and 1970s as an early phase of digitalisation. In the next section, I will explore the management of ADP in the federal government during this period.

## 2. Digitalisation in the federal government during the late 1960s

In this section, I will describe the early phase of digitalisation within the federal government. The use of computers soon became part of the political agenda in the 1960s. Congress introduced the Brooks Bill, named after Representative Jack Brooks of Texas, which proposed to coordinate the acquisition of ADP equipment centrally. It was passed in the House of Representatives in 1963, but remained pending in the Senate. Brooks therefore complained to President Johnson that millions of dollars were wasted on inefficient purchases and suggested to put "ADP management on a business-like basis" (Brooks 1963: 1). Rivalries arose almost immediately among agencies about the responsibility for digitalisation. In 1963 Kermit Gordon, director of BOB, told the Comptroller General in a letter: "we are strongly opposed to taking from the department and agency heads the authority and responsibility for decisions as to the procurement and utilization of data processing equipment for their programs"

(Gordon 1963: 4). Elmer Staats, deputy director of BOB, mentioned in a letter to President Johnson that the Comptroller General was critical of the ADP management within the federal agencies. He pointed out, however, that an earlier version of the Brooks Bill would have put the General Service Administration (GSA) in an overly strong position, making it the "virtual 'czar' over the acquisition, use and disposal of all automatic data processing equipment" (Staats 1965: 3). Meanwhile, the BOB itself was working on a report on ADP management originally initiated under the Kennedy administration. Referring to a draft version, Paul R. Ignatius, Assistant Secretary of Defense, expressed the DOD's opposition to the pending legislation in a letter to the BOB (Ignatius 1964: 1). The BOB's report stated that the government would be able to work more efficiently using ADP, but purchase and data processing standards were causing problems. In the fiscal year of 1964, the government spent about one billion US dollars on computers (Bureau of Budget 1965: ii). The lack of coordination and standards pushed the administration into action.

In March 1965, President Lyndon B. Johnson approved the BOB's report on ADP. In a letter to the Speaker of the House, Johnson stated: "The electronic computer has enabled the Government to carry out programs that otherwise would have been impossible" (Johnson 1965a: 1). Hearings were held in March and April (U.S. House 1965). However, the Comptroller General still expressed a different view from the BOB on how to manage the use of ADP and recommended to establish a central office for this purpose. According to a report of August 1965, the federal government spent three billion US dollars on computer equipment each year, three times more than the BOB estimate for 1964. It is unlikely that the amount had tripled. Assumingly, the basis of the numbers was different. According to the statistics of the NBS, the ADP costs in the fiscal year 1965 were roughly 1 billion US-dollars after the "general management classification" excluding the "Federal ADP special management category" (Gray 1979: 25f.). ADP technology was supposed to have a huge impact on the government: "The information-processing advances stemming from the

computer age bid to drastically change conventional approaches to problem solving and management decision making" (Weitzel 1965: 1). Later in 1965, in a letter to Senator John McClellan, President Johnson expressed his support for the latest version of the Brooks Bill in order to achieve "greater economy and efficiency in the conduct of government's business" (Johnson 1965b: 1). The US President finally signed the law in October 1965 regulating the "purchase, lease, maintenance, operation, and utilization" of ADP equipment within the government. To the contrary, the use of ADP equipment by agencies should not be influenced. Under the new legislation, an ADP fund was installed under the Department of Treasury, the GSA was responsible for the distribution of ADP equipment, the Department of Commerce (DOC) gave technological advice to agencies and recommended standards, while the BOB, Executive Office, exercised fiscal and policy control (U.S. House 1965: 2; P.L. 89–306). As a result, the management of computer technology in federal agencies was coordinated centrally.

In his budget proposal for 1967, President Johnson demanded the efficient management of investments in this field. Furthermore, Charles Schultze, director of the BOB, advised the President to address the federal agencies in order to improve ADP management (Schultze 1966: 1). In a memorandum in June 1966, President Johnson asked the heads of department and agencies to improve their work by using computers, but to keep the costs low. Johnson emphasised the possibilities of ADP: "The electronic computer is having a greater impact on what the Government does and how it does it than any other product of modern technology" (Johnson 1966: 1). The BOB was asked to report every six months on the progress in ADP. Likewise, Phillip Hughes, acting director of BOB, submitted a first report in January 1967, stating computers had recently been used for collating information on funding in the War on Poverty (Hughes 1967: 1). In 1968, President Johnson agreed to the DOC's recommendation to introduce a common standard for ADP. Subsequently, all federal government computers had to be compliant with the "America Stand-

ard Code for Information Interchange [ASCII]", a voluntary standard developed by the United States of America Standards Institute. In addition, from July 1969, federal computer equipment had to comply with the "Standard Code for Information Exchange" as well as standard formats for magnetic and paper tape (Johnson 1968: 1). Under specific circumstances there was the possibility of a waiver (Johnson 1968: 2). In summary, the Johnson administration was a pioneer in digitalisation within the federal government. Its lead impacted on the whole country. Procurement was coordinated centrally, and standards were introduced in order to avoid ineffective incompatibilities among different agencies' computer systems. The principles behind digitalisation were efficiency, management, and decision-making. However, when personal information was processed in databanks, a conflict between privacy and efficiency arose.

## 3. Safeguarding privacy in the context of digitalisation

In this section, I will focus on the diagnosis and the implemented rules concerning computers and privacy. The debate intensified in 1965 when Congress investigated the matter, notably Representative Cornelius Gallagher and Senator Edward Long, author of *The Intruders* (Westin 1967: 298ff., 315ff., Long 1967). Early applications of ADP discussed in the hearings were, for instance, the New York State Identification and Intelligence System, the National Crime Information Centre of the Federal Bureau of Investigation and a Social Data File of the Urban Planning Organization (U.S. House 1966: 169; U.S. Senate 1968: 279, 309). Furthermore, several empirical studies investigated the relationship between databanks and individual rights (Rule et al. 1980; Regan 74ff.). According to Paul Armer of the Research and Development Corporation (RAND), computer technology (Electronic Data Processing (EDP)) for instance made it more difficult to hide a "poor credit record". In order to prevent a lack of privacy, Armer suggested implementing technological safeguards (Armer 1966: I-231f.). A study on computer databanks published by the

National Academy of Sciences and supported by the Russell Sage Foundation illustrated on an empirical basis how computers run by government and private organisations actually worked (Westin / Baker 1972: 339f.; Rule et al. 1980: 127). The authors concluded: "computer usage has not created the revolutionary new powers of data surveillance predicted by some commentators." Organisations did not collect or share more information as a result of computerisation, and decisions were made on the same grounds, irrespective of whether they were based on computerised or manual files. However, the computer made organisations work more efficiently. Policies on individual rights such as "privacy, confidentiality, or due process" had remained unchanged since the introduction of the computer (Westin / Baker 1972: 341). Nonetheless, the study recommended extending the scope of privacy and collecting only relevant data for decision-making, providing "greater rights of access by individuals", and implementing "new rules for data sharing and confidentiality" (Westin / Baker 1972: 348ff.). An advisory committee of the Department of Health, Education and Welfare (HEW) pointed out that "computerisation" increased data processing capacity, simplified access to personal data within and between organisations and had technical consequences for the processing of data itself (U.S. HEW: 12ff.; Rule et al. 1980: 95). Although the committee chaired by Willis Ware of RAND concluded that a computer was not capable of "taking over" anything it was not specifically programmed to take over", the report mentioned "updating, merging, and linking operations" and "matching data" that could further be improved by a "standard universal identifier" such as the Social Security Number. Yet a "giant national data bank of dossiers" was not in sight (U.S. HEW: 22ff.). Altogether, the digitalisation of personal records raised concerns about the relevance and accuracy of the information itself, the question of access and confidentiality as well as computer operations able to merge, link or match files.

Scholars and politicians both addressed these issues. For instance, the Fair Credit Reporting Act (FCRA, P.L. 91–508) of 1970 regulated the

use of credit reports and guaranteed some consumer rights (Rule et al. 1980: 88). Even before management of credit records with computers, critics as Myron Brenton described investigators as very intrusive and questioned the way data was handled (Brenton 1967: 25ff.). In 1965, Data Credit Corporation installed a computer system in its San Francisco office for the automatic processing of credit reports, the first of its kind. Several offices of the Associated Credit Bureaus of America followed suit. Consequently, a study funded by the Russell Sage Foundation predicted technological competition and centralisation. The authors suggested a single office would be able to deliver credit reports nationwide in the near future (Rule 1969: 151ff.). Legal scholars and members of Congress argued, for instance, that inaccurate credit data could cause unjustified disadvantages for consumers (Rule 1969: 161ff.). In addition, individuals encountered difficulties accessing files, whereas landlords, employers and law enforcement agencies were able to consult the credit bureaus (Rule 1969: 166ff.). The FCRA was a milestone of data protection. However, no comprehensive privacy legislation concerning the private sector followed.

To safeguard individual rights, a HEW report suggested a "Code of Fair Information Practice" to address the accuracy of and access to personal information (U.S. HEW 1973: 40ff.). Federal legislation was also needed. According to a study of the Subcommittee on Constitutional Rights chaired by Senator Sam Ervin, 756 databases contained more than a billion files on individuals. Approximately 86 percent of the databases were computerised (U.S. Senate 1974: 31ff.). In 1974, Congress passed the Privacy Act that covered data protection issues within federal agencies (Regan 1995: 77–83; P.L. 93–579). A Privacy Protection Study Commission (1977; Rule et al. 1980: 104) was established to address shortcomings of the legislation, but had little impact (Regan 1995: 83–86). Furthermore, jurisdiction did not set a precedent for information privacy. In 1977, the U.S. Supreme Court acknowledged a "threat to privacy implicit in the accumulation of vast amounts of personal data in computerized data banks", but did not declare a New York databank of patient information uncon-

stitutional (Whalen v. Roe, 429 U.S. 589 (1977): 605; Regan 1995: 40). Consequently, both legislation and jurisdiction in relation to privacy had shortcomings.

## 4. Further digitalisation in the federal government in the early 1970s

Unconcerned with the privacy debate, digitalisation within the federal government continued under the principle of efficiency. New standards were set and the Brooks Bill was implemented. According to an internal OMB memorandum, in 1971, Representative Brooks held hearings on the implementation of the law referring to issues such as "individual privacy" that admittedly went beyond the scope of the law (Ink 1971: 2). In August of the same year, OMB Director George P. Shultz answered an inquiry from Representative Brooks concerning the Legislative Reorganization Act. In his answer he stated that a "computerized budget preparing system" based on the input of all agencies had been introduced several years earlier. As a result, Shultz pointed out, "a greater standardization in coding and classification of budgetary data" became necessary (Shultz 1971b: 1). In October, Shultz sent departments and agencies a circular concerning an "ADP Management Information System (ADP/MIS)" and a related inventory as well as financial management data. There were several exemptions to reporting, for instance, concerning EDP equipment "which is both integral to a combat weapons or space system and built or modified for special government design" (Shultz 1971a: 1, 5). Another bulletin sent to the heads of executive departments and agencies referred to the "Deferment of Agency Personnel Data System Acquisition". In order to avoid duplication, the OMB took the lead in issuing policy and instructions for the implementation of these systems (Schultz 1971d: 1). However, many agencies requested an exemption for current projects, for instance the HEW (Richardson 1971: 1) or the DOD (Jones 1971: 1). Under a new name and leadership, the OMB continued to be responsible for the central coordination of ADP.

Shultz asked President Richard Nixon to grant the OMB overall authority for the implementation of standards (Shultz 1971c). In a letter dated January 1972, Shultz informed the GSA that he had approved a "Federal Standard Common Business Oriented Language (COBOL)" as proposed by the NBS, DOC (Shultz 1972: 1). Later in August 1972, in a letter to the GSA, Caspar Weinberger, then Director of OMB, approved a "Federal Information Processing Standard for Synchronous Signalling Rates Between Data Terminal and Data Communication Equipment" as proposed by the NBS (Weinberger 1972b: 1). In a letter to Congress written in 1972 Weinberger concurred with a report of the Comptroller General entitled "Opportunity for Greater Efficiency and Savings Through the Use of Evaluation Techniques in the Federal Government's Computer Operations" (Weinberger 1972a: 1). The Nixon administration followed the path set under President Johnson concerning ADP management. From a technological point of view, digitalisation was a bipartisan issue.

## 5. Conclusion

In summary, the 1960s and 1970s saw an early phase of digitalisation in both the public and private sectors. Moreover, the federal government was one—if not the principal—driving force for early digitalisation. Not only did the government invest billions of dollars in the new technology and was a major buyer, but it also centralised and standardised its ADP management. In this respect, Congress passed legislation concerning the acquisition of ADP equipment, and the Johnson administration implemented a central coordination and unified standards such as ASCII. At the same time, a debate on personal privacy in the context of using computerised databanks took place. Congress held hearings, and several studies examined the impact of computers on privacy. With computer technology, personal data could be easily collected, stored and exchanged as well as processed, linked and matched. There was, however, no evidence that computer programmes by themselves made decisions or judgements about individuals. According to a maxim at the time, com-

puters worked on the basis of the principle: "garbage in, garbage out" (GIGO)" (Miller 1971: 37). In terms of civil liberties, inaccurate data could be replicated and errors could be amplified, potentially leading to negative consequences for individuals. From a legal point of view, the question arose how individuals could gain control over their personal information. From a technical perspective, computers could also provide privacy safeguards. However, solutions to address these problems fell short. Instead, voluntary guidelines and the concept of fairness dominated the debate. Regardless of the privacy debate, digitalisation continued under the Nixon administration, and new standards were implemented that made the exchange of personal data easier. In conclusion, the computer was neither a hyper-efficient government machine nor the octopus-like monster represented in the caricature mentioned earlier (Cary 1974: 31). Computer technology certainly revolutionised information processing, but the privacy debate showed the flipside of the coin. Understanding the foundations of digitalisation helps putting the privacy debate into a historical perspective.

