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## Abstraction and Professional Competition

### The Use of Abstract Knowledge in Professional Competition: A Study on the Swiss Market for Professional Environmental Services

Harald A. Mieg\*

#### 1 Introduction

Psychoanalysis is based on rather abstract knowledge. In the Freudian version, psychoanalysis commenced as an amalgamation of late 19th century medical science, Greek mythology as it was taught in the humanistic Gymnasium (German equivalent of a high school), and rudimentary psychotherapeutic know-how. Freud defined a theoretical framework that described the relationship between libido, ego and the unconscious, believing that more advanced medical science would re-translate his system into functional medicine at some later stage. Psychoanalysis was revolutionary in providing both theory and therapy for nervous diseases such as neurotic hysteria. Psychoanalytic theory not only helped psychotherapy to rise but also invaded the arts and social sciences. This success of psychoanalysis cannot be fully attributed to the success of psychoanalytic therapy (which may in fact be doubted) but owes a lot to its supposed explanatory power – that is to its kind of abstract knowledge.

Andrew Abbott in his *The System of Professions* claims that, in general, abstract knowledge is a means in the competition among professions: "Abstraction enables survival in the competitive system of professions" (1988, 9). According to Abbott, professions have to be seen in a system that links professions to particular tasks. In such a way, psychoanalysis tied a link between medicine and psychotherapeutic work, a link that has been contested by other professions such as psychology, at least as to the exclusivity of psychotherapeutic competence. In general, there are many exclusive links between the medical profession and relevant tasks, for example with appendectomy, that is the surgical removal of the vermiform appendix, today a routine matter in hospitals. However, new tasks such as genetic consultancy arise with uncertain division of competence among medicine and other professions, for example modern biology.

Psychoanalysis and appendectomy both have professional competitive value. But they clearly differ in the kind of abstractness of their professional knowledge

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bases. In contrast to the abstract therapeutic system of psychoanalysis, successful appendectomy requires skill and rather practical expertise. Does the difference in abstractness result in any differences in the kind of professional competition? Can abstract knowledge in general influence professional competition?

This article examines the empirical base of the relationship between abstraction and professional competition. The example to be examined will be the dynamics of a new service market outside medicine: competition on the market for professional environmental services in Switzerland. This is a small, almost closed market, but with divergent occupational groups. Therefore, we are able to arrive at an overview that is both comprehensive and detailed. Our study provides a “snapshot” of the situation in 1997.

## 2 Professions, Abstraction

Since the study by Carr-Saunders and Wilson, 1933, broke new ground, professions have always been a matter of sociological interest (cf., e. g., Parsons, 1968; Freidson, 1986; Rueschemeyer, 1986; Evetts, 1999). Talcott Parsons wrote:

*It is my view that the professional complex, though still incomplete in its development, has already become the most important single component in the structure of modern societies. (1968, 545)*

Today, theories of professions focus on one of the two main characteristics: firstly, a profession is knowledge-based; secondly, it establishes a monopoly in the market for its services.

Focusing on the *knowledge-base of professions*, we have to define the particularity of professional knowledge. Parsons spoke of the “intellectual component” (1968, 536). In this sense, professional knowledge is described as “abstract,” “formal,” or “academic,” emphasizing the link to academic education.

Focusing on *market monopolies*, we find an explanation for the power of professions. Parsons claimed that professions serve an altruistic, social function: “a full-fledged profession must have some institutional means of making sure that such [professional] competence will be put to socially responsible uses” (1968, 536). This view was attacked by Johnson (1967) and others who emphasized the competitive power of professions. Instead of altruism, professions aim at “market shelters” (Freidson, 1982) and market monopolies (e. g., Berlant, 1975; Larson, 1977). From this point of view, it is important for a profession to seek to license its particular professional practices (Freidson, 1986).

However, the definition of professions as privileged, self-interested monopolies does not hold for the Continental European occupational groups on account of the regulatory influence of the state. The educational and occupational systems

of France and Germany are historically much more under control of the state than in the UK or the USA, predetermining the chances for market monopolies and reducing the autonomy of occupational groups (cf., e. g., Torstendahl and Burrage, 1990).

Andrew Abbott's (1988) concept of the system of professions combines knowledge and competition. The system is centered around work and consists of professions and their links to particular tasks. Abbott calls the link between a profession and its tasks *jurisdiction*. The professions compete with one another for control of particular tasks. "In claiming jurisdiction, a profession asks society to recognize its cognitive structure through exclusive rights" (Abbott, 1988, 59). Without this link between professions and tasks, we would not understand why some professions have become so powerful such as lawyers and others disappeared completely such as railroad surgeons.

