Graduate Education in Research Ethics for Scientists and Engineers

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C O N N E X I O N S

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Chapter 1

Graduate Education in Research Ethics for Scientists and Engineers: Graduate Awareness Workshop[1]

1.1 Module Introduction

Graduate Awareness Workshop
Upon entering UPRM, you will be asked to participate in an awareness workshop that introduces basic ethical issues and concepts pertinent to research activities. A Pre-Test involving discussion of scenaros in research ethics will be followed by a lecture that defines key concepts and situates the fundamental problems of research ethics in its "Three Capital Sins," i.e., fabrication, falsification, and plagiarism. Integrated into this part of the workshop will be a demonstration of the intrinsic connection between science and ethics. This workshop closes with a Post-Test designed to measure and assess any changes in your awareness.

1.2 What you are going to do.

Workshop Activities

- To prepare for the workshop, you will read a short selection on research ethics and explore the links provided in this module on the Hwang Woo Suk, Tuskegee, and Enron cases. This will get you ready for the workshop.
- **Exercise 1:** Take a workshop pre-test in Research Ethics
- **Exercise 2:** Identify key duties in the research ethics context, the duties of researchers, duties of professors to students, and duties of students to professors.
- **Exercise 3:** Reflect and write on the fundamental mission an purpose of the university. What goes on within the university? How does the university contribute to the surrounding community?
- **Exercise 4:** You will return to the cases presented in the first part of the workshop. What issues covered during the workshop on research ethics arose in these cases? For example, what issues discussed in the workshop arose in the Tuskegee case?

Beginning your exploration of research ethics. Click on the links to the following three cases:

- Hwang Woo Suk
- Tuskegee

[1] This content is available online at <http://cnx.org/content/m14400/1.13/>.

- Enron (Exploring the link to Enron will also help you to access interviews with Jeff Skilling.)

Key Issues and Themes in Research Ethics

- **Conceptual map** exploring the etymological roots of ethics and its relations and differences with concepts like morality, religion, and law.
- **Research Ethics Themes:**Research gravitates around a double axiological axis. The first deals with issues surrounding the commitment of any academic endeavor to the **pursuit of truth**. The second arises from the **social responsibility** of the researcher to the whole academic enterprise. This double axiological axis provides a basis for framing issues in Research Ethics.
- **Academic integrity** as the condition that makes possible the university's mission.
- The intrinsic connection between **science and ethics**
- **Three Capital Sins** against academic integrity: fabrication, falsification, and plagiarism
- What is **ethical relativism** and **absolutism**?

Workshop Objectives

1. Determine your initial awareness of ethical issues in research ethics (Tied to Pre-Test activity)
2. Deepen your awareness of ethical issues that arise in scientific and engineering research. (Tied to Presentation activity)
3. Provide you with a conceptual map of key issues and concepts in research ethics. (Tied to Presentation activity)
4. Uncover and assess any changes or improvements in your awareness of ethical issues that arise in scientific and engineering research. (Tied to Post-Test activity)

1.3 What you will learn.

Ética:

- Aunque no universalmente aceptado, muchos autores adoptan hoy la siguiente distinción:
- **Moral**: Códigos de conducta que rigen diversas comunidades humanas
- **Ética**: Disciplina filosófica que estudia la conducta humana desde el punto de vista de los valores y deberes morales
- See also
- Ética: "Disciplina filosófica que estudia racionalmente la conducta humana desde un punto de vista de los deberes y virtudes morales".
- Jorge José Ferrer, y Juan Carlos Álvarez, **Para Fundamentar la Bioética**, Editorial Desclee De Brouwer, 2003: 26

Ejercicio

1. Escriba dos acciones o actitudes de un(a) estudiante que van en contra de la integridad académica.
2. Escriba dos acciones o actitudes de un profesor(a) que van en contra de la integridad académica

Qué es un dilema ético:

- Un dilema ético puede definirse como un conflicto que la persona experimenta entre dos o más obligaciones morales en una circunstancia particular
- Joseph R. Herkert, **Social, Ethical, and Policy Implications of Engineering**, IEEE Press, 2000

Integridad Académica

- Valores relacionados a la búsqueda y comunicación de los distintos saberes.

