

New Perspectives for Geomatics Bachelor and Master Education at the HafenCity University Hamburg

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Key words: education, curricula, interdisciplinarity, transdisciplinarity, geomatics

SUMMARY

The HafenCity University (HCU) Hamburg is a specialist university founded by Hamburg in January 2006 in order to achieve excellence in teaching and research in the development of the built environment. It has the full range of disciplines necessary to understand and improve the physical world, from measuring it to designing buildings and spaces, from its physical to its social and political infrastructure. Because of this comprehensive range of disciplines the HCU has the unique opportunity to find new approaches and solutions to the important problems facing the built world. To organize the multidisciplinary studies in the four departments new working levels will be established. Besides interdisciplinary courses a completely new concept of transdisciplinary studies (so called "studium fundamentale") will be invented. The goal of „studium fundamentale“ for the students is increasing creativity, communication skills and the ability of reflection in order to create new point of views and prepare for their professional life. Thereby the education of HCU leads to a graduate that has expertise and also the ability to question expertise with instruments of radical different way of thinking. This article shall give an overview over the process of a new university forming its profile of education with special attention to geomatics.

ZUSAMMENFASSUNG

Die HafenCity Universität (HCU) Hamburg ist die einzige Hochschule in Europa, die sich ausschließlich der Forschung und Lehre auf dem Gebiet der gebauten Umwelt widmet. Sie vereint alle zum Verständnis und zur Verbesserung dieser Umwelt notwendigen Fachgebiete unter einem Dach – die Architektur, das Bauingenieurwesen, die Geomatik und die Stadtplanung. Methodisch verbindet die HCU Hamburg künstlerische, technische und sozialwissenschaftliche Methoden und Interessen, die von der Theorie bis zur praktischen Anwendung reichen. Um diese Multidisziplinarität ausnutzen zu können, müssen neue Ansätze für Lehre und Studium gefunden werden. Neben bereits bekannten interdisziplinären Ansätzen steht die Transdisziplinarität („Studium Fundamentale“) im Mittelpunkt. Hierunter versteht man die Erhöhung der Kreativität, der Kommunikationsfähigkeit und der Reflexionsfähigkeit der Studierenden mit Blick auf das Studium und zur Vorbereitung der späteren Berufstätigkeit. Die Studierenden sollen in geringem Umfang systematisch mit radikal anderen Denk- und Sichtweisen konfrontiert werden und damit in die Lage versetzt werden, sich für neue Methoden, Perspektiven und Lösungen öffnen zu können. Dieser Artikel soll einen Überblick über den Profildbildungsprozess einer neuen Universität geben mit einem speziellen Augenmerk auf die Geomatik-Ausbildung.

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1. HAFENCITY UNIVERSITY HAMBURG – A SHORT REVIEW

The HafenCity University (HCU) started in January 2006 with the advantage of its already existing departments coming from three different types of higher education establishments. The HCU has no need to start from scratch. The founding of the HCU has consolidated the running taught programs along with their teaching staff, and has a wealth of experience in the relevant disciplines architecture, civil engineering, geomatics and urban planning. During the past two years and in the close future the HCU systematically probed and respectively will probe its own subject areas, asking fundamental questions about teaching and research; and, how the full spread of disciplines that exist at the HCU can lead to new approaches or solutions between and across them. The HCU will be looking at what makes an excellent learning environment, what society needs and expects from leading professionals in typical areas, what the most pressing and innovative areas of research are, where the HCU can hope to lead and, as importantly, where not. The HCU will decide how to structure so that the HCU is efficient, entrepreneurial, and foster working together.

This process will involve looking both inward and outward. It will be conducted with the help of international guests through public lectures, workshops, symposia and publications. It may sometimes be uncomfortable but is a most unusual opportunity to get behind assumptions and ways of working and thinking. At the same time the HCU will continue offering a high quality education to existing students - from bachelors to doctoral, and will finish implementing a bachelors and masters system and building a comprehensive research school. The HCU will steer itself towards a yearly intake of approximately 375 bachelors and 200 masters students. The current challenge for students at the HCU is to be part of the development of inter- and transdisciplinary work - and all this in three locations across Hamburg. Furthermore, they will have the chance to follow the creation of a new university and its buildings (shown in Fig. 1-1), due to be developed in Hamburg within the next years.