As one example, Abbott described the appearance of "personal problems" as a consequence of the social and industrial developments in the 19th century. In a rough summary: at the beginning of the 20th century, three professions, the clerical profession, neurologists and psychiatrists (neurologists and psychiatrists of that time being separate professions), struggled to gain control of the "personal problem" market. The clergy lost due to their extreme definition of personal problems as salvation problems. In contrast, neurology offered a sophisticated diagnostic system but lacked special therapies that were not part of general medicine. Only psychiatry – at that time – could provide for effective therapy, offering psychotherapy on the basis of psychoanalysis and of the psychotherapeutic know-how of that time.

The jurisdictional link between a profession and a task can change. According to Abbott (1988), the main mechanism of jurisdiction shift is *abstraction*. Abstraction, according to Abbott, takes on two forms. First, abstraction can be *reduction* in the sense of lack of content, that is "abstract which refers to many subjects interchangeably" (1988, 102). For instance, psychology claims that alcoholism is a personality disorder, thus falling into the domain of general psychotherapy. But, by abstraction, alcoholism may also be seen as a mere medical problem or a problem of public administration.

Abstraction in the second sense is *formalization* saying "that knowledge is abstract that elaborates its subjects in many layers of increasingly formal discourse" (1988, 102). Formalization means that a profession provides a formal system for the interpretation of a particular sort of problems. The language of modern medicine can be seen as such a formal system, providing a diagnostic system for tasks such as appendectomy. Formalization strengthens the jurisdiction of a profession. "No one tries to explain particle interactions without mastering the abstract knowledge of physics. More practically, no one offers insurance companies advice on underwriting without having mastered actuarial theory" (1988, 103).

What happens when new problems and new tasks arise, such as in the case of environmental protection? If the new market is attractive enough, professions will try to re-define the new tasks from the perspective of their professional knowledge system. This re-definition is necessary to apply the specific formalisms and problem solutions that the particular profession can provide. Thus, the profession exerts abstraction in the form of reduction to prevent other professions from establishing jurisdiction on new tasks.

In contrast to reduction, formalization does not seem to be a first step of a profession in a new market. Abbott characterizes formalization as a defensive strategy for established jurisdictions (1988, 103). As said, formalization strengthens the jurisdiction of a profession for a certain task or a class of tasks. Ongoing formalization can also result from the science-driven development of the professional knowledge base – as in the case of physics. We can conclude: Whereas abstraction in the form of reduction is connected to competition between professions, this is not necessarily true for formalization.

### 3 Professions in the Swiss Market for Environmental Services

As in the US, legislation is the driving factor for the Swiss market for environmental services. The first milestone was set by the Water Protection Law of 1955 (Gewässerschutzgesetz) that substituted the 1888 Fishing Law (Fischereigesetz). The law of 1888 prohibited the pollution of lakes and rivers but did not specify measurements for executing it. The 1955 Water Protection Law provided federal contributions to the construction of sewage plants. The main body of environmental law is the 1983 Environmental Protection Law (Umweltschutzgesetz). It gave rise to subsequent regulations, for instance, for contaminated soil remediation and environmental impact assessment. Some of these regulations were cast into good-practice guidelines edited by federal and cantonal offices.

Besides engineering tasks such as air filter technology or the construction of sewage plants, two types of tasks dominate in professional environmental services: firstly, concepts for nature conservation and green spaces, based on the 1966 Nature and Countryside Protection Law (Natur- und Heimatschutzgesetz) and the 1979 Area Development Law (Raumplanungsgesetz) and, secondly, environmental impact assessment (EIA). Today, environmental impact assessment is regulated by the 1988 Environmental Protection Order and the Environmental Impact Assessment Order of the same year (Verordnung über die Umweltverträglichkeitsprüfung, UVPV).

Several occupational groups have entered the Swiss market for professional environmental services: engineers, biologists, geologists, geographers, foresters, agronomists, architects, specialists for area development and so on. A group of

engineers forced the enactment of the Law on Water Protection of 1955 that gave rise to the construction of sewage plants. The different occupational groups define their environmental services differently: from an engineering point of view, environmental tasks have a defined place in an encompassing planning process, for instance in structural engineering or urban design. From an ecological point of view, for instance for biologists, environmental services serve their own ends. This difference in view reveals different abstractions: engineers tend to define – “reduce” – environmental tasks as sections of technical planning, ecologists define environmental tasks as a service to nature. Another influential group are technical specialists in public administration – the technical bureaucracy. They control the execution of environmental laws and define technical standards. As to water protection and many other operational areas, the technical specialists in public administration have taken over the lead in the discussion over the design of environmental services (cf. Bussmann, 1981).

