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[Faculty of Science
Information and Computing Sciences]

Ethics in Research and Experimentation

Code Conduct for Scientific Research

Experimentation in Software Engineering : Wohlin, Chapter 2.11

Sjaak Brinkkemper

Outline

- Ethics
- Research Code of Conduct
- Ethics in Experimentation
- Four principles
  - Informed Consent
  - Scientific Value
  - Confidentiality
  - Beneficence

Ethics in Research

Ethics: systematizing, defending and recommending concepts of right and wrong conduct

- addressing disputes of moral diversity
- a branch of philosophy
- subjective, time-bound, domain specific

Ethics are expressed in principles:

- Kind of norm or rule
- Kind of best practice

- Ethics in research
- Ethics in experimentation
- Ethics in University-Industry collaboration

Ethics in research

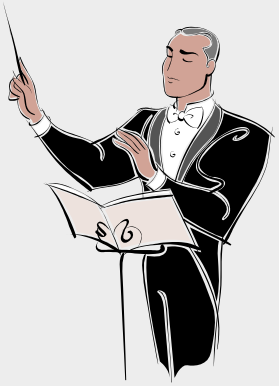
- Research has been performed for centuries
- Ethical issues have been popping up
- Rules and procedures for human subjects in the domains of medicine, biology, humanities, social sciences, etc.
- How about ICT research?

Many issues in research

- Fabrication of data (Stapel, Social Psychology)
- Plagiarism (Wolpert, Biology; Memon, Data mining)
- Ghost-writing

- See stories on RetractionWatch.com

Research Code of Conduct



- How to behave as researcher
- Formulated principles
- Misconduct: when and how to handle
- Guidelines for good practice

- European Science Foundation: European Code of Conduct for Research Integrity, March 2011
- Vereniging van Samenwerkende Nederlandse Universiteiten (VSNU): Nederlandse Gedragscode Wetenschapsbeoefening, revised, 2012.

European Research Code of Conduct: 8 Principles

1. Honesty in communication
   - presenting research goals and intentions,
   - in precise and nuanced reporting on research methods and procedures, and in
   - conveying valid interpretations and justifiable claims with respect to possible applications of research results.

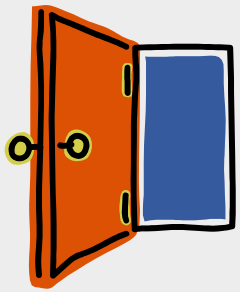
2. Reliability
   - in performing research - meticulous, careful and attentive to detail, and
   - in communication of the results - fair and full and unbiased reporting.

3. Objectivity
   - interpretations and conclusions must be founded on facts and data capable of proof and secondary review;
   - transparency in the collection, analysis and interpretation of data, and verifiability of the scientific reasoning

ERCC - 8 Principles (2)

4. Impartiality and independence
   - from commissioning or interested parties,
   - from ideological or political pressure groups, and
   - from economic or financial interests.

5. Openness and accessibility
   - in discussing the work with other scientists,
   - in contributing to public knowledge through publication of the findings,
   - in honest communication to the general public.
   - a proper storage and availability of data,
   - and accessibility for interested colleagues.



ERCC - 8 Principles (3)

6. Duty of care
   - for participants in and
   - subjects of research
   - human beings, animals, the environment or cultural objects
   - principles of respect and duty of care.

7. Fairness
   - providing proper references and giving due credits to the work of others
   - in treating colleagues with integrity and honesty

8. Responsibility for future science generations
   - education of young scientists and scholars
   - binding standards for mentorship and supervision

Misconduct

- Fabrication is making up results and recording or reporting them.
- Falsification is manipulating research processes or changing or omitting data.
- Plagiarism is the appropriation of another person's ideas, research results or words without giving appropriate credit.
  - Text, original figures, photographs, tables
  - Violation of copyright laws
- Improper dealing with infringement of integrity
  - attempts to cover up
  - reprisals to whistle-blowers
  - violations of due process
  - research institutes have the duty to promote good research management
  - research integrity is instilled into the culture.

Good Practice Rules

1. Good data practices: availability and access
   - Data stored in accessible form; Archived for replication and elaboration
2. Proper research procedures
   - Careful execution; minify harmful impact on environment
3. Responsible research procedures
   - Sensitivity to age, gender, etc.; Subject procedures not violated
4. Publication related conduct
   - Authorship based on contribution; financial contributions acknowledged
5. Reviewing and editorial issues
   - Thorough and accurate; confidentiality

Discussion: How to conduct well?