## Notes

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# The Central Register of Foreigners - A short history of early digitisation in the Swiss Federal Administration

Guido Koller

The modern Swiss Confederation was founded in 1848. Since then, government and administration have been constantly reorganised. One important, but little noticed change occurred between the 1960s and 1980s: the automation and standardisation of information management. This was an important requirement for taking "binding decisions" (Niklas Luhmann) in times of rapidly growing quantities of information. In this paper, I will examine the steps toward automation in the Swiss federal administration using the example of the *Zentrales Ausländerregister* (Central Register of Foreigners; ZAR) of the *Eidgenössische Fremdenpolizei* (Swiss Police for Foreigners). I will focus on the ZAR and data processing as a means of operationalising administrative workflows, showing that data processing developed incrementally on a path that finally led to the digitisation of increasingly large parts of the administration. A generalisation of this example yields a historical model of the early stages of digitisation of public administrations that would ultimately lead to various forms of e-government.

## 1. What is the public administration and how did it evolve?

The public administration assists a government—the executive—in its function to execute decisions made by the parliament (the legislature) (Wilson 1887). In assisting the executive, the administration's responsibilities include the preparation, implementation, and execution of laws,

regulations, and directives (Fleiner 1911: 7). During this process, the administration produces "binding decisions" that not only set a framework for society, but also increasingly entail a controlling function (Luhmann 2000: 84f.). In the 20th century, governments and administrations increasingly devised, planned and realised steps to steer certain areas of policy. The substance, direction and extent of these coordinating and controlling functions take different forms on a national and supranational level. In this article, I will explore the example of the Swiss federal government.

Administrative history analyses the origin, development and change of interactions that produce such binding decisions within the administration. In this paper, I will focus on the practices of the Swiss federal administration between 1960 and 1980, when these decisions were increasingly made based on automatically processed information, using the example of the ZAR. For this purpose, I will first introduce some key elements of the Swiss federal administration. This brief background information aims to give a better understanding of the "Swiss path" of administrative automation.

## 2. Moving on from the Ancien Regime: the evolution of the Swiss federal administration

The modern Swiss Confederation was founded in 1848, after a short war which saw the progressive liberal cantons prevail over the conservative Catholic cantons. Since the decentralised administrative structures, which largely dated from the *Ancien Régime,* no longer met the requirements of a modern 19th century political system (Bäumlin 1961: 69f.), a new central administration—a "classical state apparatus"—was needed, as Raimund E. Germann titled the second chapter of his well-known book on the public administration in Switzerland (Germann 1998).

The groundwork was laid by the Federal Act on the Organisation and the Course of Business of the *Bundesrat* (Federal Council, government) of 7th July 1849. The *Bundesverwaltung* (Federal Administration) in par-

ticular was charged with designing the framework for a modern economy and society. These measures—which were based on resolutions of the *Bundesversammlung* (Federal Assembly, parliament) and the Federal Council—were aimed at unifying a culturally, linguistically, religiously and economically highly fragmented territory.

Due to its growing workload the administration was repeatedly enlarged and reorganised. The Federal Council was divided into seven departments, which still exist to this day, with clearly defined responsibilities shared between them. This delegation of tasks was specified in detail in the Federal Council's resolution concerning the competences of the departments and their heads issued on 9th April 1897. This civic nature characterised the Swiss political system for a long time, as Max Weber also noted (Weber 1922). Decisive shifts in professionalisation occurred during World War One and World War Two.

In the context of the bureaucratically organised and coordinated war economy, the federal government extended its administration massively during the 1930s and 1940s. Because of the development and expansion of the welfare state after World War Two and a corresponding population increase, a significant part of the government's savings efforts after 1945 went unnoticed. Therefore, the Federal Council installed the *Zentralstelle der Bundesverwaltung für Organisationsfragen* (Central Office for Organisational Issues of the Federal Administration, ZOB). Among other things, it was responsible for conceptualising and planning data processing in the different government offices. An important and early project was the ZAR.

## 3. Managing data: The Central Register of Foreigners (Zentrales Ausländerregister, ZAR)

The ZAR, the Central Register of Foreigners of the *Eidgenössische Fremdenpolizei* (Swiss Police for Foreigners), is an early example of data processing and automation in the Swiss federal administration. Its operational objective was to process more information in a shorter time. Before

describing and analysing the ZAR, a conceptual clarification seems to be important: we must differentiate concepts used in the 1960s from those used today. The term "information and communication technology" (ICT) is new. Its use today emphasises the integration of hardware and software. It should enable users to collect, store, edit, output and communicate data in a uniform manner. In contrast, the term "data processing" still seems to be used like it was in the 1960s: it refers to collecting and processing information objects. If data—that is numbers, text fragments or other objects—are automatically processed on a given program, we speak of "automatic data processing". James Cortada gives a good overview of the history of information and its different concepts especially in the US (Cortada 2016).

Before exploring the ZAR in more detail, I will provide some information on the political background of the project: from 1960 to 1965, the number of foreigners living in Switzerland increased from 496,000 to 810,000. Politicians were talking about a "strong influx that should be reduced". The Federal Council adopted "first measures to restrict the influx" in 1963. In order to assess the effectiveness of these measures, reliable statistics were necessary. For the police the "problem was essentially a question of numbers and statistics". Therefore, the police proposed to use federal statistics as a way to chart and monitor all foreigners in the Swiss cantons. After an assessment of this proposal by the ZOB, an expert group was established in 1966. Based on its report, in 1970, the Federal Council decided to develop a central register. In 1971, the project was pioneered in four cantons. Two years later statistics for all Swiss cantons were available for the first time. In a second phase, after 1975, the application was expanded with more comprehensive table tools and a network of stations and screens. Incrementally, this statistical tool evolved into a permanent inventory—a database.

Implementing the ZAR project was quite complex: in 1973, all Swiss municipalities collected and registered information on 1,493,573 individuals on paper forms. They transmitted the data to the ZAR, where it was

copied to magnetic tapes in the data centre of the *Bundesamt für Statistik* (Federal Statistical Office, BfS). After a plausibility test, the data was linked to the number of the *Alters- und Hinterbliebenenversicherung* (AHV) —OASI (old-age and survivors' insurance) number—that was used as the official Swiss social security number at the time. Consequently, a dataset was definitive and official. Programming and analysing the ZAR took 17 months, and subsequently the data was updated continuously. 23 employees, mostly women, made about 8,000 changes a day. At the beginning, there were some challenges with the input and output of the ZAR: because around 30 percent of all foreign individuals left Switzerland without officially signing out, their departure was not registered. Other problems arose because initially births were registered as new entries instead of births, and some professions were wrongly coded. Furthermore, some of the tables were too complicated to be used.

Despite these problems, statistics were more reliable than before. 18,000 duplicates could be eliminated. However, the operation of the ZAR was very costly and the automated data exchange required an intensive cooperation with the other parties involved. In the beginning of the second phase, in 1975, the application was extended with more comprehensive table tools. Afterwards, the ZAR was equipped with terminals for working with the permanent inventory. Gradually, a statistical tool evolved into a usable database. This database was cross-linked with different competent authorities on the federal and cantonal level. In 1977, 36 different terminals were integrated in a network between the ZAR and the data centre in the BfS. The ZAR became the most important tool for the Swiss Police for Foreigners. It enabled the police to control the duration of stay and deadlines, and was used to find addresses (in order to collect taxes or alimonies), for surveying foreigners for the *Bundesanwaltschaft* (Office of the Attorney General of Switzerland), for the monitoring of entry bans and as a basis for the calculation of entry quotas.

The Swiss Police for Foreigners believed in the concept of a permanent inventory that "has brought a much improved control mechanism"

to Switzerland. According to officials, it helped reduce costs as administratively 27 jobs could be cut. Establishing a network caused a new problem: securing and protecting the data. In 1983, the Federal Council published an ordinance for the ZAR that for the first time contained relevant regulations.

The general characteristics of the ZAR can be used for describing a historical model path for the early stages of digitisation in public administrations: the need to process more information in less time led to the search for economic solutions and investment in data processing. The result is an operationalisation of administrative processes for the production of binding decisions. It is perhaps reminiscent of the image of the government as a machine (Agar 2003) —see, for instance, the concepts of Charles Babbage or Walter Bagehot—and of its opponents: Thomas Carlyle, Henry Thoreau and Alexis de Tocqueville thought that a government was rather a moral issue (I will come back to this in the *summary*).

It is evident that the state's need for coordination was rapidly increasing. So was the demand for the standardisation of information and appropriate technologies such as forms as interfaces between the state and its citizens and punch cards for the mechanisation of registers. In this historical model, a systematic administration enables technological change and vice versa, and the state acts as a model for the path towards automation (census, statistics, register etc.).

## 4. At the heart of the administration: the ZOB

The ZOB was amongst other things responsible for conceptualising and planning data processing in the different government offices. A brief overview of its responsibilities can be found in an article by Otto Hongler, one of its directors (Hongler 1978). In 1960, the Federal Council entrusted it with the planning and coordination of automatic data processing in the federal administration. To this end, it granted the ZOB the authority to issue technical directives, although the latter did not run the computers. They were operated by the BfS, the first government office to pro-

cess data automatically. In the 1970s, there was a growing demand for streamlining and creating better workflows in the administration. For this reason, it was decided to strengthen the ZOB's position and to employ more computer specialists in the ZOB and selected federal agencies. Parliament agreed to the Federal Council's request and passed the Act of 19th December, 1980, upgrading the ZOB to the *Bundesamt für Organisation* (Federal Office for Organisation, BfO). The 1980 Act explicitly mentions the promotion, coordination and monitoring of automation and data processing in the administration as one of the main functions of the BfO. It was now responsible for issuing new directives and technical instructions on appropriate and economic workflows and tools. The first technical instruction on data processing in the federal administration dated from 6th January 1961.[1]

Although considered as a digital revolution today, this change was, on the whole, incremental. In the administrative sector, data processing developed into information and communication technology (ICT) during the 1990s. This change was accompanied by a shift in perception. The focus on organisation was replaced by a focus on processes and computers: in 1990 the Federal Council dissolved the BfO and transferred its responsibilities to the *Bundesamt für Informatik und Telekommunikation (BIT)* (Federal Office of Information Technology, Systems and Telecommunication, FOITT).

## 5. Data processing: the flow of information in the administration

With the growth of the federal administration, more information had to be processed in less time. One important example was, as described, the *Zentrales Ausländerregister (ZAR)*, which was set up to establish reliable statistics and evolved into the main tool of the *Eidgenössische Fremdenpolizei* to control the residence of foreigners in Switzerland. Another was the *Alters- und Hinterlassenenversicherung (AHV)*, which provides each resident with an identification and insurance number. In view of this,

a technological change began that would have a lasting effect on the administration. During the 1960s, the collection of data was standardised and the procedures were increasingly computerised. Automatic data processing appeared to fulfil the promise of greater efficiency. This is illustrated by a short and interesting film produced by the *Schweizerische Filmwochenschau*.[2] It shows one of the largest data processing machines operating in Europe: the first computer of the Swiss Post Office installed in 1957. Two points in the narrator's commentary are very enlightening: first, he states that "the electronic brain can only handle problems that have been thought and planned by human intelligence". Secondly, he points out that "the purpose of using the machine is not about developing artificial intelligence, it is merely a measure to counter staff shortages!" So, again, the focus was on efficiency: more information had to be processed in less time.

At the beginning of the 1960s, the federal administration was running three data centres and had about ten large data processing machines: one at the BfS that functioned as an electronic data centre for the whole administration, and three at the *Eidgenössische Technische Hochschule* (Federal Institute of Technology, ETH) in Zurich, two at the Military Department and three others for social security, customs, and taxes. At the time, the ZOB prepared a policy paper on data processing in the administration. This paper tells us much about the perception of the challenges in processing information automatically and the first concepts for solutions. It begins by highlighting the benefits of data processing systems: great speed in performing operations (once it is prepared, see below), a more comprehensive analysis with little additional effort, print-ready tables and easy, space-saving archiving. But there are also disadvantages: data processing is a rigid system and has no flexibility; consequently, a great deal of work went into preparing operations. Finally, computers were very expensive and created staff problems, because experts were rare and costly.

The ZOB listed a number of requirements for operating such a system. Data technology is always ahead, said the ZOB, not all applications are predictable, and electronic processing is only suitable if computing tasks fulfil the following conditions: the task must be described in detail and logically; it must have a minimum volume; and it should have a certain routine character. But the main condition for operating such a system, according to the ZOB, was the adjustment of management methods as well as accurate and full planning. The ZOB's organisation experts said there could not be any short-term modifications of rules and workflows.

