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GENERATIONAL DIFFERENCES IN RESEARCHERS' PROFESSIONAL ETHICS: AN EMPIRICAL COMPARISON*

APPROACHES USED IN OTHER/EARLIER STUDIES

Empirical studies of research ethics, sociological or other, are rare and existing ones usually follow two different lines of interest. Some are interested in scientific misconduct, while others are preoccupied with scientists' cognitive standards and/or convictions. These two groups of studies differ both in conceptual and in methodological approach: the first start from pragmatic definitions of the research subject, the second from theoretical criteria.

Pragmatic approaches define scientific misconduct and questionable research practices on the basis of ethical codes or recommendations of scientific academies, scientific societies, universities and other research institutions. They investigate the spread and incidence of proscribed behaviour patterns on larger or smaller samples of the scientific (sub)population. The largest and best-known study of the American Acadia Institute was carried out on a sample of 4,000 faculty and doctoral students in chemistry, civil engineering, microbiology and sociology (Swazey et al., 1993).

Other studies were smaller, with fewer respondents, usually from one scientific field or discipline, and thematically they usually concentrated on particular ethical problems, often authorship assignment (Eastwood et al., 1996; Tarnow, 1999). These studies also analysed statistical data about scientific misconduct allegations and the findings of investigations carried out on their basis (Rhoades, 2000).

Theoretically most ambitious is research into scientists' cognitive standards or convictions. These start from at least some assumptions about the character, source and/or meaning of science ethos. Usually this is a norm-based framework, in the first place Merton's (1974) concept of science ethos, such as in the Hill (1974) research. In the nineties this concept was verified in another Acadia study, focusing on the normative orientation of faculty and doctoral students. What is more, it examined the en-

actment of mertonian norms and Mitroff's counternorms, i.e. the degree in which they represented typical faculty behaviour in the respondents' departments (Anderson, 2000). So far this is the only study that covered science ethics on both levels – normative and behavioural.

Unlike the above research that empirically verified an existing and very often criticised theory, modified normative approaches are now developing from the combination of various hypotheses about scientific values and norms, empirical results, pilot research, even teaching experiences. Some studies stopped on the level of adopting norms (Berk et al., 2000), others were performed on the behavioural level of research ethics (Kaiser, 2002). These empirical investigations also include, at least in part, some social dimensions of science ethics. Theoretically (most) interesting are studies that investigate scientists' cognitive convictions starting from classical sociological concepts and postmodern hypotheses (Andersen, 1999; 2001).

Scientists' cognitive standards can also be discerned from research quality studies, especially studies focused on quality evaluation criteria. Ranking standards of (good) research by respondent scientists enables recognising the criteria and/or cognitive norms that the scientific population finds important when evaluating research and publication quality (Chase, 1970; Hemlin and Montgomery, 1990; 1993; Hemlin, 1993; Hemlin 1996). Yet, such data are partial, too, since they show the cognitive side of science ethics but leave its social dimension completely out of research focus.

To sum up the results of this literature analysis, we will point out two major problems in the approaches used in empirical studies of research ethics. The first is that the value-normative level is separated from the behavioural level of science ethics, that is, what researchers consider their professional standards are separated from their actual everyday behaviour. The second problem is reducing research ethics to cognitive standards and neglecting social relations and considerations in scientific work and profession. None of these studies included both levels (normative and behavioural) and both dimensions (cognitive and social) of research ethics.

Unless we gain comprehensive empirical insight into both levels and both dimensions of research ethics, the contrasting descriptions of old academic and new research ethics are merely hypothetical models. In this case the discussions and controversies concerning that subject remain mainly speculative and thus not very promising.

The purpose of this contribution is not to participate in these discussions or to attempt answering these dilemmas. All the more so as the framework of Croatian society, economy, technological development and national innovation system do not allow empirical findings about Croatian researchers' ethics to be generalised to knowledge-based societies. Our picture may be interesting and indicative, although not necessarily representative, for the transitional social and economic context.

What can be generalised are trends in (generation-based) changes confirming that scientists' values and everyday behaviour are not static and uniform, as Merton's concept suggests. On the other hand, we tried to avoid the constructivist tendency of reducing science ethics to a mere set of moral prescriptions (Collins, 1982), of pronouncing epistemology to be ideology (Chubin and Restivo, 1983), and of equating professional ethics with professional ideology intended for presentation to the public, without any deeper importance in everyday scientific professional practice (Fuchs, 1992).

The starting point in both studies was the sociological concept of professional ethics understood as a constituent element of the scientific profession. Moreover, the concept of professional ethics is placed within the broadest socio-cognitive approach to science studies, emphasising the mutual linkage of the social and the intellectual organisation of science (Whitley, 1977; 1981; 1984). This approach recognises the pluralism of the cognitive and social features of contemporary science, but also presumes the existence of some common characteristics that distinguish science from other forms of intellectual and cultural production. Consequently, science ethics can be viewed as a complex structure: a) with a common (yet changeable) core of scientists' professional standards and patterns in everyday professional practice; b) with an pronounced inner differentiation of professional values and norms, and patterns of researchers' conduct according to their organisational and cognitive context.

