Report

DFG reference number and title

FA 777/1-1 – Die Frames und Funktionalbegriffe der Harndiagnostik in ihrer Entwicklung seit der frühen Neuzeit

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1 State of knowledge and goals

Several works have been published on the history of uroscopy and urine diagnostics (Ebstein 1915, Wüthrich 1967, Bleker 1972). Thus, the field itself is well explored. However, most of the works adhere to a positivistic understanding of historical developments and only very few works include aspects that have an influence on paradigm shifts such as technological developments (Büttner 2000, 2002). Even fewer works include a conceptual framework or a cognitive approach when examining possible paradigm shifts.

This desideratum is astonishing, because "uroscopy" in its modern profile as "urine diagnostics" is still one of the most important diagnostic tools in medicine. Furthermore, whereas other routine diagnostic techniques, such as the application of stethoscopes, spirometrics or blood pressure measurements etc., had not been developed before the 19th century, uroscopy looks on a long a tradition going back to antiquity. Uroscopic concepts underwent several paradigm shifts from their integration into humoral pathology during antiquity and medieval times until the introduction of iatromechanics in the 19th century.

Therefore, the investigation of uroscopy represents a unique opportunity to analyze the implementation of new ideas and techniques into language as well as the interaction of language and concepts. Theories borrowed from the philosophy of science served as heuristic

guidelines to draw on uroscopy for cognitive and lexical analyses aimed at examining the processes underlying knowledge shifts.

In connection with general debates on Thomas Kuhn's "paradigm shifts" (Marcum 2005, Nickles 2003, Dietze 2001, Fuller 2001, Bird 2000, Hoyningen-Huene 1989), the works of Ludwik Fleck have been revived in recent years (Schnelle 1982, Tsouyopoulos 1982, Cohen/Schnelle 1986, Dorobinski 1987, Löwy 1988, Neumann 1989, Löwy 2004, Egloff 2005). Most of these works focus on the philosophy of science, some authors use Fleck's and Kuhn's theories for their own case studies (Reckenfelderbäumer 1995, van den Belt 1997).

So far the analysis of shifting knowledge with the help of communication studies has evidenced less than convincing results (e.g. Sinding 1996). The most meaningful approaches were put forward by scientometric analyses like e.g. bibliometric studies. Some of the works not only attempted to reconstruct paradigm shifts or changing "thought styles", but they also aimed at visualizing knowledge shifts with the help of longitudinal citation studies. The best results have been achieved by using empirical longitudinal citation analyses in the framework of cognitive-psychological approaches (e.g. Chen 2003, Small 2003, White 2003). However, an analysis of the cognitive system of the experts themselves, as it is represented in their texts, would be more sensible. Furthermore, an analysis of this nature could reconstruct the dynamic processes inherent in the creation of knowledge. A similar level of abstraction can be achieved by applying the "frames" as implemented in cognitive psychology (e.g. by Lawrence Barsalou 1992). According to Barsalou's model, "frames" are the cognitive format, in which different forms and fields of knowledge are represented. This is also true for the complex systems found in scientific texts (Holly 2001, for linguistics essentially: Konerding 1993). Chen and Barker – according to our findings – were the first to use frames to illustrate shifts in thought styles while attempting to delineate continuities in the historical transformation of taxonomies (Chen/ Barker 2000, Andersen/ Barker/ Chen 2003).

Their study, however, neither covers different languages nor does it reconstruct the long-term development of a system. A text-based study that reconstructs texts in frames without presupposing current knowledge or structural invariants was missing, as was a study examining the role of functional concepts in the development of knowledge (Löbner 1979).

Our project aimed at closing this gap. We intended to complement the existing historical and philosophical approaches by analyzing paradigms and paradigm shifts with methods applicable to linguistics and the cognitive sciences. The conceptual frame theory was tested as an instrument for this study. According to our findings it could be instrumental in locating the identities, similarities, shifts, and differences in the structure of medical knowledge and in analyzing chronological changes on the language level. Furthermore, we explicated the role of functional concepts in the historical development of medical data and their role within text-corpus based frames. Due to the substantial amount of text material on the subject "uroscopy" as a historical diagnostic and prognostic medical tool represents an excellent example.