Future development depends on the dynamics in the Swiss market for professional environmental services. One source for these dynamics lies in the relationship between ecologists and engineers. In 1980, the Swiss Association of Ecologists was founded (Schweizerischer Verband der Ökokologen und Ökologinnen, OeVS). The founding members came from very different professions, most of them biologists or geographers. In 1996, this association decided to change its name to *Swiss Association of Environmental Professionals* (Schweizerischer Verband der Umweltfachleute, SVU). After years of separation, now the Swiss Association of Environmental Professionals is about to fuse with other specialized professional engineering associations.

The second source of the dynamics in the Swiss market for professional environmental services is the ongoing academic formalization in environmental sciences. In 1987, a comprehensive course program in Environmental Sciences (Umweltwissenschaften) was established at the Swiss Federal Institute of Technology (ETH). This curriculum is based on the classical natural sciences and defines a new discipline with specific research. Formalization in the Environmental Sciences is based on the scientific *system* metaphor: environmental problems are defined as interactions between natural systems. For instance, contaminated sites can be described by interactions of soil systems and water fluxes. Every year about 150 to 200 students begin their studies in Environmental Sciences (about 6% of the total of new students at ETH).

To conclude, the Swiss market for professional environmental services is a good example to study the dynamics of professional competition, as it is a new market open to professionals with various educational backgrounds. We also find abstraction in both forms, first reduction, as in the diverging task definition by engineers and ecologists; second formalization, as in the uprising discipline of

Environmental Sciences as well as in the standardization efforts of the technical specialists in public administration.

#### 4 Deriving and Testing Hypotheses

In 1997, the Swiss Association of Environmental Professionals (SVU) together with 9 related associations conducted a survey (Mieg, 2000). The two main objectives of the survey were, first, to evaluate the services of the SVU and of professional associations in general; and second, to find out the educational background of environmental professionals. In this survey, the professionals also defined their specific *professional activities* and revealed their activity-specific competitors. Appendix contains a translation of the respective page in the survey.

We can use the data from the SVU-survey for an analysis of the relationship between abstraction and professional competition. In this section, we have to discuss the derivation of testable hypotheses, considering, firstly, our assumptions; secondly, definitions, particularly for the concept of abstraction; and, finally, our hypotheses.

#### Appendix

##### *Market for environmental services*

Presumably you work on several professional activities or projects, for example:

- environmental auditing for corporations
- contaminated sites
- EIS,
- environmental data bases,
- academic teaching

Please indicate your three most important professional activities. Please tick the competitors for each of your activity.

	Main professional activity	Second most important professional activity	Third most important professional activity
agronomists / foresters	–	–	–
architects	–	–	–
biologists	–	–	–
chemists	–	–	–
geographers	–	–	–
engineers	–	–	–
lawyers	–	–	–
media experts	–	–	–
physicians	–	–	–
economists	–	–	–
teachers	–	–	–
experts in area development	–	–	–
environmental natural scientists	–	–	–

#### 4.1 Assumptions

To be clear, reduction is *relative* to a knowledge system. From a managerial point of view, recycling is a problem of technology and management. This managerial understanding would be considered a strong reduction of the underlying problem from an ecological perspective. From this perspective, recycling has to be interpreted in terms of mass fluxes and resource conservation. We can identify reduction only against the background of a (profession's) knowledge system.

The SVU-survey provides us with information from individual professionals about their activities in the Swiss market for environmental services in 1997. We do not have detailed information about the knowledge systems of the professions involved. Nor do we have historical data. Therefore, we cannot test for causality. Given the SVU-data, we cannot detect causal chains between inter-professional competition and changes in the professions' knowledge systems. Instead, we have a snapshot of a market and the definitions of the tasks provided by the individual professionals. To be able to derive hypotheses, we have to make a few assumptions.

Assumption A: If a market is professionalized, a profession has established a service monopoly. This monopoly encompasses every task for which the particular profession has established an exclusive jurisdiction. From the point of view of the profession, these exclusive jurisdictions are *not* reductive. We can call the monopolized tasks the *heartland* of a profession. For its heartland, the profession has replaced inter-professional competition by intra-professional competition. This means that inter-professional competition is minimized for the tasks with non-reductive jurisdictions (the heartland); likewise intra-professional competition is increased for these tasks.