Case 1:

Dr. Jonas is a professor at a well-known university in the software engineering program. He recently conducted on a research project to determine how collaboration styles influence software quality. His hypothesis is that *software engineers who work well together produce better software*.

Dr. Jonas collects data by observing SE teams at local companies. He then categorizes the teams according to their success at collaboration. He also collects metrics for software components previously developed by the same teams. Dr. Jonas plans to correlate the collaboration quality measures with the metrics to determine whether teams that collaborate better produce higher quality code.

A few weeks into the research program, a manager asks to see Dr. Jonas' field notes and wishes to know how his company compares to the other companies regarding the metrics assessment.

Discussion questions:

1. What should Dr. Jonas do?
2. To whom is he obligated?

Ethics in Experimentation

- Any empirical research activity involving human subjects must take ethical aspects into consideration.
- Singer and Vinson (2001) provided practical guidelines for the conduct of empirical studies.
- They identified four key principles:
  1. Informed Consent
  2. Scientific Value
  3. Confidentiality
  4. Beneficence

Four Ethical Principles

1. Informed Consent
   Subjects must give *informed consent* to their participation, implying that they should have access to all relevant information about the study, before making their decision to participate or not.

2. Scientific Value
   The study should have *scientific value* in order to motivate subjects to expose themselves to the risks of the empirical study.

Four Ethical Principles (2)

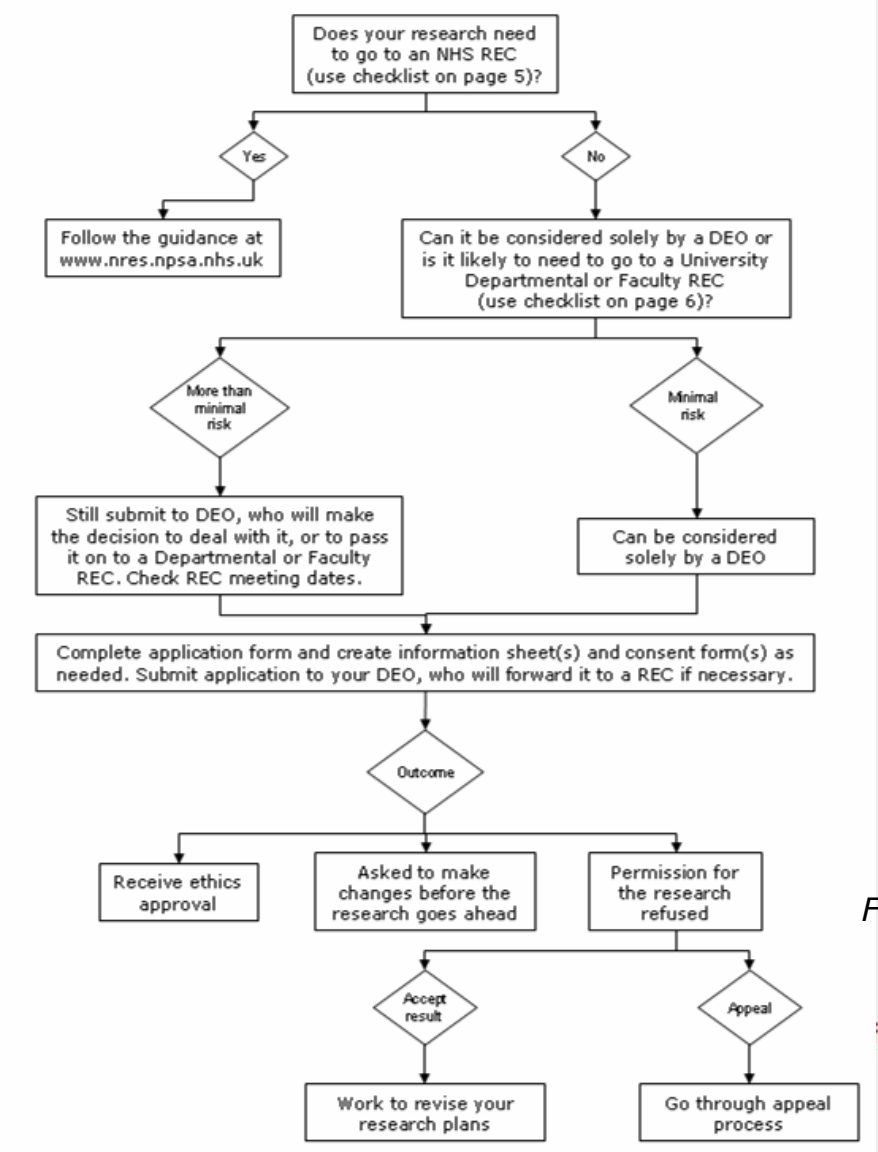
3. Confidentiality
   Researchers must take all possible measures to maintain *confidentiality* of data and sensitive information, even when this is in conflict with the publication interests.