2 Results and their significance

2.1 Text corpus

The vast amount of primary literature on uroscopy in French and German from the 12th until the 19th centuries has now been investigated and bibliographized. During this process, several problems had to be overcome. It was impossible to survey all of the literature on the topic, and comprehensive bibliographical sources do not exist. Using electronic resources to research older works also proved impossible. Therefore, time-consuming examinations of library catalogues, medical bibliographies and other printed resources had to be undertaken, in order to locate relevant authors and titles.

The literature retrieved was categorized thematically and conceptually. On the basis of Ludwik Fleck's theories on different categories of medical and scientific literature we developed a model to classify the collected works with respect to their character and their authors' purposes (Martin/ Fangerau 2006a). According to Fleck, the various social strata within scientific thought-collectives make use of different means of communication: esoteric specialist knowledge is communicated through scientific journals, the data avaliable to general specialists is found in scientific textbooks, while laymen's information is usually documented in popular books.

In order to keep the amount of literature manageable, the decision was made to incorporate works documenting "state of the art"-uroscopy into our text corpus. Articles in journals were excluded. Works representing canonized knowledge and derived from textbooks and handbooks for medical specialists and general practitioners were included. Popular treatises were included when they demarcated the boundary between academic medicine and medical penumbra in urine analysis (e.g. Brockliss/ Jones 1997).

Books held by only one or two libraries are not readily accessible. We have contacted the historical archive of the German society for urology (Deutsche Gesellschaft für Urologie), which was willing to co-operate with us and grant access to their archival holdings of rare books. The sources in French and German were checked for compatibility, since book titles are not always indicative of the contents. Thus, we were able to amass a significant corpus of French and German texts that meet our project's purposes.

2.2 Frames and texts

During the last 26 month initial frames have been constructed and the frame model has been successfully applied to exemplify major paradigm shifts in uroscopy. A paper was given at the "Fachkongress der Deutschen Gesellschaft für Urologie" (Martin/ Fangerau 2006) and a respective manuscript was published in the most important German journal on urology "Der Urologe" (Martin; Fangerau 2006b). Similarly, our approach to using frame analyses for comparative studies on French and German texts was presented to an international audience of linguists (Martin/ Zaun 2007) as well as to an interdisciplinary audience of philosophers and historians of science, neuroscientists and cognitive psychologists (Fangerau/ Geisler/ Martin/ Zaun 2007).

Our attempt to utilize the frame model for text analysis had to overcome a series of obstacles. Classical approaches to formulating, developing and using frames for concept analyses traditionally refer to single items like “car” and “vacation” (Barsalou 1992) or “bird” (Andersen/ Barker/ Chen 2003). If more complex concept frames, like Aristotle’s “physical object” (Chen/ Barker 2000), are formulated, they are based on constructed attributes and values that are only synthesized indirectly by referring to a respective (tacit) knowledge of the underlying knowledge system. In contrast to these approaches, our aim was to develop a text-based frame model which accounts for the parameters of a method derived from the cognitive sciences: attribute-value sets, structural invariants and different forms of constraints. In order to launch and test this method, we selected the pseudo-galenic work “De urinis”. Published in the 6th century, this text is considered by many scholars as one of the classical texts on uroscopy, especially since it was practiced within the framework of the humoral-pathological conception (structural invariant) defining medical formations until the 19th century. We established a basic frame that represents a specific structure of knowledge using attribute-value-sets and their “forced” connections (constraints). The frame was visualized by using arrows to mark connections and employing terms to mark attributes and values in the text.

A first approximation involved using the basic frame as a screen to project further text analyses. Accordingly, it was possible to verify similarities and differences between concepts as they are verbalized in texts. This approach makes it possible to generate complex description and analysis frames for urosocopical concepts.