Therefore, science ethics is defined here in two ways. As a *set of scientists' professional values and norms* it encompasses both cognitive and social standards, standards of scientific work and standards of behaviour in professional relations respectively. As scientists daily *professional practice*, research ethics may not strictly follow their cognitive and social ideals and thus includes their ethically questionable conduct as well.

The goal of this study, on the basis of two empirical research projects undertaken in Croatia on (large) samples of eminent and young researchers, is to show: a) a comparison between the professional values/norms of these groups, their cognitive standards, and also the behaviour standards in researchers' professional relations (normative level of research ethics); b) a comparison (of perceptions) about the frequency of ethically questionable and unacceptable behaviour of researchers in Croatian research institutions (behavioural level of ethos).

The basic concepts were defined in accordance with the above approach: cognitive and social norms, as well as ethically questionable and unacceptable behaviour of scientists.

Cognitive and social values and norms are constituent parts of scientific ethical code(s), written or not, formal or informal. Cognitive standards are seen as a basic element of the intellectual structure of science. They rest on consensus adopted by scientists about relevant scientific research criteria, research evaluation criteria and some rational procedures that science, as a collegiate profession, could not exist without. These norms are not of absolute nature, yet science analysts (philosophers) expect the epistemological orientation of most practising scientists to be realistic, even that researchers by and large accept mertonian norms (Elkana, 1978; Lelas, 1990; Cole, 1992; Sonnert, 1995; Fuchs, 1996).

In this study the choice of cognitive norms was based on some, theoretically and empirically, most frequently examined components of the scientific professional code: o*bjectivity* (represented by several procedures considered crucial for this cognitive ideal); *verifiability,* which is considered the *differentia specifica* of scientific knowledge (represented by relevant procedures too); *logical rigour*; *systematism,* which denotes incorporating research findings into a system of scientific cognition; *precision* (not only methodological, but also conceptual, as well as precision of writing), and *originality* or cognitive novelty, the most important (and the most fluid) feature of creative scientific thought and work.

The social component of science ethics consists of values and norms governing desired and prescribed behaviour in the professional relations that a scientist establishes in his/her work. These relations include: a) colleagues (cooperation, open communication, help, deserved authorship assignment), b) students (fair/correct teaching and support); c) patients and/or respondents (protecting their rights); d) clients or funders (universalistic principle and professional autonomy); e) work organisation (caring

for the institution's research excellence); f) the wide(er) social community – scientists' social (ir)responsibility was observed through three orientations: ethical neutrality, social responsibility and cognitive uncompromisingness.

Since no clear consensus on unethical behaviour in science exists, in this paper deviations from the professional – cognitive and social – values and norms defined above are observed as ethically questionable and unacceptable types of scientists' conduct. The categories used here were constructed so as to ensure comparison with other studies whenever possible.

Deviations from the cognitive norms of *objectivity, verifiability and precision* refer to data manipulation, distortions in using the findings of other scientists (Swazey et al., 1993), secrecy (Hagstrom, 1965; 1974), noncognitive particularism (Mitroff, 1974; S. Cole, 1992) and theoretical dogmatism (Mitroff, 1979; Mahoney, 1979). Also included is adjusting scientific findings to the dominant theoretical orientations and to the mainstream ideology, politics, religion and world-view in society. Expedient reasoning, i.e. adjusting arguments to the thesis (Mahoney, 1979), and empiricism or theoretically insufficient empirical research are included as the most adequate indicators of possible deviations from *logical rigour* and *systematism*.

Whereas the deviations from cognitive standards mentioned may cause damage to scientific knowledge, deviations from social norms harm or even endanger the participants in and users of scientists' professional work. Instead of an unfeasible examination of all the distortions of *collegial relations* in science, only those that maximally erode the norm of communality – plagiarism, inappropriate authorship assignment and discrimination in scientific collaboration – are covered here. Exploitation of subordinated associates has also been taken into account (Hagstrom, 1965; Heffner, 1979; Swazey et al., 1993).

The ethically questionable conduct of scientists towards *students* primarily includes "hidden" exploitation and discrimination (Berelson, in Hagstrom 1965; Swazey et al., 1993), and regarding *respondents and/or patients,* this includes jeopardising their well-being, as well as their voluntary and anonymous participation in scientific research. In the relations of researchers with their *funders/clientele* and with their *organisation,* we have focused on neglect of scientific standards in (applied and/or contract) research. Concerning the *social responsibility* of scientists, the existence of two extreme types of conduct was presumed. One shows scientists' denial of any social responsibility or their complete ethical neutrality. The other includes the impact

of social benefit on cognitive options, namely, on the un/acceptance of scientific theories and methodological criteria, and on the non/publication of scientific results.

DATA COLLECTING AND PROCESSING

Data for this study were derived from responses to two mail surveys carried out in the nineties. The first survey was mailed in 1995 to the population of the most distinguished scientists listed in the biographical directory called *Who is Who in Croatia* (Maletić, 1993). A relatively restricted definition of eminent population was used, comprising only professionally active scientists living in the country, excluding professors at academies of art and at theological faculties and institutes. This population included 769 eminent scientists to whom the questionnaire was sent.