- Valores, normas y virtudes relacionadas con el cumplimiento de la misión universitaria: búsqueda del saber, aplicación de los conocimientos, impacto a la sociedad.
- **Condición que posibilita la Misión de la Universidad**

Investigación y Responsabilidad Social

- No atropellar el interés de los sujetos de estudio.
- No atentar contra los intereses de instituciones participantes.
- No atentar contra los intereses de la sociedad.

Investigación y Responsabilidad Social

- Investigación con sujetos humanos.
- Consentimiento informado y voluntario.
- Investigación con animales de laboratorio.
- Política Pública (Comité de Protección de Sujetos Humanos en la Investigación,) IRB
- Relación con la industria, comunidad, y sociedad.
- Protección ambiental

Tres Pecados Capitales contra la Integridad Académica

1. Fabricación, invención información o datos de experimentos que no se efectuaron.
2. Falsificación de datos, alteración de datos experimentales, resultados, o información.
3. Plagio, apropiación de métodos, datos, cuerpo de un texto, trabajos sin citar o reconocer la fuente.

1.4 What did you learn?

Ejercicio

1. Escribe 5 deberes que entiendas deben tener los Investigadores
2. Escribe 5 deberes que entiendas deben tener los Profesores/TAs
3. Escribe 5 deberes que deban tener los estudiantes para con los Profesores/TAs

1.5 References

1. Kohlberg, Lawrence. 1981. **The Philosophy of Moral Development: Essays on Moral Development**, vol.1. San Francisco: Harper and Row.
2. Pritchard, Michael S. 1996. **Reasonable Children: Moral Education and Moral Learning**. Lawrence, KS: University of Kansas Press: 11.
3. Rest, James, Narvaez, Darcia, Bebeau, Muriel, and Thoma, Stephen. 1999. **Postconventional Moral Thinking: a Neo-Kohlbergian Approach**. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
4. Huff, Chuck and Frey, William. 2005. "Moral Pedagogy and Practical Ethics" in **Science and Engineering Ethics** 11(3): 394-397.
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6. Haws, David R. (2004) "The Importance of Meta-Ethics in Engineering Education" **Science and Engineering Ethics**, 10(2): 204-210.
7. Ian Barbour, Ethics in an Age of Technology, HarperCollins, 1993.
8. Elena Lugo, Ética Profesional para la Ingeniería, Ediciones Riqueña, Librería Universal.
9. M. David Ermann, Mary B. Williams, y Michele S. Shauf, Computers, Ethics, and Society, Oxford University Press, 1997.

10. Charles E. Harris, Michael S. Pritchard, and Michael J. Rabins, Engineering Ethics: Concepts and Cases, Wadsworth Publishing Company, 1995.
11. Joseph R. Herkert, Social, Ethical, and Policy Implications of Engineering, IEEE Press, 2000.
12. William Frey and Jose Cruz, Ethics Across the Curriculum Workshop, February 22, 2002.
13. Stephen R. Covey, Los 7 hábitos de la gente altamente efectiva, Paidos, 1997.
14. Louis P. Pojman, Ethics: Discovering right and Wrong, Wadworth Publishing Company, 1990.
15. Jorge José Ferrer, y Juan Carlos Álvarez, Para Fundamentar la Bioética, Editorial Desclee De Brouwer, 2003.

1.6 Presentations for Graduate Awareness Workshop

Below are two presentations upon which different variations of the Graduate Awareness Workshop will be built. They both explore basic and intermediate moral concepts such as rights, duties, plagiarism, and integrity. They also contain material and exercises designed to help capstone design courses in engineering and science effectively integrate ethical issues. In addition to the presentations, the last media file contains a document that provides the Pre-Test, Post-Test, and GAW evaluation forms in Word format.

Presentation: Integridad Academica y Etica de la Investigacion by Luis Jimenez, Efrain O'Neill, and Eddie Marrero

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http://cnx.org/content/m14400/latest/GAW_Long.ppt

Figure 1.1: This Spanish presentation provides a general introduction to academic integrity and research ethics. It has been tested with graduate students in a Graduate Awareness Workshop various times in the spring and summer of 2007 in connection with NSF grant 0629377, Graduate Education in Research Ethics for Scientists and Engineers.