Assumption B: If a market is not yet professionalized but driven by law-making, as in case of the Swiss market for environmental services, there is no profession with a monopoly for jurisdiction in this market. Instead, professions compete with one another for establishing jurisdiction for law-defined tasks.

Assumption C: In case of the Swiss market for environmental services, there is a proto-professional knowledge base, namely Environmental Sciences at the Swiss Federal Institute of Technology (ETH). Given firstly the huge amount of students in Environmental Sciences; secondly the fact that they graduate from the one and only federal university; and thirdly that the market is driven by federal law, Environmental Sciences at the ETH have the potential for becoming the academic base of an environmental profession in Switzerland.

Assumption D: Formalization is a means to strengthen a profession's jurisdiction for a particular task. However, strong formalization does not in every case prevent members of other occupational groups from using the formal know-how provided by the profession that has successfully established a particular jurisdiction. This is for instance the case for psychological tests that have been developed by psychologists but are used by physicians and social workers.

## 4.2 Definitions

*Abstraction.* Abbott (1988) distinguished two forms of abstraction, namely reduction and formalization. In our context, reduction will be referred to in the definition as *problem-reduction*: this means that an environmental task or problem is seen from the “reductive” perspective of a particular profession. Formalization refers to the development of academic or scientific knowledge systems that interpret reality. Natural sciences, engineering as well as management theory provide formalizations for environmental services. In general, formalization is a phenomenon on a societal level. On the activity level, formalization results in theoretical and procedural standards. In our context, formalization will be referred to in the form of *standardization*: this means that a particular task or an activity is linked to specific norms or concrete techniques.

*Competition.* In our context, competition will be assessed as perceived competition reported by the professionals in the survey. *Intra-professional competition* is defined as the perceived competition with professionals of the same profession. *Inter-professional competition* is defined as the perceived competition with professionals of a different profession. Our definition of inter-professional competition constitutes a *weak* form of competition, namely: the presence of members from different professions in a field of activities. This does not imply that all the represented professions claim jurisdiction for the particular tasks. If there are conflicting jurisdictions from different professions for the same task or field of activities, this constitutes a *strong* form of inter-professional competition.

*Professions.* In our context, professions are loosely defined as occupational groups. The professional affiliation of a person is defined in terms of his or her educational background.

## 4.3 Hypotheses

The hypotheses will connect abstraction to professional competition. Let us discuss the two forms of abstraction separately, starting with reduction (problem-reduction). Four points have to be made.

- First, abstraction in the form of reduction seems to affect inter-professional competition (Assumptions A and B). Thus, we will test the co-variation of inter-professional competition with reduction (problem-reduction).
- Second, in order to define degrees of problem-reduction in task definitions, we can refer to the natural-system oriented perspective of Environmental Sciences (Assumption C). This also includes environmental tasks defined by law, insofar as they concern the protection of resources and environmental systems (air, soil, water, “nature conservation”).
- Third, we have to consider the Swiss market for environmental services as *not yet professionalized* but *driven by law-making*. We can expect most intense

inter-professional competition for tasks with non-reductive jurisdiction – seen from the Environmental-Sciences perspective (Assumption B).

- Fourth, since the market is not yet professionalized, we have no clear expectation concerning intra-professional competition and abstraction in the form of reduction (problem-reduction).

Turning to formalization (standardization), two further points have to be added. First, given our operational definition of formalization as standardization, we can directly link degrees of standardization to intra-professional competition. To this end we can formulate

**Assumption E:** Intra-professional competition is most intense for half-standardized tasks. Fully standardized tasks need specific training and depend on particular regulations or procedures (e. g., for life-cycle assessment), thus being somewhat dangerous due to changes in regulations and less attractive. Non-standardized tasks do not differentiate, thus lacking competitive power.

Second, given our weak-form definition of inter-professional competition, we can state: if also inter-professional competition co-varies with standardization, we can expect more competition for highly-standardized tasks. In such cases, one can enter the market by using specific formal know-how, for instance from information technology (Assumption D).

These considerations lead to four hypotheses, two main hypotheses for problem-reduction and standardization and two adjunct hypotheses.

*Reduction-Hypothesis:* Inter-professional competition co-varies with abstraction in the form of problem-reduction.

We expect the most intense inter-professional competition for tasks with non-reductive jurisdictions.<sup>1</sup>

*Adjunct Hypothesis 1:* Intra-professional competition does not co-vary with abstraction in the form of problem-reduction.

*Standardization-Hypothesis:* Intra-professional competition co-varies with abstraction in the form of standardization.

We expect the most intense intra-professional competition for half-standardized tasks.