Figure 1-1: new university building, HafenCity (planned for 2012) [Code Unique 2007]

2. OVERALL CONCEPT FOR TEACHING AND STUDY AT HCU

2.1 General Structure and goals of HCU

To establish the striven goals of teaching and study, the HCU enunciates five primary targets in its development plan [3], which shall be implemented in teaching and study, research and administration.

The HCU is a *focussing* university. She tries to integrate the whole palette of academic methods and competences – natural scientific, artistic and creative, socioscientific - concentrating on topics around the built environment and urbanity. Thereby a consolidation of all relevant disciplines is given, and with this constellation new approaches of interdisciplinarity and transdisciplinarity are possible.

The HCU is a *creative* university. As a new founded university the HCU represents departure and innovation. Finding creative ways for solving problems and leading to new questions and other perspectives, the HCU meets the challenge of a sustainable urban environment. The university prepares the students, explores possible fields of activity for the future and is open-minded about new job descriptions.

The HCU is a *students centered* university. Although this may sound obviously it is important to get straight with this important aspect. The students are the midpoint of the universities environment. Contentment, engagement and success of students are the most important standards of orientation for a university. Moreover a smaller university like the HCU has to benefit the advantage of its compactness to achieve good quality of teaching and a good support for the students.

The HCU is *researching*. This is naturally a goal of every university. But considering the origin of the HCU it has to be defined that a former university of applied sciences needs to reinforce activities on the field of research. So it is desirable to become a laboratory for urbanity, town planning etc. outputting research work.

The HCU provides *dialogue and cooperation*. The university lives on the involvement in multiple local, national and international cooperation networks. At the same time this institution is a public place where discussions about urban environment are made in order to establish a place of interchange and debate for the citizen of Hamburg. It is intended that professionals and experts as well as “ordinary citizens” detect their interest for the built environment leading to public discussions. With the university’s new building located at the new quarter HafenCity an adequate and accessible location will be created. With this last constructional step the university will become an important centre for architecture, construction, engineering and urban development.

For developing this as regards content profile the academic structure has to be considered. On the one hand a transparent and slender decision-making structure, that is possible to respond quickly to new requirements and changes, is necessary. On the other hand the organisational structure of the university has to provide some scope for the use of interdisciplinary potential in study and research. For the HCU three different kinds of “schools” are the central elements. Among a bachelor school and a master school there will be a research school (as shown in Fig. 2-1).