Statistics prove that the ZOB's policy was quite successful. By 1978, the federal government already ran 47 computers: the Federal Department for Home Affairs had 16 machines, the Post Office 13, the military 7, the Federal Departments of Finance and Economics 5 each, and the Federal Department for Foreign Affairs 1. This equipment was worth around 195 million Swiss Francs and was run for more than 71,000 hours by 660 staff, most of them experts. As a result, staff and running costs were very high: 116 million Swiss Francs. The BfS still operated as the data centre for 33 government offices. It was running three computers now with a staff of 128 and costs of 32 million Swiss Francs. In 1980, the ZOB's responsibility for data processing was, as already mentioned, institutionalised by law.

An assessment of the ZOB's policy paper dating from the early 1960s reveals that, rather than holding a digital vision its aim was to solve problems in the management of increasing amounts of information. Therefore, data processing developed gradually on a path that would ultimately lead to the digitisation of important areas of the administration, and the operationalisation and standardization of administrative workflows. A generalisation of this example yields a historical model of the early stages of digitisation of public administrations which is briefly described in the following section.

## 6. Summary: sketch of a historical model for the early phases of digitisation in public administrations

Based on the example of the ZAR, this short history of the early stages of digitisation within the Swiss federal administration describes the origin, development and change of interactions that produce binding political decisions on a federal level as conceptualised by Niklas Luhmann. In order to maintain the ability to resolve problems in the light of increasing government spending, the federal administration was continually reorganised. This reorganisation included the expansion of the principle of departments, the delegation of responsibilities within the administration and the rationalisation of workflows. One important, but little noticed reform occurred in the 1960s and 1970s: the automation and standardisation of information management. To derive from this example the criteria for a historical model of the early stages of digitisation of public administrations, the following question needs to be answered first: is the government a machine (Agar 2003)?

The metaphor of the government as a machine was coined in the second half of the 19th century. Numerous prominent intellectuals shared this view, but many disagreed, stating that government was a moral issue. Their view was supported by many strong arguments. States shape the lives of their citizens and all other residents in their territories. Governments and administrations want control over this territory. They collect as much quantitative data as possible to manage it. Through censuses and other surveys, they gather much information about the population living in their territory. These surveys are more than statistics. The foundation of all statistical work is the creation and maintenance of registers that ensure the identity of an individual legally and administratively. The data collected is stored and managed in registers that allow the government to control and steer various aspects of the development of the population, economy, science, education, and other public issues. Clearly, the collection of data as an element of standardisation and objectification is a question of trust, as Alain Desrosières and Theodore Porter stress in their

books about the history of statistics in France and the US (Desrosières 2000; Porter 1995).

As we have seen, the state's need for coordination and control entails a growing demand for information. The technology and tools used to collect and manage this data are well known: forms, the interfaces between citizens and the state; and registers, which can be mechanised and processed using punched cards with a machine and are updated constantly, and thus gradually develop into permanent inventories or databases. Governments invest vast funds in these infrastructures and statistics. They are a model for an early automation of workflows with certain volumes and a routine character. Organisational aspects such as the management of registers and the control of information flows are decisive. The essential requirements are standardisation and organisation. These aspects form the outline for a historical model of the early stages of digitisation of public administrations.

In short, the history of administration shows that early digitisation is driven not only by technology, but also by the organisational challenges of large administrations. They had to process large amounts of information and therefore needed standardisation and mechanisation. The first data processing machines were a response to this. They helped to solve governments' constantly increasing information challenges. Administrations were continuously monitoring the technology market in search of innovative machines and procedures. *Bull, IBM, Olivetti* and *Siemens*, to name just a few manufacturers, responded to this demand.

## Notes

1 The information is taken from the following file in the Swiss Federal Archives: E6502-02#2002/226#16*, Vorgeschichte Bundesamt für Informatik BFI, 1986–1989.

2 See https://www.youtube.com/watch?v=_ZBuJnY8cTA, minute 4:50.

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# Who is leading innovation? German computer policies, the 'American Challenge' and the technological race of the 1960s and 1970s

Michael Homberg

## 1. Introduction

"Where are our billions, Mr Matthöfer?" (Maurer 1977: 7),[1] asked the magazine *Computerwoche* on 20th May 1977. The sarcasm expressed in this question was directed at the German technology sector's sense of entitlement. Taking up the criticism of West Germany's research and technology policy, the article voiced a general disappointment with the dismal failure of national IT policy and constituted a turning point in the history of state-funded advancement of data processing. The federal government's innovation policy model was in crisis. Siemens and AEG, the German market leaders in data processing, had been the two of the main beneficiaries of the federal government's strategy to promote the West German IT industry in its first decade. As *Computerwoche* pointed out, neither company had been able to reduce the considerable gap between themselves and the global market leader, IBM, or to put an end to the pre-eminence of US hardware manufacturers. It was only a small consolation that, thanks to European research cooperation and promotion schemes, the Federal Republic began to take the lead in the microelectronics race against East Germany. A decade previously, the press had rhetorically announced the battle for "technological progress" and framed it as a question of national prestige. In times of competing political regimes, rather than the product of a certain "gift" and "ability to innovate" or even of an "inventive talent

and genius", success tended to be a result of "free development" and the co-ordinated "initiative" of economic and research policy (Richardson / Parker 1968: 26; Rudzinski 1969: 11; Neues Deutschland 1968: 6). With the economic crises and socio-political upheavals at the start of the 1970s, the view on innovation changed. While achieving a definitive outcome (or *fait accompli)* of the competition between the two regimes noticeably receded, concepts of innovation policy soon took on the character of a remedy for the ailing German economy, which needed to free itself from recession and depression.

In this article, I will outline the central pillars of this discourse around innovation by comparing the roles of innovation policy in the GDR's socialist planned economy and in the FRG's democratic market economy. Innovation is a multifaceted, highly enigmatic concept (Godin 2015). There are numerous linear and holistic theories, which often grossly overrate the significance of continuities or path dependencies. Yet, in practice, product and process innovations prove to be the result of enabling circumstances and thus of complex interdependencies between supply and demand ("technology push" and "demand pull" factors). Innovations emerge from targeted actions, but they can equally happen spontaneously. Here, the particular circumstances intersect with institutional and individual operational strategies which turn out to be the effect of cultural imprints and patterns of behaviour. Therefore, processes of innovation can be understood as an interaction between systemic and cultural factors (Reith 2006: 18f.). In this article, I will explore the political discourses on innovation and their contribution to the implementation of certain innovation policies as well as their influence on the attitudes, values, models and approaches of the actors involved—that is politicians, researchers and businesspeople (Schramm 2008: 17).

The concept of "innovation policy" produced a radical change. Semantically, the policy of investment control in the Federal Republic at the end of the 1960s on the one hand evoked the frightful prospect of (centralised) planning; on the other hand, it conjured up the vision of a pan-Eu-

ropean awakening. Thus, the concept of "innovation" defined the terms for the societal debate surrounding the conditions and effects of computerisation. Government, industry bodies and employers' associations along with trade unions fought for decades over the meaning and consequences of an "innovative" technology policy. Actions to promote hardware and software development were a crucial battleground. The central argument of this article will be guided by the observation that the ideas and concepts, values and scope of action ingrained in innovation policy in West Germany and the GDR up to the 1960s remained very similar and extremely stable (Fraunholz / Hänseroth 2012: 10ff.; Bauer 2012: 305ff.). Despite this, the transformation of both countries into a "digital society" differed sharply due to the circumstances of the Cold War. While the CoCom Embargo cut the East off from essential capabilities within the high-tech space, the Western European countries grappled with themselves over how to find an acceptable way of cooperating with each other. In this way, innovation policy proved to be a touchstone of European unification.[2] While the history of state-sponsored IT development in the two Germanies has already been studied in-depth (Krieger 1987; Bähr 1995; Sobeslavsky / Lehmann 1996; Salomon 2003; Wieland 2009), so far there have been few comparative approaches (Naumann 1997).[3] While more recent research papers have written the history of information technology from an international perspective (Coopey 2004; Cortada 2009; Pieper 2012), a study of the entanglements of global IT industries remains a desideratum.

## 2. Building Semantic Bridges: Innovation Culture and the Discourse surrounding the "Techno-logical Gap"

Technology policy in both the West and the East changed radically with the "shock of globalisation" (Ferguson 2010: 60). The promotion of data processing was given a key role at the end of the 1960s following of a heated debate over the European technological lag behind the USA. The debate had been initiated by the reports of the Organisation for Eco-

nomic Cooperation and Development (OECD). In 1965, the OECD analysed the rise in research and development outputs in the USA and noted that in 1962 alone these were five times higher than in Western Europe (Freeman / Young 1965).[4] In March 1968, a series of studies by the Committee for Research and Technology Policy raised the alarm (OECD 1968). These studies shifted the discussion from the elite circles of experts in parliaments, committees and work groups to the mass media. In 1967, Jean-Jacques Servan-Schreiber, *Le Monde* columnist and editor of the news magazine *L'Express* and the business journal *L'Expansion*, coined the phrase "the American Challenge". He kept reiterating the findings of the OECD study: "In the industrial war now being waged the major battle is over computers. This battle is very much in doubt, but it has not yet been lost. […] What we do with computers will tell us whether Europe is still alive!" (Servan-Schreiber 1968: 147f.)[5] In West Germany, this discourse on "Americanisation" and "closing down sale in Germany" (Blauhorn 1966: 240; Blauhorn 1970; Steinbuch 1968) as a result of IBM's triumphant success caused a stir. "Buy German" was the order of the day.[6] While people were largely in agreement over the *reaction* to the supposed calamity, opinions about the *causes* of Europe lagging behind in computer production diverged greatly. While the OECD stated that there was a lack of "innovation capability", John Diebold, head of Diebold Management Consulting and adviser to the US State Department attributed this gap above all a failure of "management" (Diebold 1968; cf. Hilger 2004a: 69–87). Equally, Gerhard Stoltenberg, the German Minister for Research, who supported Servan-Schreiber's plea for an "effective Federation of Europe", interpreted the "technological gap" as a "political" one (Stoltenberg 1968a: 154f.; Berger 1968).[7] His concept of a "new research policy" recognised that the development of several data processing systems was indispensable for research and economic policy.[8]

In the USSR, on the other hand, the concept of an enduring technology policy was an integral part of the promised "scientific and technological revolution". At the same time, there was a controversy about the

relationship between innovation, intuition and planning (Hoffmann 1978: 622). This debate, which looked at the general framework and conditions of cutting-edge research, more than anything set the tone for the academic discussion about innovation in the GDR (Haustein / Ivanov 1979; Haustein / Maier 1985; cf. Rupp 1983). In the East German press, the problem of the technological gap was primarily discussed as a phenomenon of foreign capitalist countries. The Secretary of the Central Committee, Erich Honecker, was quoted by the newspaper *Neues Deutschland* as saying, "the leading role of the Soviet Union in many areas of academic and technical progress" and the "world class status" of research in the East was indisputable (Honecker 1967: 3). A sizeable level of furore was created primarily by the memorandum of the Russian nuclear physicist and dissident Andrei Sakharov. In his view, the USSR could now only really overtake the USA "in some of the old, traditional industries [...] [whereas] in some of the newer fields—for example, automation, computers, petro-chemicals, and especially in industrial research and development—we are not only lagging behind but are also growing more slowly, so that a complete victory of our economy in the next few decades is unlikely" (Sakharov [1968] 1973: 68). Naturally, the GDR's leadership had a different view. Walter Ulbricht calculated that "with research organised correctly" the gap could be bridged within "a relatively short time" (Ulbricht 1969: 3f.). This would be possible because, according to Ulbricht, in contrast to the capitalist enemy of the people, the socialist state was "correctly programmed" (Neues Deutschland 1970: 7). But, it was claimed, there were differences in mentality. They were given as the reasons why the GDR was lagging behind the US, namely out of a propensity for "traditional behaviours now surpassed, old habits" and the "notion of carrying out important development works at a steady pace, as it were, one step after another, without taking into account, that the development of technical research was progressing at increasing speed elsewhere in the world." In short, Ulbricht changed the meaning from "technological gap" to "ideological gap" (Ulbricht 1969: 3f.).

## 3. European Perspectives and National Exceptions: Technology Policies in the Cold War Era

### a) Supporting the Progress of the IT Industry in West Germany

In the Federal Republic of Germany, a concerted effort to promote data processing began in July 1967.[9] In a "memorandum" of the same year, Stoltenberg emphasised the meaning of promoting IT nationally: "Until very recently, data processors were almost exclusively used to carry out calculation tasks for academics, engineers or accounts [...] only more quickly and with fewer mistakes than humans can." Since then, however, computers have come a long way towards becoming "active partners" in everyday life:

> They take on the role of a teacher, passing on fundamental knowledge through exercises, and that of a nurse, monitoring the vital functions of the critically ill. They are included in the way businesses and public administration are organised, by fulfilling their basic tasks, collecting, transmitting and summarising information. In manufacturing, they regulate the machines and on the street, the traffic. (Stoltenberg 1968b: 139)

In connection with the German Research Foundation's basis programme on "information processing", the West German government established a system to promote academic teaching and research in the field of computer technology, which was supposed to apply to both the development of IT infrastructure and the application-based training of IT workers. Between 1967 and 1977, three public subsidy programmes were implemented. They amounted to around 3.7 billion Deutsche Mark (Wieland 2009: 155). From the outset, Siemens and AEG were among the largest beneficiaries. In the first IT programme, 87% of the funds went to the two manufacturers; in the second programme, their share was still 68%. The promotion of individual companies and large computing businesses

proved to be a failure and the public became noticeably more critical when success of this policy failed to materialise and the economic crisis hit. During this time, the Ministry of Research started to devise plans to bring the two industry leaders together in one union ("Großrechnerunion"). This approach petered out just as quickly as all comparable initiatives to establish a "Deutsche Computer AG" (Hilger 2004b: 338).