*Adjunct Hypothesis 2:* Inter-professional competition does not co-vary with abstraction in the form of standardization.

Otherwise, we expect the most intense inter-professional competition for highly-standardized tasks.

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<sup>1</sup> In the original version, the reduction-hypothesis was tested under the assumption of a professionalized market (Mieg, 1999, 134). Therefore, the most intense inter-professional competition was expected for the tasks with reductive jurisdiction (i. e., outside of the heartland, cf. Assumption A).

## 5 Method

The hypotheses tests will have a cross-sectional design, using forms of abstraction as independent grouping variables and forms of professional competition as dependent variables.

### 5.1 Dependent Variables

In the SVU-survey, the professionals were asked on the basis of a list of 13 professions whether they compete with members of these professions. Appendix includes a complete list of all professions that have entered the competitors' list. As the survey also included the educational-professional background of each participant, we can determine the variables for professional competition. For each activity and professional, the variable *intra-professional competition* has two values, 0 (no competition with a professional of the same profession) and 1 (in case of competition with professionals of the same profession). For each activity and professional, the variable *inter-professional competition* has the values 0, 1, ... to 12, according to the number of other competing professions.

### 5.2 Independent Variables

To determine the degree of abstraction of the definition of a particular activity, we refer to the Environmental-Sciences perspective (cf. Assumption C). From the point of view of the Environmental Sciences, environmental problems are interactions of the natural systems water, soil and air, including biotic systems (Abteilung für Umweltnaturwissenschaften, 1997, 5). Accordingly, to determine the degree of abstraction of the definition of a particular activity, we have to ask how this definition reflects the underlying environmental problem in terms of interactions of water, soil, air and biotic systems.

#### 5.2.1 Independent Variable: Problem-reduction (low, medium, high)

In our context, problem-reduction means reduction of the underlying environmental problem. The paradigmatic anchor is the definition of environmental problems as an interaction of natural systems. Then, the definitions of activities with respect to natural systems ("water," "soil" etc.) can be regarded as non-reduced definitions in an elementary sense. This is the case for activities defined as "water management" or "soil analysis." Other definitions do not directly relate to natural systems and interactions of natural systems, for example "area development." The degree of problem-reduction of the definition "area development" is higher than the degree of reduction of the paradigmatic activity areas "water," "soil" and "air." Nevertheless, a definition such as "area development" still has an aspect related to environmental problems, since "area development"

includes the possibility of problems with contaminated soil. Some definitions only vaguely relate to natural systems and interactions of natural systems; from the point of view of the natural system, we can regard these definitions as highly reduced. For example, “planning” is still more reduced than “area development,” since “planning” can also relate to business project planning or political planning. The variable for problem-reduction is defined as having three values: low, medium, high.

#### *5.2.2 Independent Variable: Standardization (low, medium, high)*

In practice, technologies and cantonal guidelines standardize the procedure of environmental services. For instance, for “contaminated sites,” we find technologies for contaminated site remediation as well as official procedural instructions (e. g., Amt für Gewässerschutz und Wasserbau des Kantons Zürich, 1996).

The degrees of standardization have been derived in analogy to the degrees of reduction. The tasks “water,” “soil” and “air” are the paradigmatic anchor. These three definitions show a relatively low degree of standardization: they do not indicate specific technological solutions for the underlying environmental problem. In contrast to these definitions, definitions such as “contaminated sites” or “environmental impact assessment” define their activities in a solution-oriented manner that indicates what has to be done. They are highly standardized. In our classification, medium standardization could be found for definitions such as “nature conservation,” which do not really indicate how to proceed but show a clear relationship to legal regulations. Thus, we can define the variable for standardization as having three values: low, medium, high.

## 6 Results

### 6.1 Sample

The ten associations distributed 1'700 questionnaires, 1'000 in German, 700 in French. About 420 were returned (return rate 35% for the German questionnaires, 10% for the French questionnaires; about 50% for the members of the SVU). For technical reasons, several professionals received more than one questionnaire from different associations and/or in different languages. No reminder was sent. Several professionals refused to reveal their business affairs and returned empty questionnaires. 406 questionnaires entered the final analysis. Table 1 shows the professional backgrounds of the participants. As we see, the sample is dominated by biologists, then come professionals with a background in Environmental Natural Sciences, and engineers.