This method for a standardized frame analysis of texts has been tested now for ten chronologically successive German and ten French texts. Questions pertaining to the level of frames encompass the visualization of events, structural invariants, constraints etc. In cooperation with the other projects of the research group these problems could be solved to a large extent. They have been tested and retested during the proceeding processes, in which new text-frames were generated. On the lexical level, the translation of colors into French and German or the development of verbs into functional concepts has been discussed (Zaun in press). An interdisciplinary workshop entitled “The scientification of medical observation – verbal mediation of science” was held on 2 March 2007 in Düsseldorf. A publication is being prepared.

2.3 Functional concepts

A system of tables has been developed for the extraction of functional concepts from the texts examined and their respective frames. The aim was to obtain an overview of which and how many functional concepts occur in the texts and to what extent the proportion of functional concepts changes over time. Since a system of tables or a database format did not exist, an individual draft had to be sketched. A specific input mask has been conceived, into which the essential parameters for the classification of functional concepts (FC) have been incorporated. These include the status of FCs as FC1 or FC2 and the allotted p-arguments and s-arguments.
An unexpected intricacy was caused by the fact that we found a number of attributes lacking lexicalization. Careful reading was required to infer attributes not yet lexicalized. An indispensable prerequisite for the reconstruction of non-lexicalized attributes was data about the historical context of the source. Homonyms and synonyms had to be marked and

categorized and the repetition of functional concepts with differing p- and s-arguments had to be coped with.

On the basis of 14 texts from different time periods we have established a table system, with which it is possible to record functional concepts. Furthermore, the system takes into account specific problems caused by examining texts from different centuries that mirror inconsistent conceptions of urine analysis. The table system will now be transformed into a database (Microsoft Access ®). On the basis of this database functional concepts that can be localized in additional texts will be recorded.

3 Relation of work schedule to outcome

Work Schedule			**Outcome**
work-package	**Work**	**Months**	
workpackage 1 Corpus			
	Literature research, selection, acquisition	1-8	Finished, cf. 2.1
workpackage 2 analysis of functional concepts and frames			
	Listing and recording attributes and values	7-30	Finished for 14 texts Table system has been invented, on the basis of which a database has been constructed Additional texts need to be integrated Short delay due to unforeseen problems (cf. 2.3)
	Frames for encyclopedia articles and frames for books	9-28	Frames for 10 French and 10 German texts have been established The frame format needed to be designed and adapted Additional texts need to be integrated (cf. 2.2)
workpackage 2: Analysis and publication of the results			
	Final analysis	29-30	Will follow
	Preparation of a concluding publication		

4 Cooperation

4.1 within the research unit

Doris Gerland (Romance Linguistics)
Christoph Kann (Philosophy)
Wiebke Petersen (Computational Linguistics)
Christoph Rumpf (Computational Linguistics)
Brigitte Schwarze (Romance Linguistics)
Gerhard Schurz (Philosophy)

4.2 with external partners

Deutsche Gesellschaft für Urologie, AK Geschichte der Urologie, Museum und Archiv
Centre d'Études Supérieures de Civilisation Médiévale, Projet „Transmedie – Translations médiévales: cinq siècles de traductions en français (Xe-XVe siècle)", Poitiers (France)
Xiang Chen, Thousand Oaks (California, USA)
Klaus Dieter Fischer, Mainz
Christoph Gradmann, Oslo (Norway)
Kirsten Jungersen, Kopenhagen (Denmark)
Karl-Heinz Leven, Freiburg
Robert Lindenberg, Düsseldorf
Irmgard Müller, Bochum
Norbert Paul, Mainz

5 Publications and activities

Martin, M., & Fangerau, H. (accepted). Listening to the heart's power: The introduction of technology into medical diagnostics. *ICOHTEC Journal.*

Fangerau, H., & Mueller, I. (2007). Scientific exchange: Jacques Loeb (1859-1924) and Emil Godlewski (1875-1944) as representatives of a transatlantic developmental biology. In *Studies in History and Philosophy of Biological And Biomedical Sciences* (pp. 608-617)

Lindenberg, R., Fangerau, H., Seitz, & R. (2007). 'Broca's area' as a collective term?. In *Brain and Language* 102: 22-29.