4. Beneficence
   Weighing risks, harms and benefits, the *beneficence* must overweigh, not only for the individual subjects, but also for groups of subjects and organizations.

Ethical Review

- Some countries legally require an ethical review for studies involving human subjects.
  - Canada, Australia, USA, NL
  - Biomedical research
  - Sociology,
- The documentation needed in the review typically includes a description of the project, comprising details on subjects and treatments, documentation of how informed consent is obtained, and a review of ethical aspects of the project.

Ethical Review procedures



From: ERB, Univ Leicester, UK

1. Informed Consent

- The basis for a human-oriented empirical study (e.g. an experiment) is that subjects are participating voluntarily, and that they have enough information to make the decision to participate or not.
- Further, this includes the option to withdraw from the study any time, without any penalty for the subject.
- In order to make this decision process clear and explicit, consent should be given in writing.

Consent form

A consent form typically comprises the following elements

- Research project title: for identification purposes.
- Contact information: both research and ethics contact.
- Consent and comprehension: the subjects state that they understand the conditions for the project and accept them.
- Withdrawal: states the right to withdraw without penalties.
- Confidentiality: defined the promises about confidential handling of data and participation.
- Risks and benefits: explicitly listing what the subjects risk and gain.
- Clarification: the right for the subject to ask questions for clarification of their role in the study.
- Signature: mostly by both subject and researcher, one copy for each, to indicate

Informed consent: the case of the student subjects

Case 2:

Dr. Gauthier is on the faculty of a large research university. She is interested in how different views of source code influence program understanding and has therefore built a tool that offers a data flow view, a control flow view, and an architectural view of a system.

She wants to see which of the different views help software engineers design and maintain source code more effectively. Unfortunately, Dr. Gauthier does not have access to industrial software engineers to test her tool. Consequently, she decides to use the students in her software engineering class as test subjects.

She divides the students into four sections. Each of three sections is given one of Dr. Gauthier's tools with a different view. The fourth section uses the standard tools provided by the university programming environment. Dr. Gauthier gives all four sections the same midterm project. She finds that some of the views offer modest gains in productivity.

Would you like to be involved in such a research project?

What do you think about the arrangements of this project?