After three reminders, 385 respondents or 50.1% sent back the questionnaire. Chi-square tests showed that the obtained sample did not significantly deviate from the known relevant characteristics of the population: gender, age and scientific field. In the analysis only 320 questionnaires were used, in which items related to scientists' professional ethics were completely answered, response rate thus falling to 41.6%. The social and professional profile of these 320 respondents was practically identical to the entire sample of eminent scientists. The application of chi-square tests discovered no significant differences in the most relevant features (respondents' scientific field and type of research) among them.

In 1998, the same questionnaire was mailed to all researches and scientists aged under 35 evidenced by the Ministry of Science and Technology of Croatia (1,696 persons). After three reminders, 840 respondents answered the questionnaire, which was 49.6% of the total population of young scientists.

The most relevant characteristics of the sample – gender, age, scientific degree and type of organisation – were compared with the corresponding data for the young researchers' population. Chi-square tests were used to establish the significance of differences among them. The sample is socio-demographically representative because it does not significantly deviate from the population in gender and age structure. However, it is socio-professionally selective, because respondents with a master's or doctor's degree, and those employed in public institutes, are over represented.

The same questionnaire (batteries of items) was used in both surveys. The most relevant social and professional

characteristics of the respondents were examined in a specially designed part of questionnaire. Operationalised professional norms and forms of ethically problematic and unacceptable types of conduct made separate sets of questions. The items were derived from the listed cognitive and social values and norms, and from the list of deviations from these norms. The questionnaire included three batteries of items concerning science ethics.

The first battery was related to the importance of each norm in respondents' scientific fields/disciplines. Respondents ranked each of the 34 items on a four-degree scale from *mostly unimportant* to *very important*. The second battery included the same norms, but this time the respondents were asked to indicate the extent to which they see these norms enacted in their fields (first survey) or institutions (second survey). A scale of four degrees was used for rating each item from the *lowest* to the *highest* degree of norm enactment. The third battery consisted of 26 items about misconduct and questionable research practices. The respondents marked the frequency with which, according to their personal observations, each type of (mis)conduct had occurred in their scientific institutions in the last five years. Four-degree scales, ranging from *never* to *very often,* were again used.

Data were analysed using the SPSS programme (for MS Windows). After obtaining descriptive statistics (frequency distributions, means and standard deviations), t-tests for equality of means were used to determine whether there were significant differences between eminent and young scientists in their subscription to the norms, and between their perceptions of incidence of ethically questionable conduct.

EMINENT AND YOUNG RESEARCHERS' ETHICAL CODE

Table 1 shows the rank-ordered means of the respondents' ratings on every scale (M), as well as t-tests for the equality of these means, showing subscription to the cognitive and social values and norms of eminent and young researchers, as well as in/significant subscription differences between these groups.

Even the first inspection of the table shows that both groups of respondents ranked the possible norms of scientific work and profession very highly, attributing each of them an above-average importance (the average result on a 1-to-4 scale is 2.5). On all scales, the overall mean subscription to the norms is 3.25 for eminent scientists, and practically the same, 3.23, for young researchers. This general

Table 1

Subscription to professional values/norms of eminent and young researchers (rank-ordered means) and the results of t-tests