With great pathos, the critics of this model of national "champions" evoked a common European "spirit" (Bößenecker 1974). In fact, from 1971–72 three of the largest European computer companies—Siemens, CII and Philips—were negotiating the conditions for the creation of a European computer business, Unidata. However, the consortium established in 1973 proved to be fragile and broke up after almost two and a half years, when the French Compagnie Industrielle pour l'Informatique (CII) withdrew from the union. Under President Giscard d'Estaing, the French government preferred contracts with US manufacturers over the European solution. In the spirit of Charles de Gaulle's national *plan calcul*, on 20th May 1975, they agreed the merger of CII and Honeywell-Bull (Griset 1999; Hilger 2008: 143f.). The vision of a European IT company as a "bastion" against the overly powerful IBM had failed before it had begun.[10] In particular the supranational structure of the organisation proved to be a trial of strength, which in the end was beyond the capacities of the businesses involved (Kranakis 2004: 233–237). The British position attracted particular attention. The British Minister of Technology, Anthony Wedgwood Benn, gave a speech to the German Council on Foreign Relations on 20th February 1968, outlining the way to a pan-European solution to the technological question with the foundation of a "European Institute of Technology".[11] However, in the aftermath of the ill-fated EC accession negotiations, all plans aimed at strengthening the European Economic Area broke down. Thus, Unidata ended in a fiasco.

It lasted until the start of the 1980s, that is until the implementation of a new, concerted European initiative to promote cooperation in the IT sector.[12] This new policy chose not to support established companies,

but followed the successful American model of supporting smaller start-ups. Hence, on 13th December 1983, the West German Foreign Minister, Hans-Dietrich Genscher told the general meeting of the Confederation of German Employers "if we do the right things, then Silicon Valleys are also possible here". He was encouraging them to emulate the model of the US high-tech region (Genscher 1985: 422). In the mid-1970s, the "technological avant-garde" of the Bay Area had become the central point of reference for West Germany's enthusiasm for technology (Held 1976: 6; Helmer 1978: 15; Gaul 1983: 34). American success originated primarily in the "military-industrial-academic complex" of the high-tech region, but public debate in West Germany focused predominantly on the new influence on the state-funded research and technology policy and in particular on the venture capital factor (Sternberg 1998: 300ff.). Nevertheless, in the mid-1980s this enthusiasm remained strong. There were only small pockets of criticism of Silicon Valley companies' capitalist drive for performance, the extraordinary stress levels, the drug excesses and often shattered family structures, but also for the moral conflicts of the information technologists (Der Spiegel 1984: 66–77; Rügemer 1985; Herding 1985: 60). In 1983, in an interview with the *Bild der Wissenschaft* magazine, the German Minister for Research Heinz Riesenhuber enthused about the mythical *Valley of Silicon*: "When you see, how in and around American research centres, such as the "Silicon Valley" in California, young researchers spontaneously found new companies, in which they quickly put into practice what they have learnt about technology and the workplace in these centres: it can make you envious." (Riesenhuber 1983: 58) The challenge was that the myth of the start-up in a Californian garage, encouraged by the local subculture, did not apply to the realities of the West German research and technology sectors. Until the 1980s, the IT sector was dominated by a handful of established companies which had evolved over decades.

Nevertheless, the government, spurred on by the ever rising media euphoria, benefited from the credo "small is beautiful" (Schumacher

1973; cf. Gall 1999: 135f.). With the foundation of the German Venture Capital Society (Deutsche Wagnisfinanzierungsgesellschaft, WFG) in 1975, a first step towards the provision of risk capital was made. The capital was provided by 27 credit institutes, whose commitment was guaranteed against losses of up to 75% by the West German government. The WFG took stakes in the innovation plans of small and medium-sized enterprises by acquiring business shares, which a company's shareholders could buy back once their plans had been successful. Clearly, the government was striving for a proportionate method of supporting these young companies. In the first 18 months, 167 ideas out of 600 applications seemed testworthy. Of these, only three received investment from the WFG, as Volker Hauff, parliamentary secretary of state in the Federal Ministry for Research and Technology reported to the *Frankfurter Allgemeine Zeitung (FAZ)* in March 1977. In the *FAZ*'s series, "innovation—preserving by changing", Hauff pointed to the increasing significance of "promoting innovation" in small and medium-sized businesses after years of hesitant federal venture capital investment (Hauff 1977: 3). The WFG promoted primarily start-ups in the high-tech space: around 32% of support went on applications from the information and communications sectors (Gaida 2002: 238; Mayer / Müller 1991: 37f.).[13] Admittedly, the risks were high. Only eight of the nearly sixty investments brought in any profits once the government had sold its stake back. Frequently, the "Wagnis Gmbh" had to prepare for the disproportionate demands of supposedly "ingenious inventors" (Blüthmann 1975: 22). Thus, the failure rate of the projects support by a total of nearly 70 million Deutsche Mark of investment capital was a considerable 30%. Nonetheless, the creation of the WFG was an expression of the gradual shift towards a coherent West German innovation policy at the end of the 1970s (Trischler 2001: 63).

### b) The Innovation of Copyists: Promoting IT in the GDR

Rather than Silicon Valley, the GDR looked towards research institutions in the East as role models. Among these models for the East German data

processing industry were the computer science institutes in Moscow, Minsk and Kiev. In this area, the West and East German myths of the computer as the technology of choice for the future bore a strong resemblance. Computer scientists in the East soon took on the mantle of "magicians" and "sorcerers" (Stern 1956: 11; Beckert 1968: 4). Between Western and Eastern Europe, and to the greatest extent between West and East Germany, an innovation gap had been growing since the mid-1950s that could no longer be put down to the greater war damage in the Soviet Occupied Zone. The 1960s saw the increasing economic isolation and a lack of "world market integration" of the Soviet Bloc states. This, more than anything else, prevented them from catching up technologically. In the West, the participation in the global market, the support through technology transfers from the US and finally the implementation of regulatory measures, among them the European Recovery Program, had set the dormant West German economy on an upward trajectory (Hardach 2000: 200ff.). In the GDR, which had been weakened by the dismantling of vital infrastructures, the exodus of its elites and the relocation of businesses, this type of support was conspicuous by its absence. New research emphasises the meaning of "innovation blockades". This was the reason why the GDR, as Johannes Bähr argues, was above all lacking the flexibility required to react adequately to unexpected circumstances and exogenous shocks (Bähr 2001: 38–42; Augustine 2007). For example, in microelectronics, the West Germans acted considerably faster than the East German planning authority and companies. This proved to be the case, particularly as the development of a self-sufficient national microelectronics industry suffered through the failure to create an effective division of labour with the Council for Mutual Economic Assistance (COMECON). The "refusal to co-operate" (Barkleit 2000: 28) of individual Bloc states slowed such processes significantly. Thus, despite extensive technology imports, COMECON countries could not keep up with the digital revolution in the 1970s. The strategy was to outdo the West by importing fully developed technologies and the "avoidance of detours" involved in

research (Buchholz 1975) — in order to, in the spirit of Ulbricht, "overtake capitalism without catching up to it" (überholen ohne einzuholen).

Pioneering work had also begun in the GDR during the 1950s. The starting gun for promoting computer science and data processing was fired in December 1963 by a resolution of the Council of Ministers on "immediate measures for the development of data processing". Within a year, the government committee of the Socialist Unity Party of Germany prepared a "Programme for the development, introduction and implantation of machine data processing in the GDR". This also encompassed a plan for information technology training within universities. The "Kader" working group conceived study programmes, designed to train more than 25,000 specialists for the production and maintenance of computing machines. Of those, the bulk would be skilled workers employed in computer installations. The technocratic belief in the GDR's victory in the "battle" of the systems was at its height during these years (van Laak 2001: 100f.). In June 1970, a "Programme for the Development of Electronic Components and Devices" (Sobeslavsky / Lehmann 1996: 59–78) followed. As a result, the promotion of IT became a cornerstone of the "New Technology" and the "New Economic System of Planning and Direction" since 1963 (Steiner 2001; Cortada 2012).[14] However, the leadership's planning soon reached its limits. The GDR possessed its own means of microelectronics production. Within the terms of the multilateral treaty on computer science (ES EVM) between the People's Republics of Hungary, Bulgaria, Poland and the USSR, the GDR's production capabilities contributed to the manufacture of production lines in both mainframe and microcomputer technology. This expressed itself in the creation of a "Unified System of Electronic Computers" (ESER), which was intended to compete with the IBM System/360. The COMECON countries also undertook successful experiments in the 1960s and 70s in the fields of data transmission technology and computer networks, in particular within the large research institutes. However, in practice, an ability to improvise was required. Cooperation agreements with hardware manufacturers "behind" the Iron Cur-

tain rarely succeeded (Herrmann 2012: 223f.). If personal tensions and a lack of clarity had already restrained a large proportion of the workforce,[15] in the mid-1960s, the increasingly efficacious stipulations as a result of the West's high-tech embargo dealt the East German computer industry a heavy blow (Donig 2009: 95ff.).

As the gap between the GDR and its Western competitors (especially market leader IBM) grew larger, the party leadership sought ways and means to get around the restrictions of the embargo. The Ministry for State Security (Stasi) devised new strategies. From 1960, the Stasi had an "informal collaborator" in Munich, who reported as IM "Sturm" from IBM's Munich office and the factory headquarters in Sindelfingen. After his emigration to the West, "Sturm", alias Gerhard Arnold, had risen through the ranks of the company. Within ten years, he climbed from being an assistant to computing specialist, systems analyst and key accounts sales manager to the head of systems analysis and head of sales. Through him, until the mid-1960s, the GDR's foreign intelligence service was able to foster a "source location in a position vital to the development of computers". The Stasi achieved this with "many years" worth of IBM development documents placed at their disposal immediately, which could be evaluated and prepared for their own development" (Müller / Rösener 2008: 78f.).

After leaving the company in 1970, Arnold founded a management consultancy. He continued to provide the GDR intelligence service with further information and international client contacts.[16] At first, he had merely sent material that had already been published and that IBM provided to its clients for marketing purposes or in the process of marketing mainframe systems. Later, in a somewhat foolhardy endeavour, he transmitted detailed technical documents and precise construction diagrams, which were necessary to reproduce individual machines such as the IBM/360. In doing so, he undermined the requirements of the 5th Plenary of the Central Committee. Its stated intention was to "develop a socialist enterprise, which can compete with the largest foreign capitalist

enterprise, IBM".[17] Notwithstanding the official propaganda, the GDR's leadership was sceptical of its own IT sector's prospects, as documented by an internal memo dating from June 1965. It stated that, as in the field of organisational technology, the sector had "great difficulties, which had their causes in our all too narrow experience". The planning and development of "mid-sized data processing systems" had "begun rather late" and the work which needed tackling had been "underestimated". Supposedly, a "danger" existed that the use of data processing systems in the years to come would remain hesitant "due to a lack of knowledge" and result in massive "losses". The authorities succinctly concluded that, "the sourcing of wide-ranging documentation from foreign capitalist countries can aid us to solve this problem".[18] Yet a gap remained to the world class "that cannot be closed even by 1970".[19] This was also visible in the number of IT systems installed. In May 1978, the GDR counted around 680 computer systems and 1,900 microcomputers. In West Germany, there had been 17,000 computer systems in the year before (in 1977 alone 300 systems were added) and 17,000 microcomputers (Hübner 2014: 205f.). In the United States, at the turn of the 1970s, almost 70,000 processors had been installed (Leimbach 2010: 99). At the beginning of the 1980s, the number of computers produced in the US exceeded a million. In the field of industrial robotics, the gap was equally as wide.

The realm of home computing spelled the next disaster. The "Resolution on Acceleration, Production and Application of Microelectronics in the GDR" dating from June 1977 was too late to turn the ship around. On the 1st January 1978, the state microelectronics holding company in Erfurt outlined its responsibilities in this area. Here, likewise, "development based on foreign models" led to a strategy of "re-invention" and "reverse engineering". This only cemented the gap between the East and the West.[20] The hunt for the 1 megabyte chip was emblematic of this. Although it was monitored with great enthusiasm in the GDR, it ended in a fiasco, as well. When the memory chip was finally presented in 1988, it was hardly state-of-the-art by this point. In order to be mass produced,

the chip needed the Toshiba model and thus a newer import of Western technology (Klenke 2008: 58–63; Macrakis 1997: 80–85).