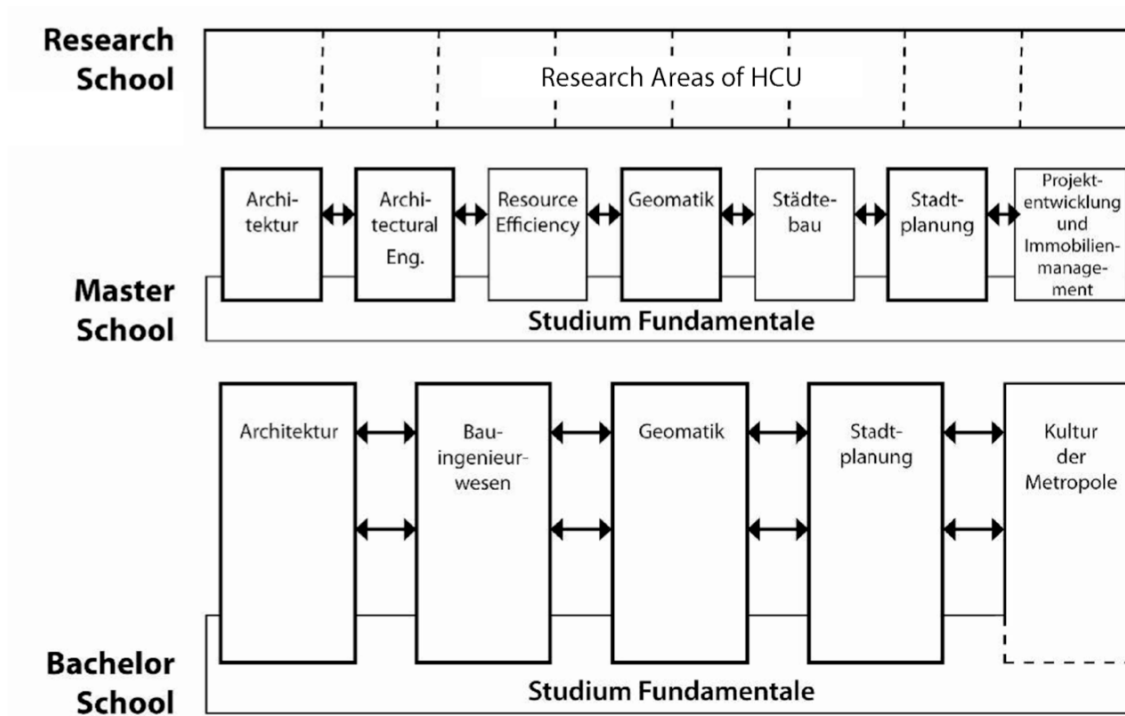


Figure 2-1: Summary about the programs of study at HCU (Study programs of bachelor school: architecture, civil engineering, geomatics, urban planning and urban studies. Study programs of master school: architecture, architecture engineering, resource efficiency, geomatics, urban development, urban planning and real estate management)

2.2 Teaching

As shown above in the general structure, the HCU wants to provide an excellent professional education. Necessary depth of academic contents, identity of the profession and embedding the graduates in established branches are important goals of the university's education. But it is also required that this professionalism has systematically to be opened. Not until then the preconditions for a responsible and creative contact with the built environment are given. Studying has not only to be comprehended as a technical education but an elementary intellectual, individual and social preparation for complex and changing requirements future professional activities.

These ambitious goals of education can be easily outlined with the three keywords: disciplinarity, interdisciplinarity and transdisciplinarity. In the following a short definition of these keywords is given:

- *disciplinarity*: excellence in one's own topic compared with the ability to gain and judge knowledge and information,
- *interdisciplinarity*: appreciation and understanding of neighboring disciplines as a precondition for creative collaboration,

- *transdisciplinarity*: accomplishment of complex tasks by means of an open-minded attitude to radical other (scientific and non-scientific) perspectives and different ways of thinking.

According to the requirements of Bologna process the bachelor programs lead the students to a first graduate that is qualifying for their profession. The program has to provide wide technical basics as well as the ability to assess the acquired knowledge. In addition to that the master programs have to induce technical and academic deepening which is done by connection to research fields and interdisciplinary projects and international exchange.

Concerning teaching the base for the study are built by the four bachelor disciplines architecture, civil engineering, geomatics and urban planning each with a consecutive master program. Three additional elements are conducive to sharpen the profile of the university:

- introduction of “studium fundamentale” with an additional small bachelor program called urban studies. With this study program the institutional anchoring of „studium fundamentale“ is provided.
- Harmonization of the curricula by organizing uniform modular structures for the specific study programs (duration of bachelor programs six semester, duration of master programs four semesters, uniform size of study courses and modules). This action will make easier the organization of courses and projects that are visited by students of different study programs. Especially on the level of the master programs really networked structures shall appear.
- The three master programs: resource efficiency in architecture and planning, real estate management and urban development are conceptual interdisciplinary arranged. It is planned to intake graduates of all different bachelor programs to these master programs. As already mentioned a creative university has to respond to new requirements of the practice and with these new master programs it is possible for students to qualify for new fields of profession.

2.3 Curriculum of Geomatics at HCU

It is not unusual for the study of geodesy to interact interdisciplinary with disciplines like mathematics, physics and other engineers. In this new university with other concepts of education the geodesists of HCU must find themselves between the other disciplines connected with the built environment. Regarding the HCU as a whole the study programs in geomatics incorporate very well to the other programs. Geomatics deals with methods and techniques of recording, administering, analyzing and representing spatial data. For this reason she is part of a field that as a result of huge changing in metrology and data processing will have effects to disciplines of construction, planning etc.

So geomatics at HCU will give important technological impulse for other disciplines which are, especially by networking in master school, very helpful. Thematic focus for networking with other disciplines is:

- 3-d data acquisition and data modeling (e.g. for monitoring of construction processes and buildings, components etc.)
- spatial information systems and geo-visualization (e.g. development of geographical information systems to the point of mapping changes in a metropolis in real time, especially turning the attention to Hamburg as a city on the water)

Regarding this profile geomatics may lead to an innovative partner for questions around construction and urban development. Analytical, integrative and critical way of thinking as well as networking is a key requirement to the graduates.