Professional values/norms	Eminent scientists		Young researchers		t-test for equality of means		
	Mean	Rank	Mean	Rank	t	df	Sig.
Conceptual accuracy	3.74	1	3.61	1	4.060	638.466	0.000
Commitment to searching for the truth	3.65	2	3.23	21	9.260	777.803	0.000
Responsibility for the effects of one's research results	3.55*	3	3.49	4-5	1.268	575.637	0.205
Strict scientific standards of applied and developmental research	3.55*	4	3.31	17	5.138	770.850	0.000
Avoiding quick generalisations	3.55*	5	3.47	6	1.622	574.589	0.105
Support for the institution's excellence	3.54	6	3.51	2-3	0.905	604.097	0.366
Encouraging talented students	3.51	7	3.33	14-16	3.885	652.969	0.000
Collegial support	3.45	8	3.43	7	0.456	593.734	0.649
Developing knowledge for the benefit of man and society	3.44	9	3.51	2-3	1.415	590.411	0.157
Receptivity to all relevant data	3.41	10	3.49	4-5	1.781	513.659	0.075
Incorporating new results into knowledge	3.40	11	3.36	12	0.712	577.750	0.477
Careful use of one's colleagues' results	3.38	12	3.27	18-19	2.221	575.130	0.027
Full autonomy in relation to funders/clients	3.34	13	3.20	22-23	2.561	665.477	0.011
Deserved authorship assignment	3.32	14-15	3.20	22-23	2.349	536.991	0.019
Scientific training and fair evaluation of students	3.32	14-15	3.37	11	1.020	593.992	0.308
Non-subjectivity in reporting one's results	3.32*	16	3.33	14-16	0.281	547.868	0.779
General logical rigour	3.29*	17	3.09	28	4.218	616.213	0.000
Precision of scientific measuring	3.29*	18	3.26	20	0.593	576.459	0.554
Accuracy and clarity of writing style	3.26	19-20	3.16	27	2.180	608.424	0.030
Non-subjective evaluation of scientific ideas and contributions	3.26	19-20	3.35	13	1.643	549.354	0.101
Constant scrutiny of statements and data	3.20	21	3.17	25-26	0.597	553.054	0.551
Independence of cognitive options from their social and political implications	3.18	22	3.04	29	2.541	675.864	0.011
Replicability of research	3.17	23	3.42	8-9	4.356	484.641	0.000
Open collegial data exchange	3.15*	24	3.38	10	4.772	568.753	0.000
Maximal professional service to funders and/or clients	3.15*	25	3.33	14-16	3.062	562.836	0.002
Theoretical originality	3.12	26	3.27	18-19	2.768	496.116	0.006
Methodological originality	3.06	27	3.17	25-26	2.116	562.975	0.035
Non-exploiting the (work of) students	3.04*	28	2.97	31	1.157	522.936	0.248
Originality of empirical evidence (data)	3.04*	29	3.42	8-9	7.648	591.858	0.000
Protection of psycho-physical integrity of respondents and/or patients	2.90	30	2.78	32	1.416	591.874	0.157
Accessibility of research and data to scientific public scrutiny	2.82	31	2.60	35	3.358	569.038	0.001
Anonymity of respondents/patients	2.80	32	2.76	33	0.473	588.557	0.636
Voluntary participation of respondents and/or patients in research	2.79	33	2.62	34	2.269	604.918	0.024
Ethical neutrality – avoiding to evaluate social desirability of scientific results	2.67	34	3.01	35	5.561	634.785	0.000

* Different ranks have been retained when the values of the means rounded to three decimals (here for the sake of comparison rounded to two) were originally different.

result implies that the ethical code of the eminent and the young consists of traditional cognitive standards connected with objectivity, verifiability, precision, logic and originality of scientific thought and work. Such cognitive standards are typical for the realistic epistemological orientation and are roughly compatible with the findings of other researchers (Chase, 1970; Hill, 1974; Hemlin and Montgomery, 1990; Hemlin, 1993; Anderson, 2000).

Yet, the professional ethics of both groups also includes values and norms that were not taken into account in studies of the traditional academic code, or they are considered to be typical of Mode 2 research (Gibbbons et al., 1997). Such non-traditional orientation can be identified in respondents' subscription to maximal professionalism regarding commissioned research and/or applied investigations and experimental development. The same conclusion applies to the highly ranked social responsibility of scientists, roughly comparable with the strong accent on the social role of scientists found in a study of the Venezuelan scientific community (Roche and Freites, 1992).

Therefore, researchers' professional ethics may be perceived as a combination of their classical cognitive convictions and standards, and their pronounced social sensitivity reflected in all social relations connected with the scientific profession. Social sensitivity is especially reflected in perceiving the importance of scientists' responsibility to the broader social community. This is true both of the older and young(est) generation of scientists: of eminent researchers and of beginners, which indicates a similar, or even identical value frame for scientists' professional socialisation.

However, we found considerable and significant differences in the importance respondents within each group give to particular cognitive and social norms, and also differences between eminent and young researchers. In other words, despite standards, about whose importance there is a relatively high level of consensus, professional ethics is nevertheless a hierarchical set of values or norms that do not have the same importance for all groups of researchers, especially in different fields of science (Prpić, 1998).

It is interesting to consider potential generation-induced differences, to which the results strongly point. At the time of the first survey (1995) eminent scientists were 59 years old on an average, while young researchers, respondents in the second survey (1998), were an average of 32 (Prpić, 1996; 2000). Therefore, there was a thirty-year age difference, and the different importance the two groups accord to particular cognitive and social norms

may be attributed to their different professional position and role, but also to the generation effect of long-term changes in the social organisation of science and professional socialisation.

Let us see to which norms young and eminent scientists attribute a significantly different importance? In the case of cognitive standards of scientific research, differences are greatest in evaluating the importance of unconditional commitment to the search for truth. Young researchers do not find this as important as their eminent colleagues, who place this value at the top of their most important cognitive convictions. On the other hand, young researchers find the originality of empirical evidence/data much more important, and also value other kinds of originality (theoretic and methodological) significantly (but not considerably) higher than their older colleagues.

Young researchers care significantly less than their distinguished colleagues about strict scientific standards of applied research and experimental development, general logical rigour and conceptual accuracy, but they find research replicability more important. They attribute significantly less importance to accuracy and precision of writing style, and also to the accessibility of research and data to scientific public scrutiny.

Although these two groups of researchers differ greatly in scientific distinction and achievements, which may lead to different criteria, it is difficult to avoid concluding that the young generation nevertheless attributes less importance to cognitive norms linked with basic research (search for truth, conceptual precision, logical rigour, clarity and precision of style, public scrutiny). On the other hand, young researchers place more emphasis on cognitive standards that may be more closely connected with applied research, such as original empirical material and research replicability. These differences in cognitive convictions could be qualified as changes typical for the manner of Mode 2 knowledge production, where the participation of basic research is considered decreasing.