Presentation: La actividad academica como empresa moral by Jorge Ferrer and Efrain O'Neill

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http://cnx.org/content/m14400/latest/GAW_Short.ppt

Figure 1.2: This presentation developed for incoming graduate students is designed to develop a preliminary basis of ethical awareness upon which moral deliberation and case analysis skills will be built. Written in Spanish, this presentation was developed by Dr. Jorge Ferrer and Dr. Efrain O'Neill

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September 29 2007 Presentation

This is an unsupported media type. To view, please see
http://cnx.org/content/m14400/latest/GAWSept292007.ppt

Figure 1.3: This figure contains the Power Point presentation given for the GAW on September 29, 2007. To date it is the most recent version of the workshop.

Graduate Awareness Workshop Pre and Post Test Exercises

This is an unsupported media type. To view, please see
http://cnx.org/content/m14400/latest/AssessGAW.doc

Figure 1.4: This presentation, developed by Efrain O'Neill and Luis Jimenez, has been used to introduce research ethics to incoming graduate students in Electrical Engineering. Eddie Marrero and Jorge Ferrer also contributed material.

Issue Identification Workshop Presentation

This is an unsupported media type. To view, please see
http://cnx.org/content/m14400/latest/RE_Issues_Nov07_V3.ppt

Figure 1.5: Clicking on this figure will open the powerpoint presentation used in a faculty issue identification activity held at the University of Puerto Rico at Mayaguez on November 29, 2007.

Chapter 2

Graduate Education in Research Ethics for Scientists and Engineers: Moral Delibaration Workshop[1]

2.1 Module Introduction

Graduate students will participate in a follow up workshop during their second semester of study that will be designed to add skills of ethical evaluation to those of ethical awareness. This workshop will advance on the first workshop (Graduate Awareness Workshop) through presentations of a taxonomy of ethical issues in research called the "Double Axiological Axis" and through a framework that integrates teleology and deontology to enable students to introduce ethical theory and principle into moral deliberation. Students will practice the skills presupposed by these presented materials by deliberating on a case in research ethics that has been chosen because it presents a conflict between moral considerations. Students will be guided through the process of identifying the conflicting moral elements and designing ethically acceptable courses of action. This workshop will target the skill of ethical evaluation and be assessed in terms of the success of the participants in resolving the conflict posed by the case over which they deliberate. Workshop objectives, outcomes, and activities are summarized below.

Module Under Construction

This workshop module is still under development. It is being published in the Connexions Content Commons to allow students participating in the workshops and interested faculty to react to its different parts and to participate in its continued development.

Moral Deliberation Workshop

Objectives	Activities
Systematic introduction to a taxonomy of key issues in research ethics	Presentation: Ethical Issues in Research (Double Axiological Axis)
	continued on next page

[1] This content is available online at <http://cnx.org/content/m14406/1.1/>.

Introduction of ethical theory and principle to aid in moral reasoning and moral judgment in research ethics	Presentation: Teleological and Deontological moments of ethical reflection in research ethics
Students learn to arbitrate between conflicting moral and practical considerations	Reflection Exercise: Students are presented with a case raising a moral conflict, such as a conflict between duties or rights. Students then use guidelines and reflection to resolve the conflict

Table 2.1

2.2 Module Activities

- Presentation on "Ethical Issues in Research." These issues will be presented in the form of a taxonomy based on a "double axiological axis." The first axis explores issues related to the pursuit of truth while the second looks at how research stands in relation to social responsibility.
- A presentation on ethical theory and principle (derived from Teleological and Deontological theoretical standpoints) will help students develop their moral reasoning and judgment in the context of research ethics.
- Student will examine a case that in which basic moral elements are in conflict. This will provide them with practice in using the taxonomy of issues and the framework based on teleology and deontology.