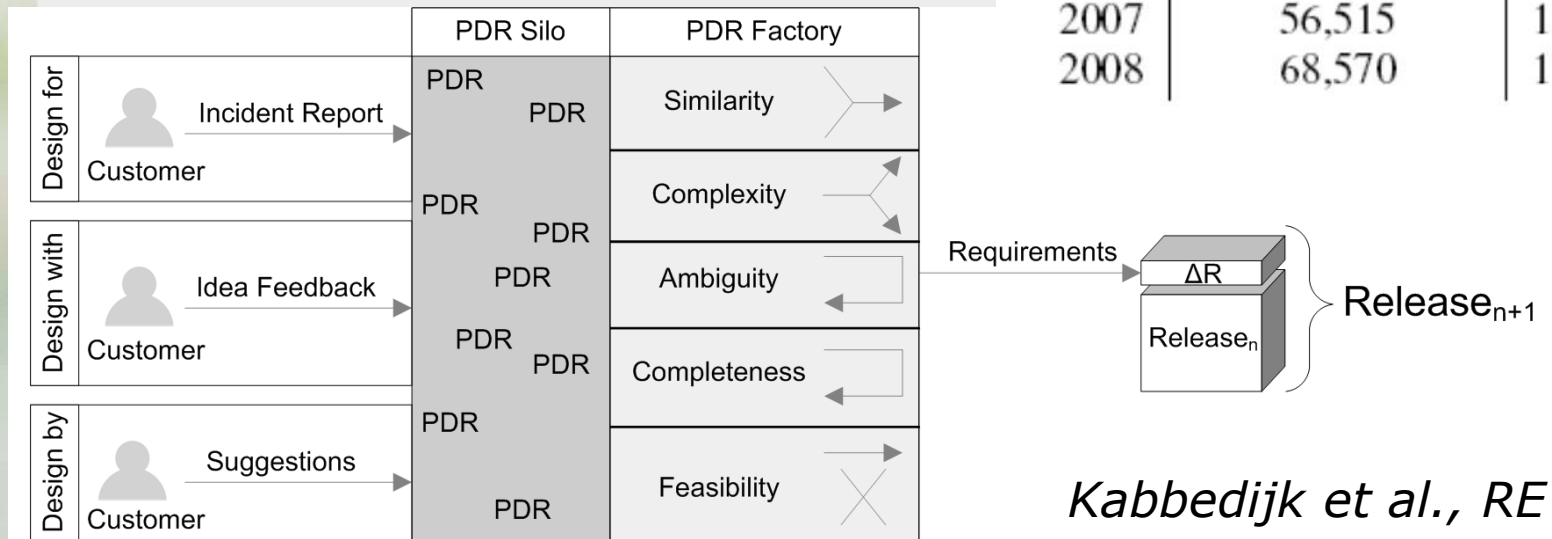
2. Scientific value

- The **WIN-**win situation
- Advancement of knowledge
- Expectation of interesting and significant contribution
- Craft and experience of the researcher
- Goal is paper published in high ranked conference or journal

Study in Customer Involvement

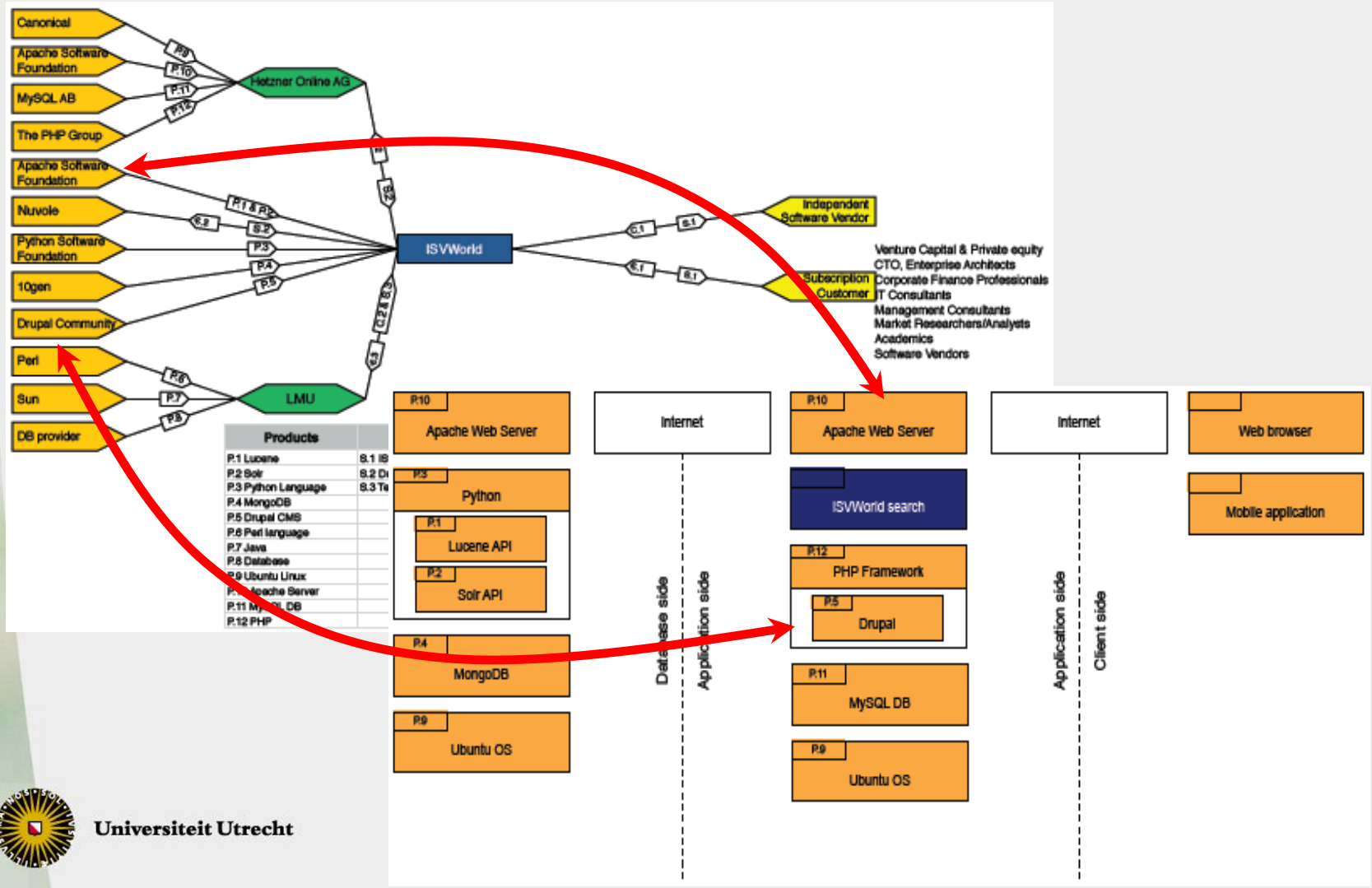
- Reports of questions, complaints or bugs
- Approximately 60.000 reports per year
- Handled by helpdesk and consultancy
- 85% can be solved by referring to the manual
- 15% is a bug or shortcoming