Table 1: Educational Background of Professionals who Participated in the Survey on the Swiss Market for Environmental Services in 1997 (only groups > 1%)

Education	Professionals
Biology	27.5%
Environmental Natural Sciences <sup>a</sup>	16.3%
Engineering	15.8%
Natural Sciences <sup>b</sup>	9.1%
Teachers	8.6%
Agronomy/Forestry	8.1%
Diplomas <sup>c</sup> for Environmental Issues	7.9%
Geography	5.7%
Diploma <sup>c</sup> for Town Planning	4.4%
Architecture	4.2%
Economics	4.2%
Chemistry	3.9%
SANU-degree <sup>d</sup>	3.7%
Diploma <sup>c</sup> for Area Development	3.2%
Media	1.5%
Law	1.5%
Social Sciences	1.2%

*Note*

– Percentages sum up to more than 100% due to professionals with multiple degrees.

a Including equivalent education outside Switzerland.

b This category refers to physicists but also to professionals who wrote that they have a diploma in natural sciences but left open in which discipline.

c Post graduate

d SANU (Schweizerische Ausbildungsstätte für Natur- und Umweltschutz) is a non-university based professional school, particularly for practitioners without an academic degree.

## 6.2 Activities

The 406 professionals who participated in the SVU-survey described 989 single professional environmental activities. Table 2 shows a classification of these activity definitions by 39 service categories. 901 activities (91%) fit into this categorization.<sup>2</sup> As we see, the main service is environmental impact assessment with a share of 9.1%. Second is teaching (5.7%), third environmental consulting (5.2%). Table 2 also contains the derived degrees of abstraction for each of the service categories. The classification was done by the author and has been validated in the test-robustness study (that will be described in footnote 4 in the context of the hypotheses tests).

2 The classification procedure was strictly literal. The names of the categories match the definitions of the tasks provided by the professionals. When a task definition fitted more than one

Table 2: Environmental Services in Switzerland (1997-Survey, N = 989)

Category of Environmental Services	Share	Problem-Reduction	Standardization
Environmental Impact Assessment	9.1%	low	high
Teaching	5.7%	high	high
Consulting <sup>a</sup>	5.2%	high	low
Research (academic/nonacademic)	5.0%	high	high
Public Relations	4.7%	high	low
Schooling	4.2%	high	low
Nature Conservation	3.8%	low	medium
Data Processing <sup>b</sup>	3.4%	high	high
Planning <sup>a</sup>	3.0%	high	low
Management <sup>a</sup>	2.9%	high	low
Environmental Auditing	2.8%	low	high
Expert Opinions <sup>a</sup>	2.8%	high	high
Waste and Recycling	2.7%	low	high
Biotopes <sup>c</sup>	2.4%	low	low
Inventories	2.4%	high <sup>d</sup>	high
Law	2.4%	high	high
Water	2.2%	low	low
Contaminated Sites	2.0%	low	high
Construction	1.8%	medium	medium
Farming and Forestry	1.6%	low	medium
Politics	1.6%	high	low
Landscape	1.5%	medium	medium
Environmental Management Systems	1.5%	low	high
Environmental Education	1.4%	low	low
Traffic	1.4%	medium	medium
Industrial Processes	1.3%	medium	medium
Soil	1.3%	low	low
Area Development	1.3%	medium	high
Documentation	1.3%	high	low
Air	1.2%	low	low
Villages	1.0%	medium	medium
Administration <sup>a</sup> (secretary level)	1.0%	high	low
Noise	1.0%	low	high
Life-Cycle Analysis	0.8%	low	high
Energy	0.7%	medium	medium
Journalism	0.6%	high	low
Chemical Analysis	0.6%	high	high
Environmental Engineering	0.6%	low	high
Sewage	0.4%	low	high
unclassified	8.9%		

*Note*

a Collective categories (e.g., for several fields of environmental consulting).

b Including GIS (Geographical Information System).

c Including marshlands.

d This is the only value that is totally different from the classification by the experts in the test-robustness study (difference = 1); in a revision, it should be changed to 0.

### 6.3 Hypotheses Tests

Four one-way analyses for variances were conducted.<sup>3</sup> The independent (grouping) variables were problem-reduction and standardization (low/medium/high). The dependent variables were inter- and intra-professional competition. No two-factorial analysis was computed due to empty cells (there is, e. g., no task definition with high problem-reduction and medium standardization). 801 individual activities entered into the analyses. Table 3 shows the test results. Both main hypotheses can be confirmed. As the Reduction-Hypothesis asserts, inter-professional competition varies according to the degree of problem-*reduction* of the task definitions ( $F[2,798] = 8.09$ ,  $p < .001$ ); intra-professional competition is furthermore not affected by degrees of problem-reduction ( $F[2,798] = 1.95$ , ns.; Adjunct Hypothesis 1). As the Standardization-Hypothesis asserts, competition *within* professions varies according to the degree of standardization of the task definitions ( $F[2,798] = 4.30$ ,  $p < .05$ ); inter-professional competition is furthermore not affected by variation in the degree of standardization ( $F[2,798] = 1.55$ , ns., Adjunct Hypothesis 2).<sup>4</sup>