2.3 Module Objectives

Objectives This workshop series is based on four skills for ethical empowerment that have been detailed in Cruz/Frey 2003: ethical awareness, ethical evaluation, ethical integration and ethical prevention. This list of moral skills is by no means exhaustive or exclusive. For example, it does not cover moral imagination, moral creativity, becoming a member of a professional community, or perseverance. Readers are encouraged to consult the moral development skills that are available in Kohlberg, Rest, Huff/Frey, and the widely accepted Hastings Center List. Bibliographical references below will provide ample resources that different institutions or groups can use to build a list of skills of moral development to fit their needs and resources.

- Ethical Awareness consists of the student's ability to select and frame moral issues and problems that arise in ordinary, day-to-day research practice.
- Ethical evaluation skills allow students to bring ethical principles, concepts, theories, and values to bear on the problems they identify in research scenarios and use these to accomplish moral reasoning and judgment.
- Ethical integration skills give ethical principles, concepts, theories, and values a constitutive role in creating and designing solutions to moral problems and generating decision alternative sthat integrate moral (and non-moral) values.
- Ethical prevention skills are employed to identify value conflicts inherent in research projects and the socio-technical systems into which they are integrated. Prevention skills more from early identification of these conflicts to the development of counter-measures that prevent them from developing into full-blown moral problems or dilemmas.

These objectives form a series in which the more complex skills presuppose and build upon the simpler ones: ethical evaluation takes place when awareness skills are mastered; integraiton presupposes evaluation and awareness; prevention builds upon the mastery of the three more basic skills. To reflect this serial relation of ethics objectives, the graduate students workshops–each of which targets a particular skill set–are sequenced so that subsequent workshops build upon the skills mastered in earlier ones. Those who adopt this module are cautioned against taking this idea of sequential development to its extremes. The sequence is not uni-directional; students can and should work on maintaining awareness even after they have practiced

prevention. More than one skill can be pursued at a time. Students could take the workshops out of sequence and still benefit. But ordering these workshops sequentially and generally requiring students to move from awareness, through evaluation and integration, to integration makes enough sense to test this model.

2.4 References

- Kohlberg, Lawrence. 1981. The Philosophy of Moral Development: Essays on Moral Development, vol.1. San Francisco: Harper and Row.
- Pritchard, Michael S. 1996. Reasonable Children: Moral Education and Moral Learning. Lawrence, KS: University of Kansas Press: 11.
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- Cruz, Jose and Frey, William. 2003. "An Effective Strategy for Integrating Ethics Across the Curriculum in Engineering: An ABET 2000 Challenge" in Science and Engineering Ethics 9(4): 546-547.

Chapter 3

Graduate Education in Research Ethics: Case Analysis Workshop[1]

3.1 Module Introduction

In a third workshop, you will work with the moral objective of ethical integration which builds upon ethical awareness and ethical evaluation. Two widely used decision-making frameworks will be presented. Thus, using a case presented by a faculty mentor, students will practice the framework by bringing the case to a resolution. You will be provided with decision alternatives that respond generically to ethical problems (gather information, negotiate, oppose, exit, etc.), rank these generic solutions, and then design and justify a decision of your own. This workshop allows you to continue practicing the resolution of moral conflicts (skills developed in the second workshop) and, in addition, to work on integrating moral considerations with practical ones. The case analyses that you develop in this workshop will serve as a preliminary draft. Then you will form work groups that will continue to refine their provisional decisions, analyses, and justifications after the workshop. This will lead to the next activity where your group, along with others, will prepare a poster presentation on your case analysis to be presented in a capstond activity called, the "Graduate Research Ethics Banquet."

Case Analysis Workshop

Objectives	**Activities**
Students learn to integrate ethical considerations in to the causistic model of case analysis	Presentation: Decision-making framework in research ethics based on casuistic model
Students learn to integrate ethical considerations into a rational decision-making framework common in the business environment	Presentation: Decision-making framework in research ethics based on rational decision model (sevel-step model)
	continued on next page

[1] This content is available online at <http://cnx.org/content/m14411/1.2/>.