	Incident Reports	PDRs
2005	64,541	15,411
2006	62,981	12,913
2007	56,515	15,346
2008	68,570	17,904



Kabbedijk et al., RE 2009

Management of dependencies in software ecosystems



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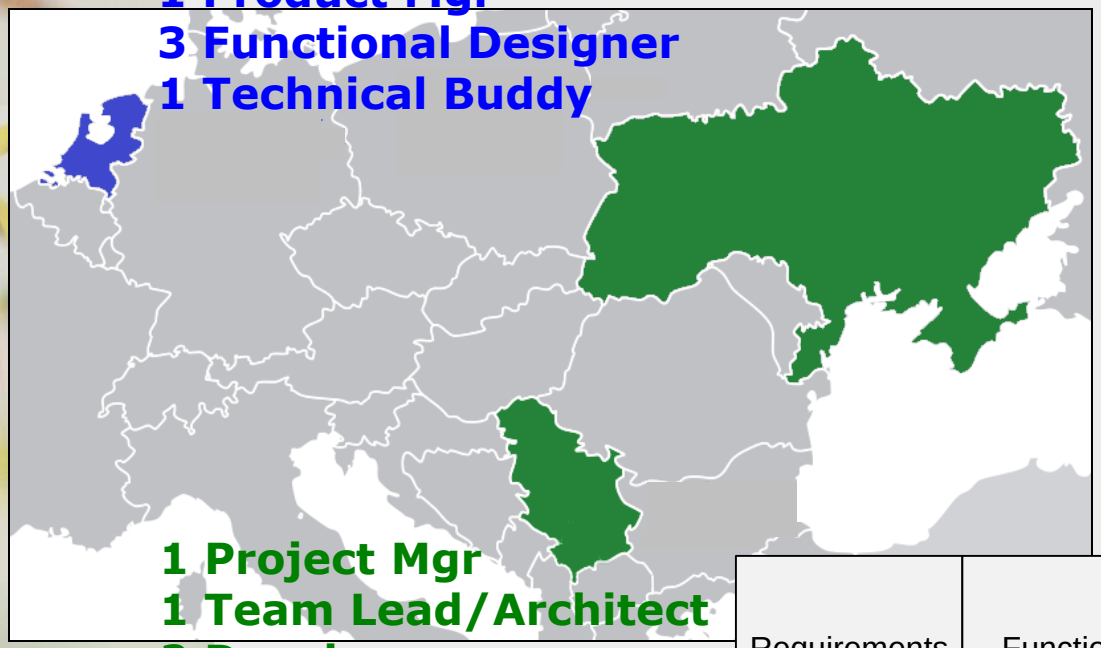
3. Confidentiality

- The subjects must be sure that any information they share with researchers will remain confidential.
- Aspects on confidentiality are:
  - Disclosure after agreement
  - Data privacy.
  - Data anonymity.
  - Anonymity of participation.