Table 3: Inter- and Intra-Professional Competition in Dependence of Degrees of Abstraction

Competition / Abstraction	Test <sup>a</sup>	Most intense competition for	Least intense competition for
Inter-professional/ Problem-reduction	$F(2,798) = 8.09$ $p < .001$	non-reduced tasks	highly reduced tasks
Inter-professional/ Standardization	$F(2,798) = 1.55$ ns.		
Intra-professional/ Problem-reduction	$F(2,798) = 1.95$ ns.		
Intra-professional/ Standardization	$F(2,798) = 4.30$ $p < .05$	half-standardized tasks	non-standardized tasks

*Note*

a One-way analysis for variances with the variables *competition* (dependent variable) and *abstraction* (independent variable).

category (e. g., “expert opinions on contaminated sites”), the more specific category was chosen (“contaminated sites” instead of “expert opinions”). Thus, there are some soft categories such as “management” or “consulting” which contain tasks for which no specific categories exist, for example “environmental health care consulting.”

3 The test results remain the same if we compute non-parametric Kruskal-Wallis tests for group differences.

4 To test the robustness of the design a validation study has been conducted, involving three experts in Environmental Sciences and professional environmental services. The experts rated

Moreover, as Table 3 shows, inter-professional competition is most intensive for non-reduced services, that is for services such as “soil”-related tasks, “nature conservation,” or “life-cycle analysis.” Intra-professional competition is most intensive for half-standardized services, that is for services such as “nature conservation,” “traffic,” or “landscapes.”

## 7 Discussion

Our analyses showed predictable relationships between abstract knowledge and professional competition. This relationship is specific to the professional domain. Abbott calls abstraction “the quality that sets inter-professional competition apart from competition in general” (1988, 8 f.). We will discuss the results under three aspects: first, the concept and “quality” of abstraction; second, the hypotheses; and finally the relevance for the sociology of professions.

### 7.1 The Concept of Abstraction

“Abstraction” is a philosophical term, it is normally used to denote a certain class of notions as “abstract,” for example the notion of “relationship” or “causality.” In contrast to concrete terms, abstract terms cannot be defined by pointing to real objects. “Abstract” also denotes the type of knowledge that is formulated in abstract terms. In general, academic and scientific knowledge is abstract. Seen as an operation, abstraction means to proceed from concrete knowledge to abstract knowledge, for instance by subsuming concrete cases (patients) under a class of diseases. Abstraction as an operation can also proceed from abstract descriptions (e. g., diseases) to a combining notion (e. g. “psychosomatic”), the latter notion being therefore more abstract than the previous descriptions.

To view professional work connected to abstraction is not unusual in the sociology of professions. It is in line with Hughes, who spoke of “detachment” in professional work: “having in a particular case no personal interest such as would influence one’s action or advice, while being deeply interested in all cases of the kind” (Hughes, 1965, 6). Although professional knowledge is mainly organized

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the degree of problem-reduction and standardization of environmental services (from Table 2). In a quasi-Delphi procedure, the experts were asked twice. In the second round they were confronted with the results of their first round ratings and asked for revisions. The overall validity of the service classification in Table 2 was measured as correlation with the medians of the experts’ classifications. This validity measure showed almost no change; it was  $r = .63$  in the first round,  $r = .62$  in the second round. More important: using the experts’ classification, the results of the four hypotheses tests from Table 3 could be confirmed (one-way analyses of variances): inter-professional competition varies with problem-reduction ( $p < .001$  in both rounds), intra-professional competition with standardization ( $p < .05$  in both rounds), other relationships between the independent variables of abstraction and the dependent variables of professional competition being non-significant. Thus, the data seem to be quite robust.

through knowledge based on concrete cases, its organizing principles are based on abstract, scientific knowledge (Mieg, 2001).

Comparing Abbott's concept of abstraction and the one this article is based on, we find some differences. Particularly, Abbott (1988) understands abstraction as a *process* that is woven into the historical process of inter-professional competition (in a strong sense of a competition between professions). In contrast, the SVU-study shows a "snapshot" of the situation in 1997. However, even "abstraction" refers sometimes to an operation (a process) and sometimes to the result of this operation. Accordingly, the SVU-study provides us with the definitions of professional tasks – which are the results of specific professional abstractions.