## 4. Conclusion

In the case of West Germany, the steps towards a common IT policy paved the way to European integration. Despite all the differences of opinion that remained, the British Minister of Technology, Anthony Wedgwood Benn, saw the computer as a vehicle for international cooperation. For him, the "infrastructure of information transmission" was a central "nervous system" of modern, increasingly globally networked societies.[21] Admittedly, the innovation culture of the 1960s and 1970s was largely a reaction to the "American Challenge". In promoting IT, however, European initiatives also started to gain traction. In spite of all the enthusiasm for a model of European unification, reservations about convergence and abandoning the self-sufficiency of a nation state at once gained the upper hand (Ambrosius / Franke 2013: 13). The case of the GDR impressively illustrates that the persistence of national data policies, which were in conflict with the standardisation of the organisational, technical and institutional requirements of computerisation, remained efficacious. During the Cold War, this influence was felt well beyond the borders of the Eastern Bloc, particularly in the "effects of the emergence of computerisation" and the "imponderability of development". National data policies would soon neutralise the best laid plans of technocrats. Nevertheless, in the 1960s, societies run by state socialism had begun to enter the information age, employing huge financial and personal resources. The promotion of computer science and data processing in the countries of the Eastern Bloc was carried out with similarly ambitious research programmes and initially cycles of innovation comparable to Western Europe. Moreover, in the GDR the cybernetics boom advanced the establishment of information technology (Danyel / Schuhmann 2015: 299). Fatal political decisions, the obstacles of bureaucratic planning, conflicts within collaboration and the division of labour within the COMECON,

and finally above all the lack of funds for investment impeded the process. The following, however, was true for both East and West: the digital "lift off" was the result of complex social agreements. Future researchers therefore will have to take further actors into account. Along with the users of computer technology in both the public and private sectors, managers, lead engineers and IT specialists in up-and-coming computer industries had a significant impact on the way cultures of innovation evolved.

## Notes

1 Where applicable, German quotes have been translated into English.

2 Integration was the stated aim of West Germany's European policy. At the same time, the turbulent years of the 1960s and 70s proved to be a "period of crisis for European unification" (Bührer 2000: 248).

3 For this reason, at the Centre for Contemporary History in Potsdam, currently several studies on the social history of computerisation in West and East Germany carried out under the direction of Frank Bösch are taking shape. Among the topics covered are the adoption of the computer in policing and the secret services, hacking as a subculture, the digitisation of the banking sector as well as the introduction of computers to governmental administration.

4 In the 1950s, IBM alone received nearly 400 million US dollars from the government; therefore, around 70% of its R&D expenditure was funded by the state. Over the decade, the United States invested around 135 million US dollars per annum to promote IT research. Thus, in 1963, the government contribution to R&D expenditure in the US was 61.8%. In the United Kingdom it was 36%, in France 30% and only 4% in Germany (OECD 1967).

5 The OECD reinforced the concerns: "The computer industry is the key element in the information revolution, just as the steam engine was the key element in the industrial revolution. Its importance lies not only in its economic output, which is already considerable, but in its far-reaching effects on the whole economic, industrial and social structure of a country." (OECD 1969: 15) See OECD Archives. Secretary-General's Speeches. "L'écart technique entre l'Europe et les Etats-Unis" (10.11.1967).

6 Siemens Corporate Archives. SAA 35–77 Lp 5, Pos. 537–540; SAA 35–77 Lp 75, Dr Heinz Janisch, Folder 3.

7 The demands for a stronger federal engagement in research policy and the calls to end the "laissez-faire eco-

nomic policy" had its origins in the zeitgeist of the devotees of central planning. BA Koblenz B136/5978. In the "long" 1970s, however, the meaning of "gap" immediately evolved to express a recognition of the crisis. This was defined by the "Age of Uncertainty" announced by the economist, John K. Galbraith (Geyer 2016: 283–287).

8 BA Koblenz B138/5531, f. 370, and B138/5532, f. 40ff.

9 The allocation of federal funds for academic research followed a programme which had been agreed with the federal finance minister on 17 July 1967. This was done according to the concept adopted by the Cabinet Committee for Academic Research, Education and the Promotion of Training in April 1967. BA Koblenz B138/5531, f. 6.

10 Siemens Corporate Archives SAA 21945; 22839; 22519; 22640; 22752.

11 Benn placed great emphasis on the importance of potential cooperation in the field of technology. He saw it as a "way Europe's wounds can be healed and a way that our old, creative continent can gain new strengths". Benn: "Technologie und Politik", 20.02.1968, p. 15f. BA Koblenz B136/5978. In a similar way, the British Prime Minister Harold Wilson pleaded for the establishment of a new "technological community". In this context, the Italian leader, Amintore Fanfani initiated a discussion about a "technological" re-vamp of the Marshall Plan.

12 The FAST-Program was the first approach (Forecasting and Assessment in the Field of Science and Technology) from 1978–1983. In the IT sector and until 1998, the European Strategic Programme for Information Technology (ESPRIT) defined research cooperation as a network of the 12 largest electronics companies.

13 On the WFG's processing of allocation risk capital, see for example the protocol of the Selection Panel: BA Koblenz, B 196/19898–19900 and B196/73733.

14 In the "societal evaluation of innovations", GDR journalism drew a sharp distinction between capitalism and socialism. "Discovering, inventing, and promoting new things all round and using them productively" was "not a task, divorced from the people and for a small number of specialists or researchers". Instead, it was "required by social economics". They said the West took "the individual calculations of private capital as its starting point" for making evaluations and therefore forgot the "social and economic consequences" of innovation. This was especially the case in its "aggressive pursuit of defence R&D". Meanwhile, socialism understood, as the story went, "the development of science and technology" precisely in the "creative collaboration of the workers in the working out of and realisation of plans" as a motor of the common "societal progress" (Hartmann 1981: 7–33).

15 Nevertheless, there were successful technological research initiatives both inside the Bloc states and between East and West. See for example Sächsisches Staatsarchiv Dresden 11594 VEB Kombinat Robotron, Nr. 395; 1625; Institut für Datenverar- For his services, Arnold received the Friedrich-Engels-Prize and the GDR's Medal of Honour. In the wake of the unmasking of the Stasi's agent handler, Werner Stiller, 15 high-ranking officers and operations were revealed. Altogether, the informal collaborator "Sturm" had operated as a spy for nearly 20 years. After the end of his detention at the end of the 1970s, he was sentenced to 2 years. According to Stiller, Arnold as well as Wilhelm Paproth, another IBM employee (codename "Wolfgang"), were "without exaggeration the fathers of the data processing machines in the GDR" (Stiller 1986: 198–209; Der Spiegel 1992: 123).

17 BSTU MfS HV A 830, f. 99.

18 BSTU MfS HV A 593, Part 2, f. 388.

19 BSTU MfS HV A 594, Part 2, f. 431f.

20 With resignation, the Stasi, holding the technology portfolio during the embargo, had to declare that "in the GDR the know-how is not available to master comprehensive systems design of complicated micro processors". BSTU, ASt. Erfurt, Abt. XVIII, No. 7, f. 18–21. The copycat strategy was not unique to the East German IT industry. In Western Europe, this strategy and its form of "reverse engineering" were also very commonplace.

21 Benn: "Technologie und Politik", 20.02.1968, p. 8. BA Koblenz B136/5978.

beitung: "Plan Neue Technik". A comprehensive history of the German computer industries remains to be written.

16 BSTU MfS HV A 593, Part 1, f. 108–110. On Arnold's mission, see BSTU MfS HV A 593, Part 1, f. 194–205.

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# Home Computer on the Line - The West German BBS Scene and the Change of Telecommunications in the 1980s

Matthias Röhr

## 1. Introduction

On the evening of 16th June 1987, the system operators of five German bulletin board systems (BBS) received unexpected visitors. Accompanied by the police, officials of the "Deutsche Bundespost" (Federal Post Office) searched the homes of the juvenile computer enthusiasts for evidence of violations of the "Fernmeldeanlagengesetz" (Telecommunications Device Act), in particular the connection of modems or acoustic couplers to the telephone line without official postal approval. The postal officials seized the devices and the home computers (Chaos Computer Club 1987).

The young people visited by the Bundespost had experimented with their home computers. They had connected them to the telephone network to enable other home computer owners to call them and exchange data and texts via the telephone line. Thus, the home computer was no longer just an isolated device, but a communication tool from which the callers could connect to each other. On such a bulletin board system, home computer users could exchange files, have discussions and gain access to information otherwise difficult to get.

For some politically-minded computer enthusiasts of the 1980s like the members of the Chaos Computer Club in Hamburg, BBS seemed the ideal medium for a "digital counterpublic". BBS were a freely accessible and non-censorable medium, ideal for publishing politically relevant information which otherwise would have remained unpublished. BBS and

electronic telecommunication therefore had a huge democratic potential for them.

However, these computer enthusiasts were not the only group with great hopes for the future of telecommunications. Nationally and internationally, telecommunications was considered a key economic playing field of the future. The West German government had its own plans for the future of the sector: in its view it was crucial to secure the long-term international competitiveness of the West German economy. The hobbyist computer networking from below was difficult to reconcile with these plans.

For several years now, home computing and computer networking in the 1980s has attracted interest from historical researchers. In the United States in particular, the history of the Internet—from the military-inspired ARPANET of the 1960s to computer networking in the 1990s—has recently been complemented by research into the diversity of private and commercial computer networking in the 1980s that created the basis for the breakthrough of the Internet in the next decade (Campbell-Kelly / Garcia-Swartz 2013; Haigh / Russel / Dutton 2015; Driscoll 2014).

In this paper, I will explore the relationship between the West German hobbyist computer scene and the state, represented by the monopolist Bundespost, in the field of telecommunications. First of all, I will give an overview of how the BBS scene in the United States developed and how this practice was adopted in West Germany. In the second part, I will focus on the structural change in telecommunications in the 1970s and 1980s and the ensuing reaction of the West German federal government. I will conclude by tying both developments together.

## 2. The emergence of the BBS scene

In the 1960s, users discovered that computers were an ideal and powerful means of communication. Through the development of timesharing, a broader group of people gained direct access to computers. They soon developed the ability to communicate with each other on the same

system and to share data, programs and more or less private messages (Siegert 2008: 107).

From the mid-1970s, the microchip and the home computer brought simple and affordable devices into many US middle class households. The possible applications of these home computers had not been fully defined in the first years. What you could do with your own computer was an open question for the first owners of these devices. Connecting the computer to the telephone network was an obvious possibility, because many of the first computer users in the United States were "phone freaks" (Lapsley 2013) or ham radio enthusiasts, thrilled by communication.

The first electronic bulletin board on a home computer was connected to the telephone network in Chicago in early 1978. This BBS enabled callers to exchange and discuss messages with each other. Using a home computer in this way proved to be successful in the US. During the 1980s, the number of privately operated BBS increased. In the early 1990s, at the peak of the American BBS scene, between 90,000 and 150,000 private bulletin board systems existed in the United States (Sadofsky 2005: Ep. 1). In addition, there were a number of commercial online services such as *CompuServe*, which in 1979 made their business-oriented timesharing service available for home computer users. (Campbell-Kelly / Garcia-Swartz 2008), or, more prominent in the Californian subculture, the bulletin board *The WELL* (Turner 2005).

Turning the home computer into a communication medium would not have been possible without the openness of the US telephone network. In the United States, unlike Germany, telecommunication systems were not a state-owned monopoly. The operator, AT&T, was a privately-owned company, whose monopoly was regulated by the Federal Communications Commission (FCC). Since the 1950s, the FCC had restricted AT&T's monopoly constantly, as new technologies, such as microwave radio relays, created alternatives to the unwanted monopoly.

A milestone in the regulation of AT&T's monopoly was the so-called Carterfone decision of 1968. This decision forced AT&T to abandon its mo-

nopoly on terminal equipment such as telephones and modems, and ordered the company to allow the connection of all kinds of devices as long as they did not interfere with their telephone network. This led to the development of new types of devices, which expanded the functions of the telephone network, for example fax (Coopersmith 2015: 105) and answering machines. In 1976, a young company called Hayes started to sell inexpensive modems, aimed especially at the booming market of home computers. To protect the business interests of smaller companies, the FCC also instructed AT&T to stay out of data processing (Wu 2012: 228).

In the early 1980s, when home computers became available in West Germany, their connection to the telephone network had already become a part of their established usage. However, the practice of home computer-based BBS was affected by the structure of the German telecommunications sector that differed from the United States. At the beginning of the decade, the telecommunication monopoly was very comprehensive, even though the criticism of the extensive activities of the state-owned Bundespost was growing (Monopolkommission 1981).

Among the critics of the strict German telecommunication monopoly were members of the young German hacker scene close to the Chaos Computer Club (CCC) in Hamburg, which was influenced by the left alternative milieu. In contrast to other critics, which were usually economically oriented, the CCC's objections were based on the practice of alternative media by left-wing groups. In addition to traditional approaches, the alternative media movement of the 1970s had already been experimenting with new technologies such as video. These were seen as an option to counter the manipulative power of television (Büttner 1979).

The German hacker scene applied the practice and the discourse of alternative media to the home computer and bulletin board systems. In doing so, the CCC's members developed a negative attitude towards the German telecommunication monopoly, which they regarded as a violation of the constitutionally guaranteed freedom of speech and freedom of the press (Chaos Computer Club 1984a). Therefore, the CCC indirectly en-

couraged the public to defy the German telecommunication laws by publishing a blueprint for a modem not approved by the postal service (Chaos Computer Club 1985).

With its focus on computers, the club differed from most of the German left-wing milieu in the early 1980s. Rather than seeing computers solely as a dangerous instrument of power with the ability to control and manipulate people, the CCC viewed them as some sort of neutral amplifiers. Their use did indeed entail the risk of making dominant institutions, such as the government, even more powerful. But by a creative and decentralised usage, computers also offered powerful opportunities for alternative structures (Schrutzki 1988: 168).