Full names: Research on Outsourcing collaboration patterns



1 Sub-Team Lead/Architect
3 Developers
1 QA Manager
1 Tester

Kristjansson et al., JKE 2011

Exact

Requirements Management	Functional Design	Acceptance Testing	
		Programming	Deployment
Architecture	Technical Design	QA Testing	

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Anonimity of respondents

Table 1. Roles occupied by respondents (multiple roles allowed)			
Role		**Frequency**	**Percentage**
EA Creator	Enterpr Architect Business & Inform	97	33.1%
	Enterpr Architect Application & Infrastr	95	32.4%
	Manager	39	13.3%
	External EA Consultant	19	6.5%
EA User	Manager	42	14.3%
	Project Manager	39	13.3%
	Project Architect	56	19.1%
	Business Analyst/Designer	34	11.6%
	System & Information Analyst/Functional Designer	26	8.9%
	Software Architect	35	11.9%
	Technical Designer	19	6.5%
	Developer/Programmer	8	2.7%
	Maintenance Engineer	8	2.7%

Foorthuis, ICIS 2010

Pseudonimisation of Cases

Case Identification Code	Time	Inter-viewees	Informal interviewees	Organiza-tion size	Duration of study
ERPComp	Early 2004	15	24	1504	2 months
OCSComp	Early 2005	4	8	115	1,5 months
HISComp	Mid 2005	7	12	100	6 weeks
FMSComp	Late 2005	8	8	160	4 weeks
CMSComp	Early 2006	4	8	65	3 weeks
TDSComp	Mid 2006	4	5	60	3 weeks

Pseudonyms (nick names) are used for the sake of readability of the paper. Cf. calling the companies A, B, C , etc.

Sensitive Results

- For results sensitive to:
  - *Subjects*, make sure that confidentiality procedures apply, independently of facts revealed,
  - *Sponsors*, include clear statements on rights for independent publications of the anonymized results in the informed consent form for companies, and in research project contracts (typically in acknowledgement in footnote or endnote,
  - *Researchers*, consider having peers to perform statistical analyses on anonymized data (both subjects and scales) independently from the experimenters, especially when the treatment is designed by the experimenters themselves. This also reduces the threat of experimenter expectancies.

4. Inducement

- The win-**WIN** situation
- In recruiting subjects for an experiment, there must be inducements to motivate their participation. The experience and knowledge gained by applying a new method may be inducement enough.
- The inducement must be balanced to ensure that the consent to participate really is voluntary, and not forced by too large economic or other inducements.

Typical incentives

- Scientific reflection
- Recognition as a technology leader
- Benchmarking

Discussion: Inducement

Case 3:

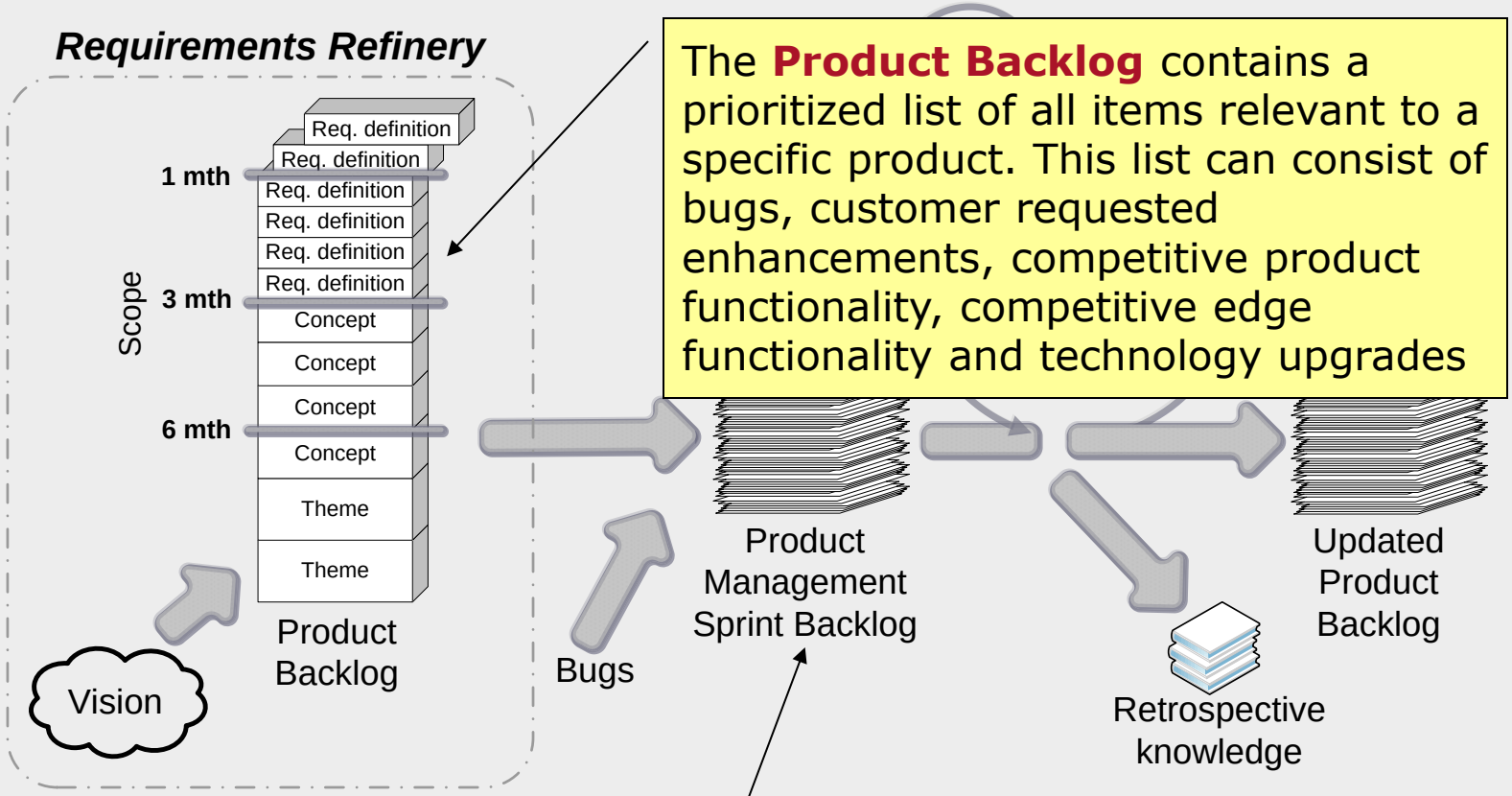
Dr. Johns works in a software engineering research center. Her research deals with process improvement. Dr. Johns is quite excited by a newly published process model. Consequently, she collects process data from a software development team working for a large government contractor.