Besides these new approaches caused by new structures in a new university it is important to guarantee the complete training of a geomatics engineer. Consequently all geodetic basics appear in the geomatics curriculum as well as the possibility to specialize in certain fields of geomatics by taking elective courses. The training for geomatics is practice-related and project-oriented although an internship does not exist anymore. After the six-semester bachelor course, the knowledge obtained and expertise gained can be extended in a master program in either of two main areas of study. The master program in geomatics broadens the skills in the subjects of measuring technology and visualization. Besides academic training in areas like navigation, location based services, industrial metrology, laserscanning and automated data processing a close collaboration with practitioner, ranging from small engineering firms, to public institutions like the Office for Geoinformation and Surveying, to companies such as Airbus and Daimler Industries is given. The international master program in hydrography teaches surveying of inland waterways and coastal waters and is a unique feature of HCU in Germany and also international oriented.

Already in the year 2000 the department responded to the structural change of the profession geodesist / surveyor and designed an adapted curriculum renamed in geomatics. In addition to this former curriculum development, the bachelor and master programs in geomatics now have to react to the guidelines of the HCU development plan. A couple of interior and exterior colleagues observe this upcoming curriculum development very critically and are afraid that the necessary depth of the technical training may get lost. The difference between the existing curriculum of geomatics study programs and the future curriculum (significantly influenced by the HCU development plan) is shown in Fig. 2-2 and Fig. 2-3.

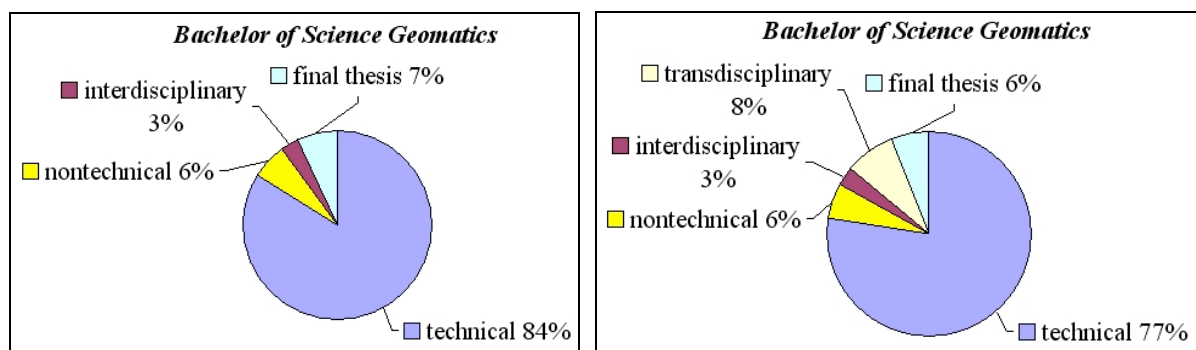


Figure 2-2: analysis of the bachelors former (left) and future (right) curriculum structure

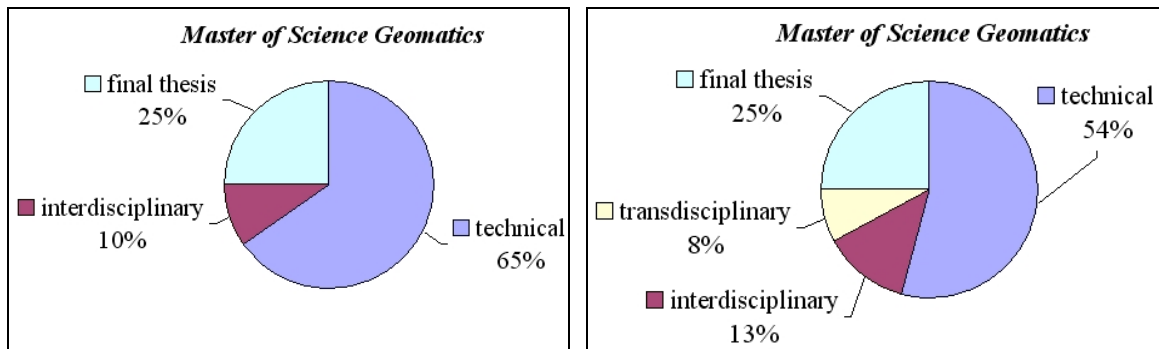


Figure 2-3: analysis of the masters former (left) and future (right) curriculum structure