However, contrary to this conclusion are the results showing that there is no significant difference in the structure of research in which eminent and young scientists are predominantly engaged. Both groups are engaged on more or less the same level in basic research (about 1/3 of the respondents) and applied and mixed types of research (also 1/3 respondents). Furthermore, some empirical studies indicate that the concept of basic research is itself flexible, so scientists tailor their research to make it appear more

applicable (Calvert, 2000). It therefore seems that the reasons for generation-induced differences in cognitive convictions should be sought in the social organisation of science, especially in priorities of scientific policy that favourises applied research.

The greatest differences in assessing the importance of social norms appear in attitudes to scientists' ethical neutrality. The young, in a significantly greater degree, consider it important to consistently avoid any evaluation of the human and social desirability of research results. At the same time they find independence of cognitive options (accepting theories, methodological criteria and non/publication of papers) from their social and political implications less important. This contradiction, and the misbalance between the highly ranked values of social responsibility and ethical neutrality of scientists, was found among eminent respondents too, but this need not necessarily be confusing. Most of them accept social responsibility in principle, but at the same time guard the traditional views about the importance of ethical neutrality. This mixture of different, sometimes even contrary values, emerges out of real-life conditions. In the case of young scientists the inconsistency is greater, which is both socially and psychologically convincing.

The other social norms to which eminent and young researchers attribute a significantly different importance may indicate the different professional position and obligations of the two groups. The young will therefore probably rank incentives for gifted students lower. At the same time, they also rank lower some standards of collegial relations, such as careful use of colleagues' work or assigning authorship corresponding to scientific contribution. They also consider less important autonomy from those who commissioned research. These are, in fact, relations on which they have less influence because of their low/lower professional status. The above social norms correspond with traditional academic values of collegiality, communality and autonomy, and may in truth be less important for new generations of scientists.

The young accord greater importance to open exchange of information about research and maximum professional services to clients. The latter corresponds with the growing importance of contract research. The greater inclination of the young to open collegial communication, and thus their smaller inclination to secrecy, seemingly fits into traditional academic values better than into new research ethics. It may emerge from young researchers' subordinate professional position and their need to

enter the collegial network, which is extremely important in current knowledge production.

To conclude. Although the ethical code of distinguished and young researchers has the common core of the same professional values, the differences we found suggest that a significant change has taken place in cognitive and social standards between older and younger generations of scientists. The results do not allow us to speak about the emergence of new research ethics contrary to the previous academic ethics, but nevertheless we notice a decreased importance of the cognitive norms of classical fundamental research with an increased importance of the norms of applied and developmental research. In the case of social norms the importance attributed to traditional academic values is also decreasing, with the concurrent growth in the importance of professionalism and establishing research networks. Younger research generations also find social sensitivity indisputable, but they are still under the (even greater) influence of the traditional value of ethical neutrality.

RESEARCH PRACTICE PERCEPTIONS AND GENERATIONAL DIFFERENCES

The question about the practical enactment of norms differed in the two surveys because the eminent scientists estimated it for their entire scientific field, while the young scientists estimated it for their research institution only, so comparison between the groups is not possible. Thus we will analyse only basic results about young respondents' perceptions (see Table A in the supplement). The overall mean for norm enactment is 2.57, much smaller than the respondents' evaluations of norm importance and only slightly greater than the mean on the 1-to-4 scale.

The first conclusion to which these results point is that enactment of professional norms is above average in Croatian scientific institutions, that researchers, according to the perceptions of young scientists, follow them in quite a high degree. Most respondents estimate that most cognitive and social standards of the scientific profession are realised mostly or in a high degree in everyday life. At the same time great differences appear in respect to practising particular norms. With the exception of norms concerning respondents and/or patients, with which most scientists do not work in any case, there is below average adherence to some traditional cognitive and social standards. This refers to constant scrutiny of statements and data, unconditional scientific commitment to searching for the

truth, and the public nature of scientific research. The same is true of some communality norms – open collegial exchange of research information and helping colleagues, especially younger – and of some aspects of the relations with students, such as the prohibition of exploiting (the work) of students and encouraging gifted students.

Therefore, despite the importance (both eminent and young) scientists give to professional norms, the latter do not idealise everyday professional practice in research and development. Although only a minority of respondents perceives that researchers do not follow these standards, a much larger number reports that in their organisations professional standards are followed only to a degree. Some norms connected with mertonian "communism" and organised scepticism are realised least in scientists' professional practice. Consensus about the common normative core of scientific professional ethics is much higher than about the harmony between values/norms and researchers' professional practice. The Acadia study (Anderson, 2000) reached a similar finding and conclusion.