This twofold potential of computers required a precise analysis of their usage, including technical details. For example, the club rejected the German "Bildschirmtext" (teletext), introduced in 1984, because it was a central system that granted the Bundespost full control of content and communications, while forcing users to be passive consumers (Chaos Computer Club 1984b). In contrast, the CCC viewed privately-owned bulletin board systems as a democratic medium, because they were decentralised and free to use for everyone who wanted to publish information.

This perspective on computers led to a fundamental criticism of centralised systems for unnecessarily restricting the options of users and their devices. The telephone network of the 1980s, on which BBS were based, was a highly centralised system, which now came under pressure from technological change.

## 3. Structual change in communications

To understand the West German government's telecommunication policy in the 1980s, two developments are paramount.

The first dates back to the 1960s and is based on the debate concerning the "technological gap" between the United States and Europe (Bähr 1995). Following a report published by the OECD (OECD 1968) and an influential book written by the French journalist Jean-Jacques Servan-Schrei-

ber (Servan-Schreiber 1970), European governments feared a non-recoverable lead of the United States in the field of high technology. In reality this gap only existed in the aerospace and computer sectors, but the debate in Europe was very effective and led the German government, among other activities, to set up funding programmes for data processing research (Pieper 2009). The main objective of these funding programmes was to create a German (and European) equivalent to the US world market leader, IBM (Gall 1999). Despite the German government's massive financial support, which mainly went to the "national champion" Siemens, the technological and economic advantage of the US IT industry grew further and further during the 1970s (Rösner 1978).

The economic crises of the 1970s exacerbated the perception of a German weakness on the IT market, as data processing was seen as an area with the potential to create high economic values with little use of energy or other resources. The crises also prompted the formulation of a new economic policy concept. Under the term "Aktive Strukturpolitik" (active structural policy), the German government discussed the idea of the state assuming a stronger role in managing structural change in the economy. The goal was to secure the competitiveness of the German economy on an international level (Hauff / Scharpf 1977; Hartwich 1977; Scholz / Thalacker 1980).

The second important development was the convergence of telecommunications and data processing since the early 1970s. The recently emerged computer manufacturers focused more on data communication, while the established telecommunications industry was increasingly dependent on digital technology. As a "newcomer" in telecommunication, the computer industry questioned established structures and the distribution of profits on the telecommunications markets. At the same time, the telecommunication equipment suppliers suffered increasing economic pressure because of high development costs and rapid innovation cycles. Their traditional domestic markets had become too small to support the costly and fast-paced changes.

Simultaneously, the network providers attempted to benefit from the growing revenues of data transmission by expanding their monopoly in this area. They feared that the market for analogue telephone line connections would soon be saturated (Werle 1990: 212). Their situation was further aggravated by the development of new communication technologies, such as satellites and radio relays. These weakened their key argument that only a monopoly structure could guarantee the most efficient outcome in telecommunications.

An example of the IT industry's commitment to telecommunications was IBM's entry into the development of communication satellites in 1974. Together with their SNA network protocol, which was presented almost at the same time, this advance could be seen as a planned attack by the IT sector's market leader on the telecommunication industry, especially on AT&T leased line services for business consumers.

A second example of the evolving conflict between the IT and the telecommunications industry was the debate about the standardisation of X.25, the telecommunication providers' first international data communication standard in 1976. Despite the IT industry and research community's demands to realise a more flexible network concept based on datagrams, the telecommunication providers designed X.25 as a virtual connection, which secured their control over data transfers in their networks (Russel 2014: 171f.).

Summarising the situation at the end of the 1970s, the West German government saw the economic power of the US IT industry as a growing threat. At the same time, telecommunications became increasingly important for the future of data processing. In this area, through its telecommunication monopoly, the state still had significant influence.

In France, where the situation was similar to Germany, the government officials Simon Nora and Alain Minc suggested in their report "The computerisation of society" that the French government should use its influence on telecommunications to strengthen the national economy and, in particular, to reduce the national dependency on IBM (Nora /

Minc 1979). The idea of using government influence to strengthen the national telecommunications industry also appealed to the German government, in particular because, at the end of the 1970s, telecommunications was still seen as one of the German economy's strong sectors with a high export rate (Graffe / Bilgmann 1980: 242; OECD 1983: 24). It seemed particularly promising to use the German Bundespost to modernise the economy. In 1980, the Bundespost was one of the largest investors in the Federal Republic, with an investment volume of 10 billion Deutsche Mark (Schmahl / Wohlers 1987: 375). To transform the Bundespost into a driving force of economic structural change, the well-established relationship between the Bundespost and its long-time hardware suppliers under the leadership of Siemens had to change.

During the 1970s, the Bundespost had expanded its monopoly to the field of data processing, which led to accusations that it was complicating and obstructing innovations in this area. A complaint case filed by companies before the "Bundesverfassungsgericht" (German Constitutional Court) against the monopoly on modems was dismissed in 1975. However, in this case, the legitimacy of the monopoly was not the issue in question. The Constitutional Court only clarified that the effect of the monopoly on modems, which was de facto a ban for others to enter the market, had a constitutional basis (Scherer 1985: 613).

In spite of this indirect legal confirmation, at the end of the 1970s, criticism concerning the monopoly structure of the German telecommunications industry grew (Monopolkommission 1981). The Ministry of Economics, led by Otto Graf Lambsdorff, a member of the liberal party FDP, questioned in particular the Bundespost's monopoly. Lambsdorff's idea was to reduce the economic activities of the state and to create new lucrative markets for innovative German electronics companies, for example Nixdorf. In 1979, he prevailed over Postal Minister Kurt Gscheidle: following an agreement between the two politicians, the Bundespost voluntarily limited its monopoly and committed to cap its market share for

telefax machines to 20 percent, leaving the rest of the market to private companies (Werle 1990: 239).

The conflict behind this concession touched a core issue for the future of telecommunications: the development of semiconductor and computer technology facilitated new forms of organising telecommunication in the 1970s. Before the microchip was developed, it made sense economically to concentrate the expensive logic at a central location inside the communication network. But the chip made it possible to move more tasks and features from the network to the terminal equipment. This decentralisation created the opportunity to fundamentally change the balance of power in the telecommunications sector by enabling the creation of new services without the cooperation of the network operators. This posed a threat to network operators, as they were in danger of being excluded from the development of new and potentially lucrative telecommunication services and markets.

Telefax is a good example of this process: for the Bundespost, the introduction of the telefax service in 1979 implied that the revenues of the structurally loss-making "yellow" letter post might decline even further. As the fax machines were sold on the open market, the Bundespost also lost the lucrative monthly rental income it could have generated for renting out the equipment. Since the devices were connected to standard telephone landlines, it also lost the option of charging additional fees for specialised fax landlines. The Bundespost also could not benefit financially from further technological improvements, which would have made it possible to charge extra fees for future higher fax speeds. Instead, it only received the standard connection fees, while private companies marketed new paid information services via telefax (Coopersmith 2015: 145f.).

Consequently, for a long time, the Bundespost opposed any further liberalisation of its terminal equipment monopoly. In the case of fax machines, the company insisted despite the compromise that all fax devices had to be checked and connected by its own technicians (Bohm / Wolf / Nitsch / Burda 1980). The permission to connect privately-owned

modems to the telephone network, as demanded by the German hacker scene and some economic stakeholder groups, was only granted by the Bundespost in 1986 following external pressure from the European Commission. Pushed through by the CDU-FDP coalition government against the resistance of many Bundespost executives, the fundamental reform of the German postal system (Postreform I) finally saw the demise of the terminal equipment monopoly in 1990 (Witte 1987).

The debate about the terminal equipment monopoly illustrates the dilemma the German government and the telecommunications industry faced in the 1980s. On the one hand general trade policy required the liberalisation of the telecommunications market. Failure to achieve this threatened to exclude German equipment manufacturers from other lucrative world markets, especially the United States. On the other hand stakeholders feared that a liberalisation of the German telecommunications market would primarily benefit foreign companies. This fear was not unsubstantiated: in the mid-1980s, Japanese companies had already achieved global market leadership for fax machines (Coopersmith 2015: 157), and most modems were produced by US companies.

In this situation, the international standardisation of data transmission according to the OSI model and the complete digitisation of the telephone network using ISDN seemed to provide a solution. It was hoped that ISDN and OSI as comprehensive standards for data telecommunication would revert the conditions of the telecommunications market in favour of the traditional telecommunications sector by reducing the development costs and the speed of innovation and at the same time increasing international sales opportunities (Cowhey and Aronson 1986). It was thought that, because of the pioneering role of Germany, especially in the development of ISDN, and the Bundespost's purchasing policy, the international competitiveness of the German manufacturers in particular would benefit from this process (Gottschalk 1991).

There is some evidence that the effectiveness of this strategy had been weakened during the standardisation process of ISDN and OSI. For ex-

ample, the ISDN project manager at the Bundespost, Theodor Irmler, reported in 1987 that the Americans were only focused on defining the basic data transport services, giving the terminal devices a greater influence, while the Europeans wanted to standardise further aspects of the telecommunication services (Irmler 1987: 68).

## 4. Conclusion: The bulletin board scene in the structural change of telecommunications

To conclude, I will return the West German BBS scene. Bulletin board systems were the result of two overlapping developments: the first is the convergence of telecommunications and computing and the computing industry's attempt to compete for influence and, ultimately, revenue in the telecommunications market; secondly, the BBS stood for a change in the computer industry itself that created the personal computer and brought it into private homes. The basis of both developments was the introduction of the microchip which steadily reduced the costs of digital technology.

Due to the deregulated telecommunications sector, the use of home computers as private communication devices was fairly straightforward in the United States, but in West Germany the conditions were different. Here, the IT industry was relatively weak in comparison to the telecommunications sector, characterised by the state's monopoly.

In this situation, the German government used its influence on telecommunications strategically in favour of the German economy to compensate for the strength of the US computer sector. However, the use of home computers as a means of communication was in conflict with the aims of this government policy.

Unlike companies, which were obliged to adhere to the law, the subcultural hacker and BBS scene felt free to deal with the realities of German telecommunications. The scene practiced a "forward-looking approach to laws", as Wau Holland, an important figure of the scene, once phrased it, which meant simply ignoring the legal constraints of the telecommunication monopoly.

The hacker and BBS scene had other priorities than the German government. Its members focused on the technical possibilities and - from their point of view—the socially desirable values rather than the letter of the law. They simply adopted US telecommunication practices. For the members of the BBS scene, connecting home computers to the telephone network provided an opportunity to communicate independently. From this perspective, telecommunications was not a question of market share, but of freedom and power. The members of the scene wanted to make the unowned spaces created by technical progress accessible for everyone. They wanted them to be neither restricted nor left purely for economic exploitation. The practices of the BBS scene made this aspect of telecommunications finally visible, although there is little evidence to prove this had a direct impact on the political process. The transformation of telecommunications had already gained technological and economic momentum, making it difficult to control the result.

Bulletin board systems also epitomise a development in telecommunications which saw terminal equipment gaining importance, while the physical network receded. This development was strengthened in particular by the establishment of Internet Protocol (IP) as the standard for data transmission in the 1990s. As a pure end-to-end protocol, IP manages communication almost entirely at the terminal. The underlying network's role is reduced to delivering data packets (Bunz 2008: 83). The global success of the Internet Protocol therefore changed the conditions of the telecommunications market radically in favour of the US-dominated IT industry. For the time being, this put an end to all hopes that Germany or Europe would be able to compete in the telecommunications and IT sector.

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# And Postal Services? The Universal Postal Union and the Digitisation of Communication in the 1980s

Christian Henrich-Franke

## 1. Introduction

"The Post should not become the monopolist for slow mail."[1] In his opening speech to the 8th Electronic Mail Conference in Munich in September 1986, the German Minister for Postal Services and Telecommunications, Christian Schwarz-Schilling, used these words of warning to highlight the Post's decreasing importance in light of the possibilities offered by electronic mail services via digitised telecommunication networks. The conference was organised under the umbrella of the "Paris Group" which, since 1978, brought together postal administrations from the most technically advanced countries. The aim of their cooperation was to analyse how the digitisation of telecommunication and the introduction of new services impacted on letter post. The group addressed these challenges, which the Universal Postal Union (UPU) had largely ignored, despite being the major international organisation responsible for postal services. The 8th Electronic Mail Conference took place at a critical juncture in the evolution of electronic mail services, exerting pressure on the postal administrations to act more decisively and adopt methods of digitised communication to meet a growing societal demand. It was time for the postal administrations to keep pace and "venture into advanced services in order to maintain their share in the markets"[2].

In this paper, I will focus on how the postal administrations and their international organisations reacted to the digitisation of communication and in particular to electronic mail services, raising a number of ques-

tions: why, when and how did the postal administrations and their international organisations, the UPU in particular, respond to the digitisation of communication and the emergence of electronic mail services? Why did digital technology suddenly become a matter of urgency in 1986, after being neglected in the years before, especially by the UPU? What were the objectives the postal administrations could and had to pursue? And last but not least: what can the evolution of electronic mail services teach us about the broader context of the history of digitisation? By answering these questions, I will shift emphasis away from the computer and telecommunications sector to the monopolists for physical mail (letter mail).