Students learn to integrate ethical considerations (principles, concepts, theories, and values) into day-to-day decision-making in research activities	Reflection Exercise: Students are presented with scenarios that raise an ethical problem and create a decision point. Students then rank alternative solutions, choose an alternative, and justify their choice

Table 3.1

3.2 Module Activities

- During a presentation, you will learn about a decision-making framework based on the casuistic model.
- Those who work in a business context make use of a decision-making procedure based on a rational decision model. This framework breaks the decision procedure down into seven steps: (1) identifying the relevant facts, (2) stating the problem, (3) identifying the stakeholders and their stakes, (4) brainstorming solutions, (5) evaluating solution alternatives according to their ethics, (6) making a decision, and (7) identifying preventive measures to stop the problem from reoccuring.
- You will be assigned a decision point within case or scenario that raises an ethical problem. Your job is to generate alternatives, rank them according to their ethics, make a choice, and then justify that choice using ethical considerations.
- You will be divided into work teams. After the workshop, you will continue to refine your analysis and decision and prepare a poster that presents your final mature decision and justification. This will be presented in a subsequent activity, the "Graduate Research Ethics Banquet."

3.3 Module Objectives

This workshop series is based on four skills for ethical empowerment that have been detailed in Cruz/Frey 2003: ethical awareness, ethical evaluation, ethical integration and ethical prevention. This list of moral skills is by no means exhaustive or exclusive. For example, it does not cover moral imagination, moral creativity, becoming a member of a professional community, or perseverance. Readers are encouraged to consult the moral development skills that are available in Kohlberg, Rest, Huff/Frey, and the widely accepted Hastings Center List. Bibliographical references below will provide ample resources that different institutions or groups can use to build a list of skills of moral development to fit their needs and resources.

- Ethical Awareness consists of the student's ability to select and frame moral issues and problems that arise in ordinary, day-to-day research practice. Ethical evaluation skills allow students to bring ethical principles, concepts, theories, and values to bear on the problems they identify in research scenarios and use these to accomplish moral reasoning and judgment.
- Ethical integration skills give ethical principles, concepts, theories, and values a constitutive role in creating and designing solutions to moral problems and generating decision alternative sthat integrate moral (and non-moral) values.
- Ethical prevention skills are employed to identify value conflicts inherent in research projects and the socio-technical systems into which they are integrated. Prevention skills more from early identification of these conflicts to the development of counter-measures that prevent them from developing into full-blown moral problems or dilemmas.

These objectives form a series in which the more complex skills presuppose and build upon the simpler ones: ethical evaluation takes place when awareness skills are mastered; integraiton presupposes evaluation and awareness; prevention builds upon the mastery of the three more basic skills. To reflect this serial relation of ethics objectives, the graduate students workshops–each of which targets a particular skill set–are sequenced so that subsequent workshops build upon the skills mastered in earlier ones. Those who adopt this module are cautioned against taking this idea of sequential development to its extremes. The sequence

is not uni-directional; students can and should work on maintaining awareness even after they have practiced prevention. More than one skill can be pursued at a time. Students could take the workshops out of sequence and still benefit. But ordering these workshops sequentially and generally requiring students to move from awareness, through evaluation and integration, to integration makes enough sense to test this model.

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- Pritchard, Michael S. 1996. Reasonable Children: Moral Education and Moral Learning. Lawrence, KS: University of Kansas Press: 11.
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Chapter 4

Graduate Education in Research Ethics for Scientists and Engineers: Graduate Research Ethics Banquet[1]

4.1 Module Introduction

The capstone event in this series of graduate student activities is a Graduate Student Research Ethics Banquet. To prepare for this activity, interdisciplinary student groups organized in the Case Analysis Workshop will prepare poster presentations which will outline their solutions to the case or cases presented during the earlier workshop. Students from the research ethics course will also be invited to develop interdisciplinary gorups and submit posters. The posters will receive campus-wide publicity and will be displayed for a week at UPRM's Center for Ethics in the Professions, where students and faculty will carry out a preliminary evaluation. Then an evening banquet will be held where the groups will present their case resolutions to an interdisciplinary audience of faculty mentors and other graduate students. The student groups will justify their solutions and respond to questions and comments from participants. Upon completing this series of activities (three workshops plus the banquet) graduate students will receive a certificate from UPRM's Center for Professional Enhancement acknowledging their work in research ethics. The banquet's objectives and activities are presented in the table below.