Two methodological remarks concerning the following analysis of professional (mal)practice in science are important. On the one hand, the required respondents' personal observation of ethically problematic and unacceptable conduct in their scientific institutions excluded all cases based on second-hand information. On the other hand, a serious methodological limitation is data overlapping, i.e. reports on the same cases of professional misbehaviour (respondents from the same scientific institution). Therefore, it is not possible to estimate either the number of ethical incidents or the number of wrongdoers during the examined period. Bearing in mind these remarks, let us examine the incidence of different types of ethically questionable and unacceptable conduct according to the perceptions of eminent and young scientists'.

A glance at Table 2, which contains rank-ordered means of the respondents' ratings on every scale and t-tests results, shows that both eminent and young scientists ranked relatively low, under the average of the 1-to-4 scale, the incidence of all ethically unacceptable and questionable conduct of colleagues in their institutions. The ratings of eminent and young researchers give almost identical overall means: 1.84 and 1.82 respectively. This implies that, on the average, respondents met deviant conduct among their colleagues relatively rarely.

It can in general be said that both groups of respondents perceived (somewhat) more frequently (M>2) conduct about whose harm or irregularity the scientific com-

munity does not always agree. Deviations from cognitive norms are considered questionable research practices which may harm scientific knowledge, but there is usually neither agreement about the seriousness of such conduct nor consensus about standards in these matters (Swazey et al., 1993). Both the eminent and the young most frequently encountered adjustments of result interpretation to the dominant theoretical model or school of thought in their scientific field. This is not a question of the well-known impact of theoretical expectations on selective attention and perceptual distortion (Mahoney, 1979), but of a certain intellectual conformism. The decisive importance of result publication can encourage researchers' conformity with the theoretical orientation of editorial boards or of reviewers of (leading) scientific journals.

Other questionable research practices rated as relatively (more) frequent in both surveys are:

- Rigidity or persistent commitment to one's own theoretical, hypothetical model, even when it is not empirically confirmed. The result is congruent with the findings of other researchers, showing that theoretical dogmatism is not rare among scientists (Mittrof, 1974; Mahoney, 1979).
- Expedient reasoning – adjusting or selecting arguments logically congruent with a thesis or a theory, a not unknown aspect of research practice (Mahoney, 1979).
- Secrecy – denying access to information on the course and the results of research before publication. This is compatible with Hagstrom's (1974) classical findings and with more recent studies (Eastwood et al., 1996).
- Uncritical use of other scientists' data and/or interpretation – this finding is somewhat comparable with Acadia study which shows overlooking sloppy use of data or interpretations by others (Swazey et al., 1993).
- Empiricism or insufficient theoretical foundation of empirical research.

Significant differences in the incidence of these problematic practices appear in the case of secrecy, which eminent scientists report more often than young. They also more frequently observe uncritical use of the findings of others. Similar differences appear in the perception of other problematic research practices, which is probably connected with the different personal insight and level of informedness of those at the top and those at the bottom of the professional pyramid. Thus eminent scientists significantly more often notice adapting the interpretation of research results to dominant political,

Table 2

Eminent and young scientists' perceptions of incidence of ethically questionable or unacceptable conduct in Croatian scientific institutions (rank-ordered means and t-tests results)

Types of questionable research practice and research misconduct	Eminent scientists		Young researchers		t-test for equality of means		
	Mean	Rank	Mean	Rank	t	df	Sig.
Adjusting interpretation of the findings to dominant theoretical model or school	2.38	1	2.30	1	1.622	1.158.000	0.105
Secrecy – denying access to information on research (results) before publication	2.28	2	2.09	7	3.341	651.545	0.001
Rigidity – commitment to one's theoretical model, even when it is not confirmed	2.26	3	2.25	3	0.129	1.158.000	0.897
Expedient reasoning – selecting arguments logically congruent with a thesis or theory	2.23	4	2.18	5	1.078	1.158.000	0.281
Consistent ethical neutrality – full distancing from every social responsibility	2.21	5	1.85	13	6.717	1.158.000	0.000
Uncritical use of other scientists' data	2.18	6-7	2.06	9	2.453	1.158.000	0.014
Insufficient theoretical foundation of empirical research	2.18	6-7	2.08	8	1.950	1.158.000	0.051
Undeserved assignment of authorship	2.16	8	2.26	2	1.840	645.067	0.066
Adjusting the interpretation of results to mainstream politics, ideology, religion, world-view	1.99	9	1.73	17	4.304	1.158.000	0.000
Exploitation of the work of subordinate associates	1.93	10	2.21	4	5.293	731.545	0.000
Failing to present findings contradictory to the author's research	1.91	11-12	1.86	12	1.199	664.481	0.231
The impact of social benefit criteria on cognitive options	1.91	11-12	1.60	21	6.614	619.109	0.000
Failing to publish procedures essential for replicating and verifying the research	1.91*	13	1.92	11	0.294	641.196	0.769
Evaluating scientific findings under the influence of their authors´ nonscientific characteristics	1.84	14	1.61	20	4.294	1.158.000	0.000
Plagiarism	1.83	15-16	1.81	15	0.352	636.334	0.725
Neglecting scientific criteria in applied research and experimental development	1.83	15-16	1.77	16	1.248	644.460	0.213
Adjusting research criteria and results to the expectations of funders/clients	1.76	17	1.72	18	0.840	1.158.000	0.401
Subordinating educational needs of students to one's personal scientific interests	1.75	18	2.02	10	5.049	1.158.000	0.000
Collaboration with colleagues dependent on their nonscientific characteristics	1.73	19	2.12	6	6.924	719.262	0.000
Forging or polishing of data and/or results	1.62	20	1.83	14	4.444	1.158.000	0.000
Insufficient care for the protection of environment, for (experimental) animals	1.60	21	1.52	22	1.650	1.158.000	0.099
Fabricating data and/or results	1.49	22	1.61	19	2.619	1.158.000	0.009
Discriminating students on the basis of their gender, nationality, political affiliation, world-view or religion	1.34	23	1.36	23	0.531	1.158.000	0.595
Executing research without voluntary consent of respondents/patients	1.29	24	1.26	24	1.007	1.158.000	0.314
Violating anonymity of respondents/patients and misusing data for nonscientific purposes	1.21	25	1.15	25	2.041	562.729	0.042
Jeopardising the psychophysical integrity of respondents/patients	1.14	26	1.12	26	0.559	1.158.000	0.576