Starting to implement the changes bringing along with the goal of interdisciplinary and transdisciplinary work the geodesist of HCU can build up new curricula on the fundament of already accredited (by ASIIN until 2012) study programs. In consultation with teachers, academic senate, accreditation reviewers and practitioners the percentage (approximately 20 %) of nontechnical, interdisciplinary and transdisciplinary courses for geomatics education has to be formed.

3. ROLE OF NONTECHNICAL COURSES

To understand the relevance of nontechnical content in engineering education it is important to clarify the goals of this kind of education in Germany for example given by the DFG (“Deutsche Forschungsgemeinschaft”). Therein an adequate wide engineering fundament have to be given with specific deepening, which

- qualifies for development of sustainable technical solutions,
- gives besides technical knowledge the ability to communicate and to interact with neighbouring disciplines and natural sciences,
- provides basic knowledge of economics and social sciences,
- and thus leading to a graduate that has the ability for lifelong learning.

Regarding this purpose of the DFG [1] or for example guidelines of accreditation organisations that demand at least 10 % of the curriculum reserved for nontechnical and respectively interdisciplinary courses it is important to discuss these contents. The choice of the term “nontechnical courses” for courses that are neither in connection with mathematics and natural science nor engineering and technics is a compromise for a multiplicity of names. This shows a problem of these contents: goal, content and size are very heterogeneous [5]. Correlated with the purpose of this content it is possible to identify three different approaches:

- general education, teaching of general knowledge that is independent from engineering,
- functional approach, teaching of nontechnical content with respect to the benefit for the engineer and its later employer,
- general approach, technics / engineering is part of a complex system with various effects to the environment, understanding this requires corresponding knowledge.

Concerning the geomatics education in Germany we have generally the functional approach and consequently nontechnical content that directly leads to a benefit of the graduate by the training of specific courses (shown in Fig. 3-1). Other approaches are not very common and accepted at German universities because of traceable arguments like lack of time or understanding. Analysing the curricula of German universities it is possible to see that the percentage of nontechnical courses at universities is lower than at universities of applied sciences. The contents are very similar and show a dominance of law and administration, business administration, technical English, project management and techniques of presentation and academic work. And so these courses are as regards content not that far away as its name may implicate.

percentage of nontechnical courses	
universities	5 – 10 %
universities of applied sciences	10 – 15 %
law and administration, business administration, technical english, project management, techniques of presentation and academic work	

Figure 3-1: percentage of nontechnical courses at German universities

At some universities explicit interdisciplinary work is specified in the curriculum. The particularity of interdisciplinary work is not the training of nontechnical content but the training together with other disciplines. To establish a new kind of nontechnical courses another approach is possible. The content has to be more far away from the origin of the discipline and the benefit may not be visible directly. A possible approach is discussed in the following.

4. STUDIUM FUNDAMENTALE

Goal of the „studium fundamentale“ for the students is increasing creativity, communications skills and the ability of reflection in order to create new point of views and prepare for their professional life. They shall systematically be confronted with radical different ways of thinking. Thereby they earn the ability to question their expertise and are open-minded to new methods, perspectives and solutions. Consequently this will lead to a more flexible graduate concerning changing requirements for their professional life. The role model is the humboldtian idea of a university, performed in the United States in terms of the much acknowledged “Liberal Arts Education”.

The „studium fundamentale“ or almost similar concepts are up to now only implemented in small universities (e.g. university of St. Gallen, Zeppelin university, university of Witten-Herdecke). These programs contribute to a very good reputation of the graduates because of their professional creativity. Recently are appearing some classical universities (university of Erfurt, university of Oldenburg) that imitate this concept each with different orientation. „Studium fundamentale“ is practiced in very different study programs like business administration, medical science, dentistry, law, pedagogy etc. In a context of construction and urban development the „studium fundamentale“ is unique and will be a central part of the

HCU's profile: a place for radical creativity and inter- and transdisciplinary work. Fig. 4-1 shows what the „studium fundamentale“ has to be and what not.