Martin, M. (2007). Basilisken der Medizintechnik. Zur schwierigen Durchsetzung technischer Verfahren in der medizinischen Diagnostik vor 1900. *Technikgeschichte* 74:1-24.

Martin, M., & Fangerau, H. (2006b). Historische Umbrüche in der Harndiagnostik und ihre Visualisierung in "Frames". In *Der Urologe* 45:742-748.

Refereed publications on scientific congresses

Martin, M., & Fangerau, H. (2007). Listening to the heart's power: Designing blood pressure measurement (Section: Designing the Body: Technology and Medicine), on: ICOHTEC – International Committee for the History of Technology, International Symposium 2007, Copenhagen, Denmark, 14 – 18 August 2007.

Martin, Michael; Zaun, Stefanie (2007): Uroscopic texts in the French and German Vernacular: Paradigm Shifts and the Evolution of the Medical Lexicon, on: Symposium on the Languages of Science in the Time of Linnaeus, 7 – 9 June 2007, Upspala, Sweden.

Martin, Michael (2007): Basilisken der Medizintechnik. Zur schwierigen Durchsetzung technischer Verfahren in der medizinischen Diagnostik vor 1900, on: Medizintechnik – mehr als Apparatemedizin. Jahrestagung des Vereins Deutscher Ingenieure, Düssedorf, 22 – 23 February 2007.

Martin, Michael; Fangerau, Heiner (2006a): Vom „Pissprophet“ zum Arzt im Labor: Die Entwicklung der Harnschau in „Frames“, on: 58. Kongress der Deutschen Gesellschaft für Urologie, Hamburg, 20 – 23 September 2006.

Zaun, Stefanie (2007): „Les Aphorismes d'Hippocrate“ – Ein Klassiker der Medizin in französischen Übersetzungen verschiedener Jahrhunderte, XXX. Romanistentag Wien, 24.September 2007.

Refereed publications in anthologies

Fangerau, Heiner; Müller, Irmgard: „Der Biologe Jacques Loeb (1859-1924) in der Zoologischen Forschungsstation Anton Dohrn (1840-1909) in Neapel: ein Beispiel für Ludwik Flecks (1896-1961) Theorie vom Denkkollektiv?“, *Verhandlungen zur Geschichte und Theorie der Biologie* 11. 153-168.

Non-refereed publications on scientific congresses

Fangerau, Heiner; Geisler, Hans; Martin, Michael; Zaun, Stefanie (2007): Concept Frames in Action – An example from the History of Medicine. International Conferences FOR 600 Concept Types and Frames in Language, Cognition and Science, Düsseldorf 20- 22.August2007.

Non-refereed publications in anthologies

Martin, Michael; Fangerau, Heiner (2006): Die Bedeutung unterschiedlicher Textsorten für die Repräsentation von Denkstil-Verschiebungen, in: Jörg Vögele, Heiner Fangerau, Thorsten Noack (ed.): Geschichte der Medizin – Geschichte in der Medizin: Forschungsthemen und Perspektiven, Münster.141-148.

Zaun, Stefanie (in press): Konzept- und Sprachentwicklung in französischen uroskopischen Fachtexten des Mittelalters und der frühen Neuzeit, in: Lidia Becker (ed.): Aktualität des Mittelalters und der Renaissance in der Romanistik (proceedings of the network „Mittelalter und Renaissance in der Romania“ in Trier, 13.-15.10.2006), München: Meidenbauer.

Workshop

One problem discussed during the project was the translation of colors into French and German or the development of verbs into functional concepts. An interdisciplinary workshop on this issue, entitled “The scientification of medical observation – verbal mediation of science”, was successfully conducted on the 2 March 2007 in Düsseldorf. A publication of the proceedings is in preparation.

Invited speaker for the FFF-seminar series

Kirsten Jungersen, Kopenhagen

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