



Utrecht University

# A Roadmap for Ethics-Aware Software Engineering

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Fatma Başak Aydemir and Fabiano Dalpiaz

FairWare 2018

Requirements Engineering Lab

Department of Computing and Information Sciences

Utrecht University

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**Do we need ethics in software engineering?**

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# Few past incidents...



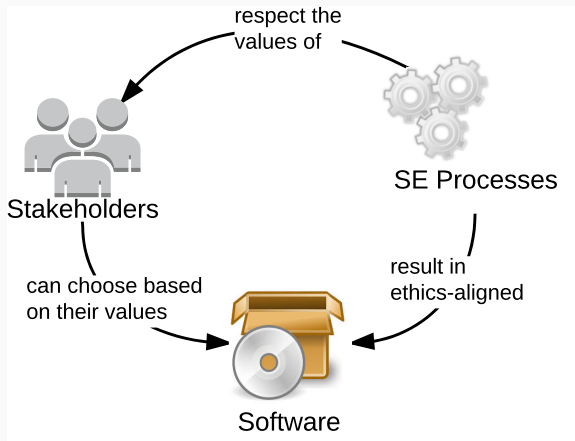
## Few ethical concerns...

- Fairness
- Diversity
- Sustainability
- Responsibility
- Privacy
- Transparency
- Dependability
- Professional conduct
- Business conducts

## **Our vision**

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# Ethical harmony

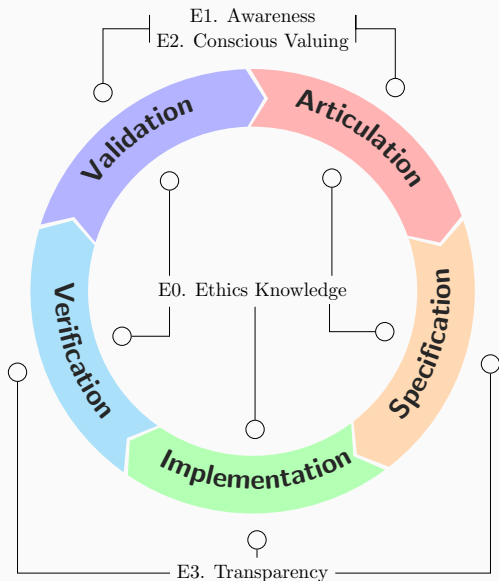


## Ethical harmony exists when

- Stakeholders state requirements on
  - Software product
  - Software engineering processes
- Professionals produce software and work for organizations that are aligned with their ethical values
- Organizations follow their ethical principles



# Ethics-aware software engineering



# **A roadmap for ethics-aware software engineering**

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# Research Question 1

## **RQ1**

What are the relevant ethics issues for software engineering?



A word cloud of ethics issues, with words in various colors and orientations. The words include:

- energy-consumption
- public's-benefit
- accountability
- transparency
- dependability
- confidentiality
- diversity
- piracy
- autonomy
- privacy
- education
- discrimination
- fairness
- intellectual-property
- cyber-bullying
- responsibility
- common-goods
- sustainability

# Research Question 1

## RQ1

What are the relevant ethics issues for software engineering?

### Artifacts

- Catalog of ethics issues in software engineering
- Crowd-driven ethics standards and code of conduct
- Elicitation methods for ethics requirements

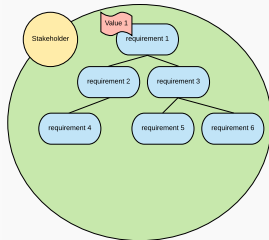
## Research Question 2

### **RQ2**

What are adequate modeling primitives to capture ethics requirements?

# Ethics requirements

- The algorithm shall be fair
- The system shall consume XYZ energy per transaction
- The interface shall promote diversity



### **RQ2**

What are adequate modeling primitives to capture ethics requirements?

### **Artifacts**

- Language for expressing ethics requirements
- NLP tool for deriving ethics requirements from natural language text



## Research Question 3

### **RQ3**

Which visual notations can help capture ethics requirements?

### **RQ3**

Which visual notations can help capture ethics requirements?

### **Artifact**

- Visual notation for the ethics requirements language

## Research Question 4

### **RQ4**

How to analyze the interplay of ethics requirements and other requirements?

# Interplay of requirements

- The algorithm shall be fair
- The system shall consume XYZ energy per transaction
- The interface shall promote diversity
- Performance?
- Safety?
- Security?

### **RQ4**

How to analyze the interplay of ethics requirements and other requirements?

### **Artifact**

- Analysis tool kit for ethics statements

## Research Question 5

### **RQ5**

Which techniques can help trace ethics requirements?

## RQ5

Which techniques can help trace ethics requirements?

### **Artifact**

- Design patterns to map ethics requirements to ethics design
- Traceability techniques for ethics requirements

## Research Question 6

### **RQ6**

How can we verify software artifacts and processes against ethics specifications?



## **RQ6**

How can we verify software artifacts and processes against ethics specifications?

## **Artifact**

- Verification techniques for ethics requirements

## Research Question 7

### **RQ7**

How can we validate software against ethics requirements?

# Research Question 7

## **RQ7**

How can we validate software against ethics requirements?

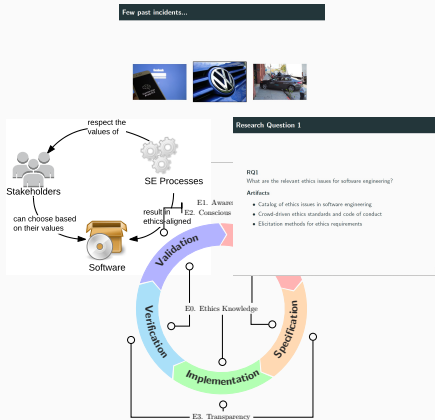
## **Artifact**

- Ethics acceptance tests

# Conclusions

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# Conclusions



## Future Work

- Research questions!
- RQ1: Systematic and grey literature survey
- RE related RQ2,3,4

## Contact us!



Fatma Başak Aydemir  
f.b.aydemir@uu.nl  
@aydemirfb



Fabiano Dalpiaz  
f.dalpiaz@uu.nl  
@FabianoDalpiaz

Thank you for your attention!