* Different ranks have been retained when the values of the means rounded to three decimals (here for the sake of comparison rounded to two) were originally different.

ideological, religious or world-view currents. They more often register the influence of social benefit criteria on cognitive options (on accepting theories, methodological criteria and non/publication of papers), and evaluating scientific contributions under the influence of their authors' gender, ethnicity, political affiliation, religion or world-view.

Except for consistent ethical neutrality, which the eminent notice more often in the behaviour of their colleagues, young scientists report more often on conduct differing from the social norms of the scientific profession. They report on conduct that those at the bottom of the professional hierarchy might sooner experience, in the first place cooperation with colleagues depending on their ascriptive features (gender, ethnicity, political affiliation, religion or world-view), exploiting (the work of) subordinated associates, and subjecting students' educational needs to one's own scientific interests.

According to both studies, there is least unethical conduct in researchers' relations with respondents and/or patients. A great majority of respondents have never noticed jeopardising the integrity and the rights of these participants in scientific research in their institutions. What is more, data generally show fewer incidents of jeopardising or damaging the rights of non-scientists participating in scientific and teaching processes. Most respondents report that student discrimination on the basis of gender, ethnicity, world-view, political affiliation and religion never occurred in their scientific institutions.

Finally, let us look at behaviour usually classified as misconduct, i.e. the ethically unacceptable behaviour of scientists. This is plagiarism, fabrication and forgery. Whereas only 8% of American university faculty knew colleagues who plagiarised (Swazey et al., 1993), as many as 15.7% of our eminent respondents and 18.3% of the young rank plagiarism as (very) frequent. The differences are very great but can mostly be ascribed to more frequent data overlapping in the smaller research community and to a much broader definition of plagiarism in our research, which includes stealing (individual) ideas, methods and techniques, data, texts, reports.

There are also considerable comparative differences between the Acadia and our studies in regard to forgery. In the former, the authors reported that 6% of faculty knew colleagues who forged or "cooked" research data (Swazey et al., 1993), but in another American investigation postdoctoral research fellows reported greater proportions of forgery (Eastwood et al., 1996). Our results show

that 8.4% of the eminent and almost twice as many of the young (15.8%) stated that forgery was (very) frequent in Croatian scientific institutions.

Finally, fabrication or invention of data/results is the rarest of these three types of scientific misconduct, since 5.0% of the eminent and 8.4% of the young report that it is (very) frequent. Although fabrication does not appear in alarming proportions in R&D, even the smallest proportion is always very serious and intolerable.

In conclusion, the findings about implementing cognitive and social norms in the scientific profession are as expected. Everyday scientific practice does not adhere to professional standards impeccably, but researchers nevertheless follow them to a considerable degree. Data about the incidence of ethically questionable and unacceptable behaviour in the experience of eminent and young researchers supplements this picture. In everyday scientific professional life questionable research practices, even marring collegial relations, are met more often than infringing social norms that jeopardise or threaten participants in and users of scientists' professional work. Eminent and young respondents differ in perceiving the incidence of certain kinds of questionable behaviour, which may be attributed to their different professional position and experience, and their insight into the professional practice of scientific institutions.

CONCLUSIONS

Our findings indicate that it is empirically corroborated and theoretically meaningful to observe scientists' professional ethics on both levels – normative and behavioural, and in both dimensions – cognitive and social.

As a set of professional values and norms, science ethics includes a core of cognitive and social standards about which there is relatively high consensus in the research population. Cognitive standards correspond to epistemological realism with an accent on objective, reliable, measurable and precise new knowledge. This finding is not only consistent with the assumptions of science philosophers, but also with the findings of other empirical studies of normative orientations or the criteria for judging scientific quality. The fundamental social values of the scientific profession include the broadest social responsibility, responsibility towards colleagues and students, and professionalism in relation with funders and/or clients. In social dimension, most rarely investigated and least well known, researchers' professional values are more similar to what is

called new research ethics than to the traditional academic, socially isolated, value matrix.