A further difference concerns the definition of *formalization*. Defining formalization, Abbott refers to "many layers of increasingly formal discourse" (1988, 102). By this definition, scientific or theory-based discourse *per se* is formalized. The definition of formalization as standardization, which is used in this article, refers to standard procedures and techniques that help solve a professional problem. From this point of view, some technology (e.g., for the remediation of contaminated soils) is more standardized (formalized) than the theory on underlying environmental problems (e. g., in terms of an interaction of the natural systems water, soil, air). The main conceptual difference concerns the *role of science*. Whereas Abbott seems to conceive science as the final state of formalization, the definition of formalization as standardization understands science as one starting point for designing technologies for professional use. Thus, we take into account the need for technical, professional standards, that is, "concrete recipes" for professional work (Goode, 1969, 282). Professional standards are "formalized and codified decision rules that join professional knowledge to action" (Baer, 1986, 533). As Baer (1986) has analyzed, standards "absorb" the uncertainties that are involved in the practical application of professional knowledge.

## 7.2 The Hypotheses

The system of professions, as conceived by Abbott, consists of interactions between professions. Our level of testing was clearly the level of *individual* professionals. This might provoke the question: Can we really analyze professional competition on this individual level? Nowadays, there is a necessity for team work and interdisciplinary, inter-professional work. Therefore, inter-professional competition seems not quite obvious on the level of individual professionals. To answer, firstly, if there is indeed competition between professions at all, we should find evidence for it in – at least – some individual professionals. Secondly, the methodological basis of our study was the analysis of the *definitions of* tasks or activities. In our study, these definitions were provided by the individual professionals. However, such definitions are not completely individual or subjective. In order to be competitive, they have to be plausible, that is, they should show how a

particular competence helps in delivering a particular service. We can say that definitions of activities are the visible traces of professional jurisdiction (as Abbott has conceived it).

The Reduction-Hypothesis links *inter*-professional competition to abstraction in the form of reduction. It says that inter-professional competition varies according to the degree of problem-reduction of the definitions of tasks. This can be found in the data. The direction of inter-professional competition depends on the grade of professionalization of the market. A profession monopolizing this market would replace inter-professional competition by intra-professional competition. Therefore, the most intense competition should be found in tasks with highly reduced definitions. This is not the case for the Swiss market for environmental services, where we could find the most intense competition for tasks with non-reduced definitions (often defined by law). Accordingly, we could not find a co-variation of intra-professional competition with problem-reduction.

The Standardization-Hypothesis links *intra*-professional competition to abstraction in the form of formalization or standardization, respectively. It says that intra-professional competition varies according to the degree of standardization of the definitions of the tasks. This can be found in the data, particularly the peak of competition in half-standardized tasks. The data show no co-variation of *inter*-professional competition with standardization. If they did, the direction of the effect would have theoretical implications. We expected the peak in highly standardized tasks – since standardized, effective procedures can attract professionals from other occupational groups (Assumption D). However, if the data showed the least intense inter-professional competition in highly formalized tasks, this would give evidence for the defensive character of formalization (as Abbott has conceived it).

### 7.3 Relevance for the Sociology Of Professions

Let us finally turn to the consequences for the sociology of professions. As mentioned, theorizing about professions focuses either on professional knowledge or on market monopolies. The study showed a link between these two sides, providing evidence for the relationship between the definitions of professional tasks and professional competition. This sheds light also on the relationship between professional knowledge and the dynamics of the service markets. From this perspective, market monopolies of professions are equally *definitional monopolies*. Particularly, our study demonstrated the role of abstraction (abstract professional knowledge) in the form of *problem-reduction* for inter-professional competition. Problem-reduction means: Professions try to re-define (“reduce”) tasks from the point of view of their particular professional knowledge base. Our result is in line with recent studies on professional competition that showed the competitive role of abstract professional knowledge, especially in the context of the classical

professions medicine and law. For instance, Saks (1995) described how the British medical profession mobilized the definitions of medical health activities ("professional ideologies") against acupuncture in the nineteenth century. Dezelay and Garth (1996) studied "terms, definition, and institutions as sites of professional competition" in the context of professional commercial arbitration, the means of competition being the "symbolic capital" of the professions involved.

To conclude, this study has demonstrated the reality of abstraction in the Swiss market for professional environmental services. It has shown the influence of task definitions. The "cognitive structure" (Abbott) of professional work seems strongly correlated with the competition in the service market.

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