4.2

Graduate Research Ethics Banquet

Objectives	Activities
Students practice skill objectives of ethical awareness, ethical evaluation, and ethical integration in the context of preparing a poster presentation	Poster Preparation: Students prepare a poster presentation on their analysis and resolution of the case presented in the Case Analysis Workshop
	continued on next page

[1] This content is available online at <http://cnx.org/content/m14412/1.1/>.

Poster presentation display helps to disseminate efforts in integrating ethics into graduate research in science and engineering. Interaction with undergraduate students also helps to establish mentoring relationships.	Poster Presentation Displays: Students will present their posters and solutions to ethics cases before peers and faculty mentors. They will respond to comments and questions.
Graduate students receive reaction, feedback, and coaching from their faculty mentors and peers	Graduate Research Ethics Banquet: Students will present their posters and solutions to ethics cases before peers and faculty mentors. They will respond to comments and questions.
Students receive formal recognition of their efforts in research ethics	Graduate Ethics Certificate: Upon completion of the workshop series and banquet, students will be given a certificate in research ethics

Table 4.1

4.3 Module Activities

1. Poster Presentation: You will prepare a poster presentation based on the case you began to analyze in the previous, Case Analysis, workshop. Your presentation will provide a resolution of the problem raised in your case.
2. Poster Presentation Displays: Your group's poster will be displayed in UPRM's Center for Ethics in the Profession along with other poster presentations from other groups. Undergraduate students in science and engineering classes will view the posters presented in this forum and write informal reaction papers. Feedback will also be elicited from your teachers and peers.
3. Graduate Research Ethics Banquet: During a capstone activity, an ethics banquet, you will present your posters and solutions to the ethics cases you have been studying. Your audience will consist of faculty mentors and peers. During a dialogue between presenters and audience, they will ask questions and make suggestions/comments to which you will respond.
4. Graduate Ethics Certificate: When you complete this workshop series and banquet, you will receive a Certificate in Research Ethics.

4.4 Module Objectives

This workshop series is based on four skills for ethical empowerment that have been detailed in Cruz/Frey 2003: ethical awareness, ethical evaluation, ethical integration and ethical prevention. This list of moral skills is by no means exhaustive or exclusive. For example, it does not cover moral imagination, moral creativity, becoming a member of a professional community, or perseverance. Readers are encouraged to consult the moral development skills that are available in Kohlberg, Rest, Huff/Frey, and the widely accepted Hastings Center List. Bibliographical references below will provide ample resources that different institutions or groups can use to build a list of skills of moral development to fit their needs and resources.

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- Cruz, Jose and Frey, William. 2003. "An Effective Strategy for Integrating Ethics Across the Curriculum in Engineering: An ABET 2000 Challenge" in Science and Engineering Ethics 9(4): 546-547.

Index of Keywords and Terms

Keywords are listed by the section with that keyword (page numbers are in parentheses). Keywords do not necessarily appear in the text of the page. They are merely associated with that section. *Ex.* apples, § 1.1 (1) **Terms** are referenced by the page they appear on. *Ex.* apples, 1

Attributions

Graduate Education in Research Ethics for Scientists and Engineers

"Graduate Education in Research Ethics for Sciencists and Engineers" is a project funded by the National Science Foundation (SES 0629377) to design and integrate a pilot program in research ethics for graduate students in science and engineering to prepare them to face the complex and encompassing ethical and social issues that arise in professional activity. This project is being built around three key components: (1) Three specially designed graduate student workshops, a freestanding course, and a capstone activity will provide students with problem-solving skills and a conceptual framework in research ethics; (2) Participants in faculty development workshops will design research ethics cases and materials to provide graduate students with practice and guidance in confronting ethical challenges in research; (3) Faculty mentoring workshops will foster collaboration between faculty experienced with integrating ethidcs and those new to the task. This collection of modules in Connexions will describe these activities and display modifications and improvements as these activities evolve and are tried out at different locations. The conversion of this workshop activity into module and course formats has come about through the EAC Toolkit project, NSF SES 0551779

About Connexions

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