Using the model to analyze her data, Dr. Johns finds five major flaws in the contractor's software process, including the contractor's over-reliance on one team leader. Dr. Johns is very impressed with the new model's usefulness and publishes her results in a publicly available conference proceedings.

Discussion:

What will happen when the company finds out about the paper?

Planon case: Scrum extension for SPM Agile Requirements Refinery



The **Product Backlog** contains a prioritized list of all items relevant to a specific product. This list can consist of bugs, customer requested enhancements, competitive product functionality, competitive edge functionality and technology upgrades

The **Product Management Software Backlog** consists of tasks that can be finished by the SPM team within the sprint

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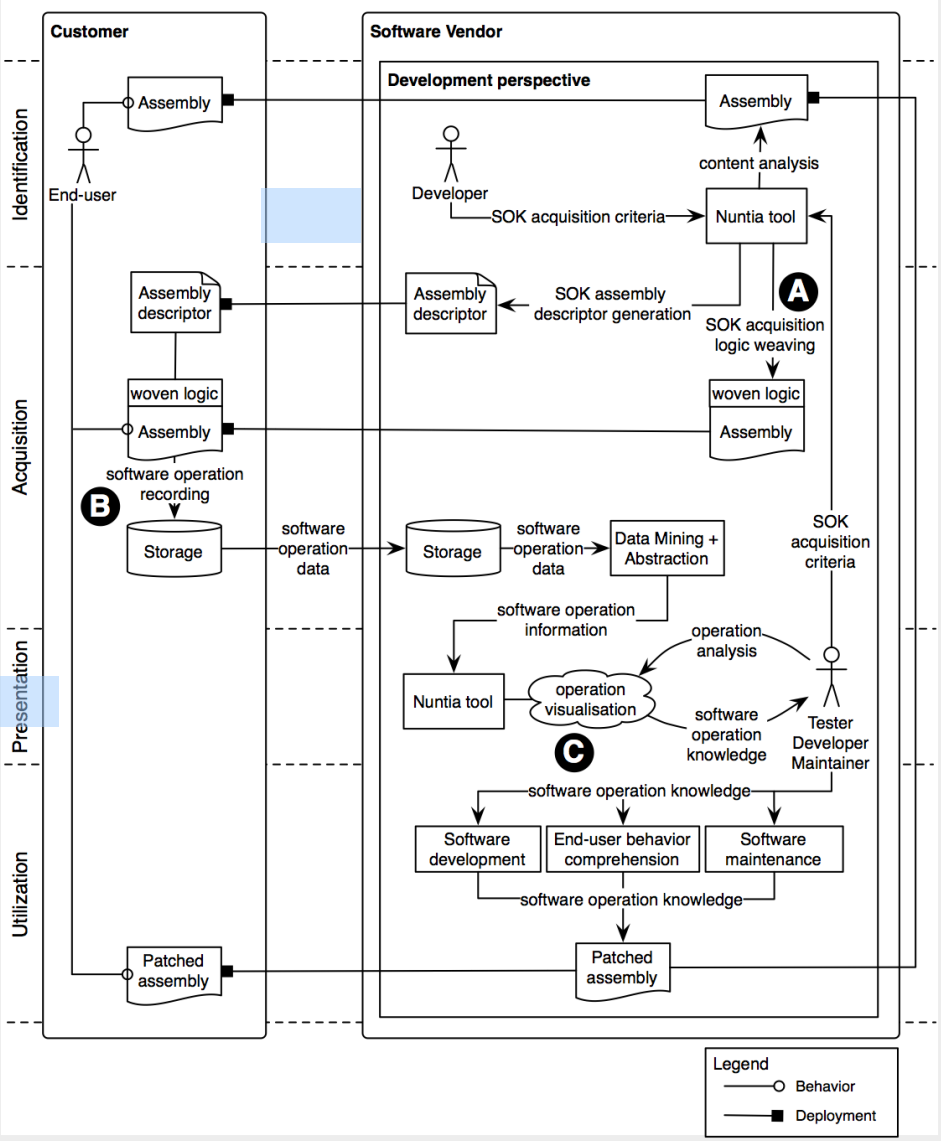
Vlaanderen et al., IST 2011