Thus it is difficult to avoid the generalisation that research ethos rests on a set of common, cognitive and social standards that distinguish the scientific profession from other forms of intellectual production. It is a combination of traditional cognitive norms and new socially-engaged values.

However, research ethics is not a static or homogeneous set of professional values and norms about which researchers are in absolute consensus. Generational differences also play a part. Young scientists value cognitive norms relating to basic research lower, but rank some cognitive standards more closely linked with applied empirical research higher. Considering the social dimensions of research ethics, young researchers rate traditional academic values of collegiality, communality and autonomy less important than do eminent scientists, but they hold professionalism and establishing research networks more important.

As expected, cognitive and social values and norms are not strictly followed on the behavioural level, on the level of professional practice. Young researchers perceive that the practical application of these professional standards in Croatian research institutions is not ideal, but nor is it dissatisfactory because both norms are relatively highly respected.

In their everyday professional life eminent and young researchers experience particular questionable research practices that could harm research work and results, and impair collegial relations in science, more often than they encounter breaking social norms that harm or even threaten participants in and users of scientific professional work. Graver forms of scientific misconduct are not very widespread but are not insignificant, as claimed in classical sociological studies of scientific ethos.

In short, researchers' cognitive and social values and norms are important professional benchmarks in the scientific profession, not only a façade turned to the public, but they are by no means omnipotent regulators of everyday behaviour and professional practice in research and development.

FOOTNOTE

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APPENDIX

Table A

Young researchers' perceptions of the enactment of norms in their institutions (rank-ordered means and the structure of answers in %)

Professional values/norms	Mean	SD	Enactment of professional norms			
			Mostly not enacted	Enacted to some extent	Mostly enacted	Enacted to a great extent
Originality of empirical evidence (data)	2.83	0.86	7.5	24.8	45.5	22.3
Maximal professional service to funders and/or clients	2.81	0.93	11.2	20.5	44.2	24.2
Conceptual accuracy	2.78	0.85	6.3	30.0	42.6	21.1
Developing knowledge for the benefit of man and society	2.78	0.89	8.6	27.5	41.8	22.1
Replicability of research	2.73	0.88	9.5	27.7	43.2	19.5
Responsibility for the effects of one's research results	2.72	0.89	9.6	28.0	42.9	19.5
Support for the institution's excellence	2.71	0.91	9.8	30.6	38.2	21.4
Receptivity to all relevant data	2.69	0.81	6.9	32.4	45.7	15.0
Strict scientific standards of applied and developmental research	2.69	0.88	11.0	26.3	45.8	16.9
Full autonomy in relation to funders/clients	2.67	0.89	11.7	26.4	45.4	16.5
Precision of scientific measuring	2.67	0.90	11.3	28.2	42.6	17.9
Methodological originality	2.62	0.85	10.1	32.4	43.1	14.4
Avoiding quick generalisations	2.62	0.88	10.4	33.6	39.6	16.4
spnumAccuracy and clarity of writing style	2.61	0.84	8.9	35.6	40.8	14.6
Scientific training and fair evaluation of students	2.61	0.87	11.0	32.5	41.2	15.4
Careful use of one's colleagues' results	2.61	0.89	11.9	31.2	41.0	16.0
Theoretical originality	2.59	0.86	9.9	36.2	38.8	15.1
Non-subjectivity in reporting one's results	2.57	0.85	10.4	35.5	41.0	13.2
Non-subjective evaluation of scientific ideas and contributions	2.56	0.85	11.4	33.6	42.6	12.4
Incorporating new results into knowledge	2.56	0.89	12.5	33.9	38.8	14.8
Ethical neutrality – avoiding to evaluate social desirability of scientific results	2.55	0.89	14.3	29.5	43.5	12.7
General logical rigour	2.54	0.84	11.4	35.0	42.0	11.5
Anonymity of respondents/patients	2.53	1.16	29.6	12.4	33.3	24.6
Deserved authorship assignment	2.51	0.86	13.1	34.0	41.5	11.3
Independence of cognitive options from their social and political implications	2.51	0.89	14.9	32.0	40.7	12.4
Protection of psycho-physical integrity of respondents and/or patients	2.50	1.15	30.5	12.7	33.6	23.2
Constant scrutiny of statements and data	2.46	0.87	14.0	37.4	37.5	11.1
Commitment to searching for the truth	2.46	0.89	15.1	36.2	36.4	12.3
Non-exploiting the (work of) students	2.43	0.91	17.3	34.2	36.4	12.1
Voluntary participation of respondents and/or patients in research	2.36	1.09	30.8	19.3	32.9	17.0
Collegial support	2.35	0.90	17.7	40.6	30.5	11.2
Encouraging talented students	2.35	0.92	19.3	37.4	32.0	11.3
Open collegial data exchange	2.31	0.94	21.8	37.4	29.0	11.8
Accessibility of research and data to scientific public scrutiny	2.23	0.92	24.4	37.3	29.3	9.0