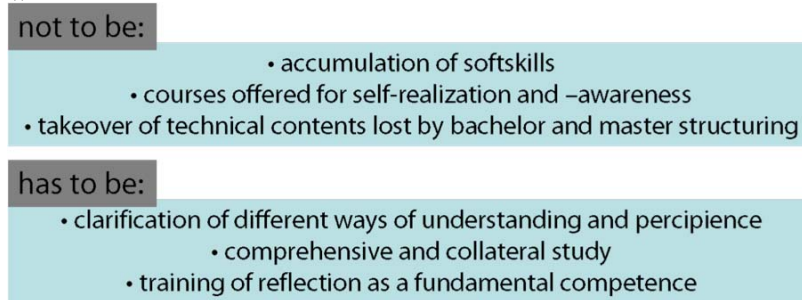


Figure 4-1: goals and non-goals of „studium fundamentale“

The success of similar programs at other universities shows that „studium fundamentale“ has to be integrated as a required subject in all bachelor and master programs of HCU. Consequently approximately 10 % of the curriculum (18 ECTS in bachelor and 12 ECTS in master program) will be kept free for these nontechnical contents. Every student has to achieve an independent course achievement (project, assignment, presentation etc.) in „studium fundamentale“.

The explicit structures that shall occur at HCU are now discussed and still have to be considered and formed. In winter semester 2008/2009 a first start-up phase will happen for the three interdisciplinary master programs. Later it is desirable to achieve a balanced distance to the field of study and to fulfil the variety of the students and study programs. A new point of view for engineers may be reached by teaching topics like musicology, ethics, theatre etc. For rather artistic oriented architects or sociocultural oriented planners perhaps topics like astronomy or natural science are possible. Although the HCU consolidates only four disciplines with one focus, every discipline has its own peculiarity. So it is difficult to create new perspectives for everyone in a course visited by students of every discipline.

The basic concept for future discussion about „studium fundamentale“ is strongly leaned on the concept of the university of Witten-Herdecke and will be supported by the Hochschule für Musik und Theater Hamburg. The actual concept for the transdisciplinary studies at HCU is shown in Fig. 4-2 with the four basic goals: generating, transforming, presenting and reflection.

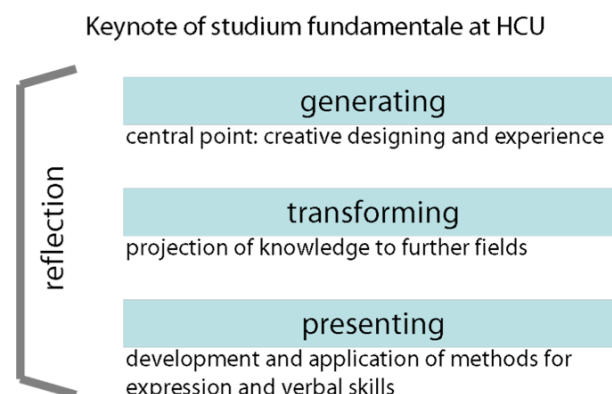


Figure 4-2: keynote of „studium fundamentale“ at HCU

5. CONCLUSION

In this article a new place for geodesists training and education, the HafenCity University, was discussed. A detailed overview of new teaching concepts was given in order to inform geodesy experts from other institutions about the particular development of a new university. In detail the unique role of geomatics at the university has been figured out with all advantages of a compact university with interdisciplinary goals and the risks for the geomatics education in Hamburg becoming a softened graduate that can not operate with his transdisciplinary knowledge. The concepts for the study of geomatics at HCU may not sound completely different and unusual to other universities but with implementing a „studium fundamentale“ with 10 % of the curriculum a new kind of nontechnical training will be achieved. The acceptance of this concept may be hindered by some aspects. The connected goals seem to be an advancement and enlargement but it is not possible to approve this. This means for university teachers to take part to this experiment without any certainty of a success or benefit. For the students it has to achieve an advantage for their professional life. But if the programs for inter- and transdisciplinarity are not well designed, it may be that e.g. architects and planners of HCU benefit and the engineers of HCU can not gain from it. Regarding geomatics respectively geodesy as a fast developing and depending science it is important to respond to requirements of interdisciplinary work.

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BIOGRAPHICAL NOTES

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