Stabiplan case: Software Operation Knowledge

Definition:
Software Operation Knowledge is knowledge of in-the-field performance, quality and usage of software, and knowledge of in-the-field end-user software experience feedback

Vd Schuur et al., CSMR 2011



Feedback

- To maintain long term relationships and trust with the subjects of a study, feedback of results and analysis are important.
- Subjects must not agree on the analysis, but should be given the opportunity to get information about the study and its results.

Feedback: Studies on Maturity in SPM

Focus Area	None	A	B	C	D	E	
Portfolio management							
Market analysis	30.2	32.6	16.3	4.7	7.0	9.3	
Partnering & contracting	16.3	23.3	37.2	2.3	11.6	9.3	
Product lifecycle mgmt	47.6	14.3	19.0	7.1	0.0	11.9	-
Release planning							
Roadmap intelligence	46.5	23.3	4.7	2.3	14.0	9.3	-
Core asset roadmapping	48.4	21.0	19.4	6.5	4.8	-	-
Product roadmapping	14.5	25.8	12.9	33.9	3.2	9.7	-
Product planning							
Requirements prioritization	21.0	35.5	21.0	3.2	9.7	9.7	-
Release definition	9.7	45.2	8.1	33.9	1.6	1.6	-
Release definition validation	25.8	38.7	16.1	19.4	-	-	-
Scope change management	59.0	9.8	6.6	8.2	16.4	-	-
Build validation	9.3	32.6	55.8	2.3	-	-	-
Launch preparation	12.9	45.2	11.3	1.6	3.2	6.5	-
Requirements management							
Requirements gathering	0.0	22.6	32.3	1.6	6.5	19.4	17.7
Requirements identification	25.6	11.6	14.0	46.5	2.3	-	-
Requirements organizing	17.7	21.0	38.7	22.6	-	-	-

Many organizations have low maturity

Percentage of organizations achieving the level

Intriguing data

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Bekkers et al., RE 2012

Conclusion on Ethics

- Singer and Vinson ask in their early work for a code of ethics for empirical software engineering.
- 10 years later the community has not yet developed one; the closest is Vinson and Singer's guidelines.
- Research funding agencies start to require general codes of ethics be applied, which may not fit the purpose.
- Concrete and tailored ethical guidelines for empirical software engineering research would benefit both the subjects, which they aim to protect, and the development of the research field as such.
- Students should be trained in research ethics

Reading

- European Science Foundation: European Code of Conduct for Research Integrity, March 2011
- Vereniging van Samenwerkende Nederlandse Universiteiten (VSNU): Nederlandse Gedragscode Wetenschapsbeoefening, revised, 2012.
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- Vinson, N.G. & Singer, J.A. (2008). A Practical Guide to Ethical Research Involving Humans, In Guide to Advanced Empirical Software Engineering (Shull, Singer, Sjøberg Eds.) pp. 229-256, Springer.