Usually, postal and telecommunication administrations were combined within one common PTT (postal, telegraph, telephone) administration in the 1970s and 1980s. However, within these PTT administrations their business activities were strictly separated. In terms of their organisation, postal and telecommunication services were independent from one another; the specialist expertise required for the two services was also completely different. To understand postal administrations and their stakeholders, it is necessary to grasp their logic of thinking concerning communication services. As monopolists, the postal administrations were required by law to offer high-quality, low-cost physical mail services nationwide for the economy and society. According to national postal legislation, the administrations had to provide an effective and low-priced nationwide physical mail service. The postal administrations were neither obliged to explore telecommunication technology nor allowed to invest in equipment with uncertain prospects of success. They had little access to risk capital for investments in technology.

In recent years, the number of studies on the digitisation of telecommunications (Henrich-Franke 2014), the history of computing (Haigh 2016; Ceruzzi 2003), the history of networks (Gießmann 2014) and the consequences of digitisation for society (Erdogan / Funke / Kasper / Schmitt 2016; Danyel 2012) has increased. These studies usually focus on the dynamic aspects of technological development, ignoring postal administra-

tions or physical mail. However, a systematic analysis of the postal sector is necessary to establish a more diversified view of how digitisation affected the communications sector in general. It is certainly the case that the digitisation of telecommunications had a greater fundamental impact on the postal services (letter post) than any other previous innovation in the field of telecommunications.

To answer the questions above, I will first analyse the postal sector and the UPU's role before the digitisation of telecommunications beginning in the 1970s. In the next section, I will trace the stages of technological development and the reactions of the postal administrations and the UPU in the years 1978 to 1984 and 1985 to 1989, before drawing a conclusion.

## 2. The Post and the Universal Postal Union in analogue times

In 1874, the national postal administrations founded the Universal Postal Union to cooperate on all aspects of cross-border postal services (Lyall 2011; Neutsch 2009; Mazou 2004). They met at regular World Postal Congresses to negotiate rules for, amongst others, tariffs, operational requirements for rail or air mail, or the automation of letter sorting systems. The member administrations even set up a "Consultative Committee for Postal Services" (CCPS) in order to jointly explore specific questions and to report the results back to the World Postal Congresses. It is important to underline that the CCPS was not composed of telecommunication engineers. These met within the "Consultative Committee for Telegraph and Telephone" (CCITT), which was part of the International Telecommunication Union (ITU). Within the CCITT, engineers from the telecommunication administrations and the equipment industry negotiated technical standards, amongst others for digital networks and electronic mail services (Henrich-Franke 2014; Laborie 2010). Consequently, the technical aspects of postal and telecommunication services followed completely separate developments paths on a national and international level.

The long-term development of the markets for postal and telecommunication services is key to understanding the postal administrations' reaction to digitisation. Since the 19th century, the physical and electronic transmission of information was clearly separated. Physical mail, and letter mail in particular, remained a lucrative business until the mid-20th century. The different innovations in telecommunications such as the telegraph, the telephone or the telex all entered particular market segments, never challenging the need for letter mail. The transportation of parcel and letter mail by rail and air became faster and cheaper (Benz 2013), putting the postal administrations into a position where, for a long time, they were not threatened by any competition. Nevertheless, the expensive infrastructure, and staff costs in particular, prompted a demand for cost savings since the 1960s. Like many other postal administrations in the 1970s, the Bundespost consequently invested in automatic letter sorting systems to increase efficiency and to lower costs. The Post incorporated digital technology into the letter mail infrastructure, but only at particular hubs, where letter mail was sorted according to postcodes. Up to the 1990s, these sorting systems were introduced nationwide across Western Europe.

## 3. The Post and the origins of digital network communication

The year 1977 was a milestone in the development of digital network communication. Technical developments such as the evolution of computer networks like the ARPANET (Haigh 2016) or the digitisation of telephone switches had begun some time earlier. In 1977, however, the CCITT began to issue recommendations for the transmission of typewritten texts. Hence, the topic of digital networks appeared on the agenda of a large international standard-setting body for the first time.

The postal administrations realised that the digitisation of telecommunications and the increased use of data networks would sooner or later raise questions about how to deal with electronic mail and how to

react to the new modes of information transmission. After carefully analysing the market situation, the Bundespost concluded in 1977 that "in the Federal Republic no concrete demand for electronic mail is perceptible" (Elias 1977: 56). This assessment was based on economic assumptions which can be grouped into three categories:

1) Electronic mail systems would offer customers little added value, because letter mail was delivered very effectively in Germany within only 24 hours.
2) Due to the high cost of technical equipment, the majority of electronic mails had to be delivered by hybrid systems. These were a combination of physical and electronic mail services. Electronic mails were sent to the post office where they were printed out, enveloped and delivered manually. The cost of manual delivery would outweigh other economic advantages.
3) Electronic mail systems would require the postal administrations to make high investments not covered by savings in the letter mail systems.

Overall, the German postal administration assessed electronic mail services delivered via digitised telecommunication networks from a purely economic point of view—especially with regard to restrictions in national law.

In unison, the postal administration avoided any urgent reaction as it did not expect an economic threat in the medium term. Nevertheless, it intended to monitor the technological developments. As late as September 1983, the British Post Office stated in a policy paper for the European postal administrations that "the electronic messaging capability of word processing systems is not currently perceived as being of major importance. In the medium term the lack of commitment by equipment suppliers will militate against the widespread use of word processes in the electronic messaging field "[3]. Despite this widespread view, a few postal

administrations set up national pilot projects for electronic mail services such as the Swedish "Postfax-System" or the German "Telebrief". They all were hybrid systems involving the manual delivery of electronic mails. The administrations only focused on special applications for office communication. Mass markets for public users were not taken into consideration. These pilot projects in the early 1980s confirmed the administrations' reservations as they proved economically less attractive. They were unable to overcome an important obstacle: the traditional letter mail systems. In 1982, the German "Telebrief" delivered a total of 29,976 mails (or 70,426 pages) within Germany. In comparison, the traditional mail service delivered 36 million letters a day.[4]

Initially, the members of the Universal Postal Union overwhelmingly rejected an in-depth study of electronic mail services because of their actual economic importance. Within the UPU, members preferred to discuss intra-system improvements such as the automation of letter sorting systems rather than comparing the benefits and disadvantages of electronic mail systems and telecommunication facilities. The World Postal Congress in 1979 finally enabled the CCPS to set up a first working group on the topic of "Electronic mail and other advanced message systems". After nearly five years, the group delivered its final report on electronic mail systems at the World Postal Congress in Hamburg in 1984.[5] There, the UPU decided to intensify its cooperation with the ITU on the issue. The CCITT had called for a closer cooperation between the two bodies for many years, but in July 1979 the UPU had still voiced reservations about some issues as well as procedures of cooperation. As a first step, the UPU's International Office wanted to establish an institutional basis for cooperation. This took more than two years, with a first preliminary meeting between the UPU and the ITU taking place in autumn 1981. The first ordinary working meeting convened in September 1984, after the CCITT's Common Assembly had agreed on a formal statute of cooperation between both organisations. In preparation, the CCPS had formally defined guidelines and areas of responsibility in autumn 1983, which were ac-

cepted by the ITU's Administrative Council in April 1984. In lengthy institutional coordination processes the organisations clarified what role and rights the UPU was to have within the CCITT and who would have to bear the costs.[6] Overall, the UPU showed an inert institutional reaction.

Nevertheless, a first UPU delegation participated on an informal basis in a meeting of the CCITT's working group I/7, which had responsibility for "bureau fax and telewriting", in spring 1982. Some postal administrations were prompted to take part by their pilot projects, for instance the "Telebrief". A first result of the cooperation was the revised CCITT recommendation F170, which set the transmission formats for the international fax service (paper and envelope sizes, rules for addressing etc.). Telecommunication engineers, of course, considered these issues as non-technical questions. Before 1984, little cooperation between the UPU and the ITU took place. Neither did the UPU conduct any in-depth technical research on the impact of digitisation on mail services. Remarkably, the organisers of the "World Postal Day" on 9th October 1984 coined the symptomatic slogan: "Nichts kann die Post ersetzen" (Nothing can replace the Post).[7]

Prompted by the UPU's sluggish attitude, some of the more technically advanced postal administrations initiated a cooperation within the Paris Group in 1979. Its members met annually at "Electronic Mail Conferences" to discuss developments. A technical committee and a marketing/operations committee were set up to publish reports annually that included recommendations for further action. In contrast to the UPU, both committees carefully monitored the development of electronic mail systems. The committees analysed national pilot projects, and the postal administrations exchanged information of mutual interest.[8] A major problem discussed by both committees was the privacy of correspondence in hybrid mail systems. Enveloping in the post offices required protection of data privacy, indelibility and high quality transmission. All these aspects were crucial if public administrations, private enterprises and financial service providers were to become customers of hybrid mail systems. The


Source: Bundesarchiv Berlin, DM3/18218

committees also researched and analysed software packages like Comsat. Nevertheless, the key problem of all electronic mail services remained an economic one: low bandwidth and digit rates combined with high costs for lines made electronic mail services too expensive for a limited number of customers. In 1982, using the Comsat software, postal administrations were able to transmit a maximum of 25 pages per hour.[9]

The activities of the Paris Group's member administrations played a crucial role. While internal discussions were of a theoretical nature, at least the group studied electronic mail services at a time when the UPU chose to ignore them. It was the Paris Group that initiated the revision of the CCITT recommendation F170 and drafted the first "Guidelines for the selection of facsimile equipment for direct communication via public telephone networks"[10]. The group raised awareness for the consequences of digitisation and was the driving force for several agreements on international services, including a common vocabulary, a common basis of calculation and the corporate identity of the Intelpost system, which facilitated international cooperation.

So in the years 1983/84, only a limited number of postal administrations engaged with electronic mail systems and carried out pilot projects. These systems were neither profitable nor did they fulfil the postal administrations' service requirement of unlimited access, high transmission quality, data security or integration into existing mail systems. Taking into account that the monopoly for postal services had never been seriously challenged before, the postal administrations had little motivation to take decisive action.

## 4. The Post and the ISDN standard

The years from 1984 to1986 can be considered as a critical juncture, because the postal administrations—at least in technologically advanced countries such as the US, the UK, Sweden or Germany—realised that electronic mail could become a serious competitor for physical mail services. Technologies had developed rapidly, while the majority of postal

administrations and the UPU had been slow to react. Between 1980 and 1984, a multitude of technical advances in areas such as corporate closed data networks, data transmission via fax or personal computers such as the Commodore 64 occurred. One major achievement was the standardisation of the "Integrated Services Digital Network" (ISDN) which promised digital data transmission between terminal equipment in companies and private homes using the existing public telephone network (Rutkowski 1986). For the first time, a structural change in the markets for mail transmission was imminent. The postal administrations' monopoly on physical mail services now was in danger of being eroded by electronic transmission. This shift took place independently from the political debate about a liberalisation of the postal markets in the 1980s. In the medium and long term, all economic calculations based on the operation of hybrid systems risked becoming obsolete. To that effect, the British Post Office stated as early as September 1983 that "the continued expansion of conventional letter mail services is under threat from the competing technologies. The timing and rate of the conventional mail erosion process is difficult to assess, but it is now clear that some of the competing technologies have left the development stage and are gaining ground in the electronic messaging market place"[11].

The postal administrations, the UPU and the Paris Group had to adapt their strategies to the accelerating technical developments, in particular to ISDN. Between 1984 and 1986, it became increasingly obvious that the standardisation of transmission technologies within the CCITT would continuously pose new challenges for the traditional physical mail service. The Paris Group's members warned therefore that "further development of electronic mail services would require ever more telecommunication expertise"[12]. In 1985, the international cooperation of postal administrations increased remarkably within a few months. On the one hand, the CCITT-CCPS Contact Committee started working as a permanent institution. This meant the UPU assumed a pivotal role on the postal side, forcing the Paris Group to connect with the UPU, because it was not

allowed to participate in the CCITT. On the other hand, the rapidly developing technology kicked an increasing number of postal administrations into action, prompting them to participate in the international cooperation on electronic mail services.

The first substantial meetings between stakeholders from the postal and the telecommunications sides in spring 1986 revealed two important points. (1) Postal administrations would only be able to influence the technical development of electronic mail services, if they spoke with one voice. The telecommunication engineers within the CCITT's study groups had a completely different mindset. They believed the further development of electronic data networks or electronic mail systems should follow an engineering logic. The preservation of the monopoly for letter mail, the cost effectiveness of letter mail infrastructures or the development of hybrid systems was of no interest to them. (2) Postal administrations had missed the right time to enter the standardisation process for digital transmissions and electronic mail services. According to the CCITT's working procedures, the next standards were due to be agreed in spring 1987. The postal side had little to contribute to the next set of standards that were issued for electronic mail services and digital transmissions, despite the CCPS hurriedly appointing a new study group, which was advised to take the Paris Group's work as a starting point. The postal administrations were in a position to give input for CCITT standards, but only in some marginal aspects such as the design of fax formulas. Consequently, the basic standards for digital transmission networks which had a fundamental impact on the postal services in the medium and long term were agreed without any noticeable participation from the postal administrations, the UPU or the Paris Group. The Post was a passive onlooker of technical changes and ultimately transformed itself into "the monopolist for slow mail". Even the ISDN standard was agreed without the Post's input.

The standardisation of ISDN and the general digitisation of communication impacted postal administrations and the UPU in two respects.

First, postal administrations focused their attention on hybrid systems and conventional letter mail. They expected electronic mail systems would take 15 to 20 years to capture the private home market. In the meantime, they hoped physical mail systems with their wide infrastructures networks would satisfy the demands for both business and private communication.[13] At the World Postal Congress in 1989, they even agreed to set up the "Express Mail Service" (EMS), which would deliver international letter mail within the shortest possible time.[14] Secondly, many postal administrations voiced a scathing criticism of the UPU for its long working cycles and demanded more effective procedures, in particular in terms of updates on the development of express mail services and competition with private companies in the field of communication.

## 5. Conclusion

For a number of partially connected reasons, the reaction of the UPU and its members to digitisation and electronic mail systems in the late 1970s and early 1980s was restrained. The crucial factor was a combination of a lack of financial incentives and the historically evolved expectation that innovations within telecommunications (such as the telegraph, telephone or telex) would never fundamentally challenge the physical postal services. More importantly, the decision-makers within the postal administrations were neither telecommunication engineers who could evaluate the potential of new technologies nor did they participate in the standardisation of telecommunication equipment. Some postal administrations, however, wanted to monitor on the development of electronic mail systems and set up the Paris Group.

The decision-makers within the postal administrations evaluated the consequences of digitisation on mail services from a strikingly different perspective compared to the telecommunication engineers. The postal administrations based their thinking on a holistic hybrid mail system that integrated physical and electronic components to address the entire service area of an administration. In contrast, the telecommunica-

tion engineers envisaged purely digital transmission networks either within companies and administrations or using the existing telephone network. These differences in thinking, approaching and scaling mail systems were an important reason why the postal administrations refrained from researching new technical possibilities.

Rapid technological progress in the early 1980s caused a change in the postal administrations' attitude towards digitisation and electronic mail systems. The standardisation of ISDN promised a structural change towards a nationwide digitisation of transmission networks and a comprehensive distribution of terminal equipment for electronic mail services even in private homes. The CCITT's recommendations for ISDN in 1984 were a significant turning point in how the digitisation of communication was perceived. In addition, the first half of the 1980s saw enormous technological progress in the fields of computerisation and data handling.

Any judgement of the actions taken by the postal administrations and the UPU has to take into consideration the legal framework constraining postal services, in particular in many European countries. Against this backdrop, the postal administrations' reactions towards the digitisation of communication can be explained with the logic of financing and supplying postal services at the time. The postal administrations and the UPU observed their rules and approached the issue with more focus only when the technological groundwork such as ISDN and home computers promised mass markets for electronic mail services after 1984/85.

The digitisation of communication is not only a process of permanent technological progress, but also of alignment, examination and competition by and between different forms of communication such as physical mail. The physical postal services are an interesting example for a traditional form of communication which has had to find its way into the digital era. In the 1980s, on the one hand digital data processing became part of the letter mail infrastructures in the form of automatic letter sorting systems and on the other hand electronic mail services evolved as a potential future competitor. The Express Mail Service established in 1989 is

an answer to the digital challenge. Today it still is a key service offered by postal administrations. Overall, this paper shows that the postal services and postal administrations deserve much more attention by (historical) research.

## Notes

1 Opening speech by the German Minister for Postal Services and Telecommunications, Schwarz-Schilling, at the 8th Electronic Mail Conference, 24th September 1986, Bundesarchiv Koblenz, B257/53521.
2 Opening speech by the German Minister for Postal Services and Telecommunications, Schwarz-Schilling, at the 8th Electronic Mail Conference, 24th September 1986, Bundesarchiv Koblenz, B257/53521.
3 Report on "Technical developments in electronic mail systems" by the British Post Office, September 1983, Bundesarchiv Koblenz, B257/53520.
4 Report on "Electronic mail programs and plans" by the Bundespost, August 1983, Bundesarchiv Koblenz, B257/53520.
5 Report on the World Postal Congress by the Deutsche Post, Bundesarchiv Berlin, DM3/13983.
6 Report of the first meeting of the CCITT-CCPS Contact-Committee, May 1986, Archives of the International Telecommunication Union, Geneva, Doc. COM I-76-E.
7 Poster of the World Post Day 1984, Bundesarchiv Berlin, DM3/18218.
8 Report on the Activities of the Technical Committee of the Paris Group, September 1986, Bundesarchiv Koblenz, B257/53523.
9 Report of the Technical Committee of the Paris Group to the Plenary Assembly, October 1983, Bundesarchiv Koblenz, B257/53520.
10 Report of the Paris Group Management Committee on International Co-operation, September 1986, Bundesarchiv Koblenz, B257/53525.
11 Report on "Technical developments in electronic mail systems" by the British Post Office, September 1983, Bundesarchiv Koblenz, B257/53520.
12 Internal report of the Bundespost on the Meeting of the Paris Group Management Committee, September 1986, Bundesarchiv Koblenz, B257/53525.
13 Report of the Bundespost on "Electronic Mail for Mass Communication", September 1986, Bundesarchiv Koblenz, B257/53525.
14 Report of the Deutsche Post on the World Postal Congress 1989, Bundesarchiv Berlin, DM3/26249.

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# Reports

# Media of Cooperation: Ethnomethodology, GPS, and Tacit Knowledge

Michael Lynch

I was hosted at DFG Collaborative Research Center "Media of Cooperation" in Siegen in June 2016, supported by the Mercator Fellowship. At the start of my visit, I attended the International Conference on Digital Practices: Situating People, Things and Data (7–9 June 2016), which was organized by the DFG Research Training Group "Locating Media," in collaboration with the Research Center.

During the next two weeks, I participated in numerous seminars, consultations, and discussions with research groups, faculty members, and post-graduate students. All of these meetings were very stimulating, and I learned a lot from them. It is difficult to give a concise summary of all of these activities and discussions, but many of them involved the topic of how embodied practices in concrete social environments relate to instructional devices and representations of the relevant practices. The discussions and activities including the following:

- Andrea Ploder interviewed me as part of her project on the history of ethnomethodology. I was a student of Harold Garfinkel, the founder of the field, and we focused on my relationship to him and other key figures, and on the trajectory of my own work as I became associated with the field of Science & Technology Studies (STS).
- I also met with Christian Erbacher on two occasions to discuss his project on the editing of Wittgenstein's Nachlass, focusing especially on the correspondence of G.H. von Wright. This fascinating study examines the relatively invisible work of Wittgenstein's editors to turn

the large collection of his posthumous writings into published philosophical works. In our discussions we also discussed my own interest in Garfinkel's posthumous writings, which connects with ongoing efforts at Siegen to help organize the Garfinkel archive.

- In connection with the Garfinkel archive, I had discussions with Tristan Thielmann and others about efforts to organize and digitize the large collection of Garfinkel's manuscripts, recorded conversations, and recorded lectures.
- In addition to the focus on Garfinkel's work, I met with some of the Research Group's individual projects. One was with Cornelius Schubert, Andreas Kolb, Judith Willkomm, and Julia Kurz, who are a team of sociologists and information scientists investigating the design of an augmented reality application by exploring new visual modes for organizing clinical cooperation on a neurosurgical ward. The second was with Jutta Wiesemann, Clemens Eisenmann, Bina Mohn, Inka Fürtig, and Jochen Lange, who are a research group conducting an ethnomethodological project on the use of smart phones in early childhood. The project not only records the interactions of children with smartphone devices, but also analyzes the recorded pictures from the smart phones to gain insight into the users' perspectives.
- I also attended two seminars organized around critical theoretical papers I had published on the themes of "reflexivity" and "the turn to ontology" in sociology and STS. These meetings were attended by a group of scholars from the Reserach Center and the University of Siegen, including principal investigators, post-docs as well as phd and graduate students.
- More informally, I met with Clemens Eisenmann for a very illuminating discussion of his ethnomethodological research on the embodied practices of yoga and tai chi, and my reflections as a novice-practitioner of the latter.
- Finally, I enjoyed an outing to a nearby nature preserve with Judith Willkomm and Asher Boersma, in which we discussed Judith's re-

search on field ornithology. Years ago, I had written on the uses of field guides by amateur bird watchers.

These consultations, seminar discussions, and informal meetings were informed by my background and continuing interests in ethnomethodology and Science & Technology Studies (STS), and I was pleased to see that both areas (often in unique combination) are very well represented in Siegen.

Ethnomethodology is a field that was founded more than a half-century ago by Harold Garfinkel (1917–2011). I completed my PhD dissertation under Garfinkel's supervision in the 1970s, and also worked with him as a postdoctoral fellow in the early 1980s. Much of the research in ethnomethodology is concerned with the social organization of "ordinary" embodied actions and social interaction performed in day-to-day life. Such activities include face-to-face conversation, as well as mediated exchanges over telephone and other kinds of communication and information technology. My own interests, going back to my PhD research on the day to day practices in a neurosciences laboratory, focus on the ordinary underpinnings of specialized practices in legal and scientific settings. I am especially interested in the production of evidence, such as testimony in courtroom interrogation, and graphic displays of neuro-anatomical data in a research laboratory.

Now that ethnomethodology has a history that spans more than a half-century, I also am involved in efforts to document and make sense of that (often contentious) history. As noted above, I met with Tristan Thielmann to discuss efforts that he, Anne Rawls of Bentley College, and others have made to organize a massive collection of papers, tape recordings and material devices that are stored in the Boston area, and are currently being assembled into the Garfinkel archive. He and I discussed ideas for helping with the organization of that archive, and the dissemination of materials and research in connection with it. Several months following my visit to Siegen, I traveled to Boston and met with Prof. Rawls, and

we went through a small portion of the materials of interest to me. Currently, I am interested in putting together a volume of his writings on the work of the natural sciences, written in the 1970s and 1980s. I'm also interested in the collaboration between Garfinkel and Sacks in the late 1960s, which culminated in a co-authored paper published in 1970. What interests me about the collaboration is that in the decades since then Conversation Analysis and ethnomethodology have largely gone in different directions, and I believe there is potential to recover and develop common ground between them.

Many of my discussions with PhD students, faculty and postdoctoral researchers at Siegen concerned the theme of "instructed actions": the practices of conducting actions that are presented (often in idealized form) in instructional materials. The paper I presented at the International Conference on Digital Practices on 8 June was on that topic. The paper was based on a project conducted with three PhD student at Cornell, which will be published in the forthcoming *Digital STS Handbook*. Our study is on the uses and practical problems of navigating with handheld and windscreen mounted GPS devices. Previous ethnomethodological studies by George Psathas, Harold Garfinkel, Kenneth Liberman, Eric Laurier and others examined how persons read maps and follow directions in relation while navigating through familiar and unfamiliar terrain. Consistent with these earlier studies, we pay attention to practical "troubles" that reveal systematic problems and require improvised repairs for coordinating the formal instructions with specific journeys. With static maps, and even with maps sketched for a particular journey, the instructions do not adapt dynamically with the movements of the user, and it often turns out to be difficult in the course of a journey to find where one is "on" the map (assuming that one has not wandered out of the territory covered by the map. The GPS solves many of these problems, with its repositioning and adaptation of directions to the current position of the user, but we also experienced distinctive troubles with using it, as well as variants of trouble that occur with older forms of map and

instruction. Despite the apparent verisimilitude of the GPS scenic display and the experience of journeying, confusing gaps remain between the small screen display and the immediate environment. Such gaps were most strikingly evident when using GPS to navigate through environments that lacked the material "discipline" of a modern cityscape: where roadways were not clearly bounded or intersections signed, and where pedestrians and stray dogs wandered freely in and out of roadways. We also used GPS to navigate through familiar routes, in order to detect incongruities between its directions and our usual routes. When GPS led us astray, either or both through our incompetent use of it or malfunctions in its operations, we often used back-up strategies to repair the disrupted routes: asking passers-by for directions, reading the landscape for clues, and deploying older forms of map. This study certainly seemed to be congruent with the overall themes of "Media of Cooperation" and "Locating Media", as it literally involved close attention to the use of GPS devices in the actions of a journey.

The study also bears upon the topic of "tacit knowledge" and its relationship to technology. Michael Polanyi originally developed the theme as a way to address skills and practices that underlie, and perhaps even contradict, the accomplishment of scientific methods but are not mentioned in formal descriptions of methodological procedure. Harry Collins developed the theme more recently in STS. Of course, it applies to all manner of practices. In connection with the GPS study, I am interested in how the domain of tacit knowledge shifts with innovations in the technical means of instruction. Much of the work on tacit knowledge points to a gap between written instructions (whether in the form of a methods protocol, or a more commonplace form of recipe) and the situated practice of following the instructions. However, with the advent of video instructions that show and instruct a developing task, and interactive media that enable real-time consultation, it might seem that tacit knowledge becomes constricted to a vanishing point. Certainly, that balance between tacit and explicit shifts, though from the GPS study and other examples,

I believe that it is more of a reconfiguration than an erasure. Moreover, the very concept of tacit knowledge begins to seem undifferentiated and perhaps not very helpful anymore.

My discussions with others at Siegen often delved into the practices, practical difficulties, and unanticipated contingencies that arise in the course of attempting to teach and master an embodied practice (whether in a science such as ornithology, a literary art, or an embodied regimen such as yoga). Overall, I benefitted greatly from exposure to the interesting projects being conducted at Siegen, and the innovative ideas associated with them.