Analyzing the Effect of Preprocessor Annotations on Code Clones

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INF

Preprocessor Annotations – #ifdef

```
 void push(Object o
#ifdef SYNC
 , Transaction txn
#endif
 ){
    if (o==null
#ifdef SYNC
   || txn==null
#endif
   )
   return;
#ifdef SYNC
   Lock l=txn.lock(o);
#endif
   elementData[size++]
        = o;
#ifdef SYNC
   l.unlock();
#endif
   fireStackChanged();
 }
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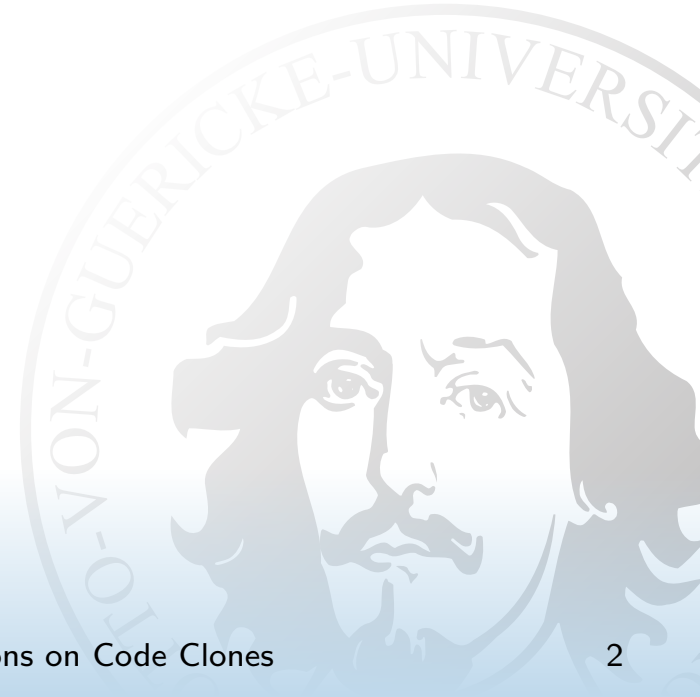

Preprocessor Annotations – #ifdef

undisciplined annotation

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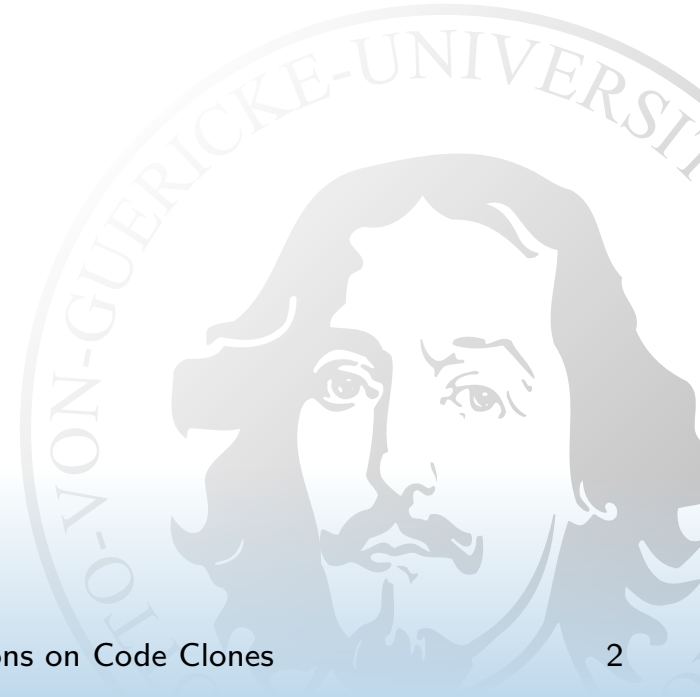

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   [illegible]
#en
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   I
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Definition Disciplined Annotations (Liebig et al.)

Annotations on one or a sequence of *entire functions* and *type defintions* . . . annotations on one or a sequence of *entire statements* and *elements inside type definitions* . . . are *disciplined*.

Code Clones

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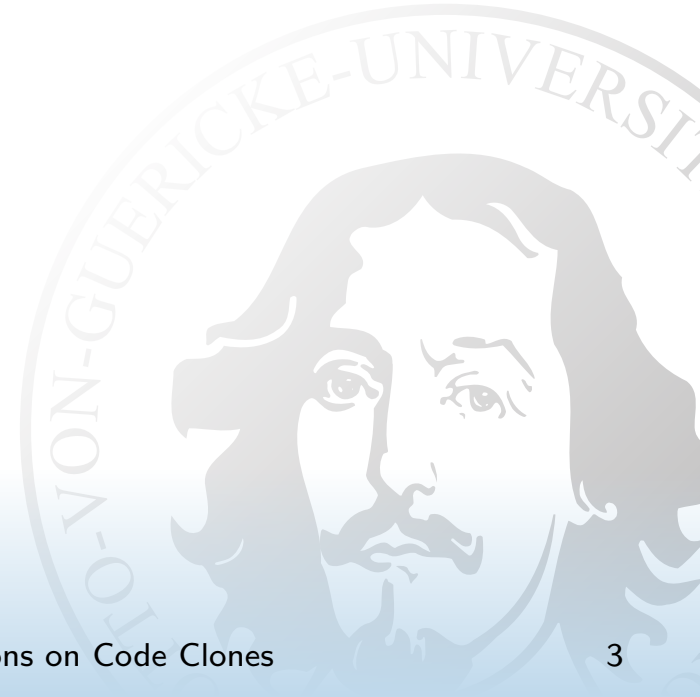

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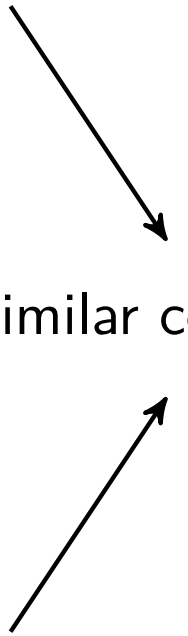
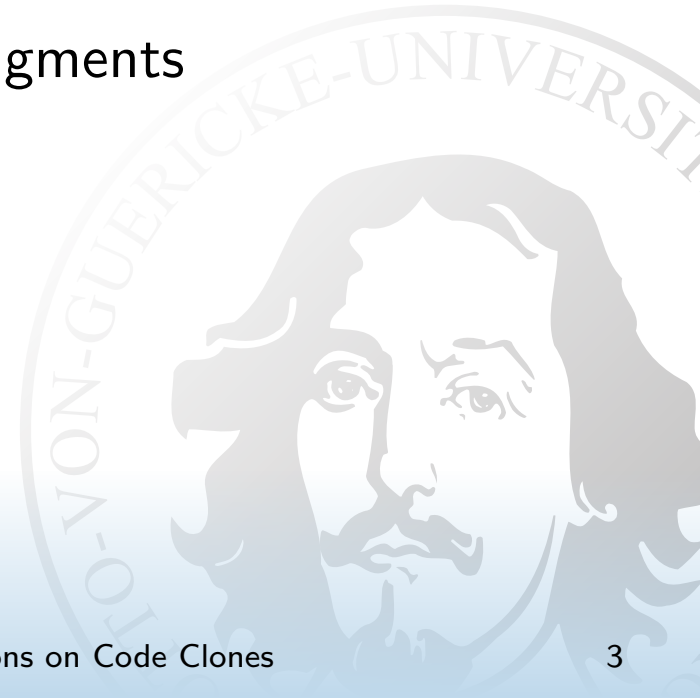


similar code fragments



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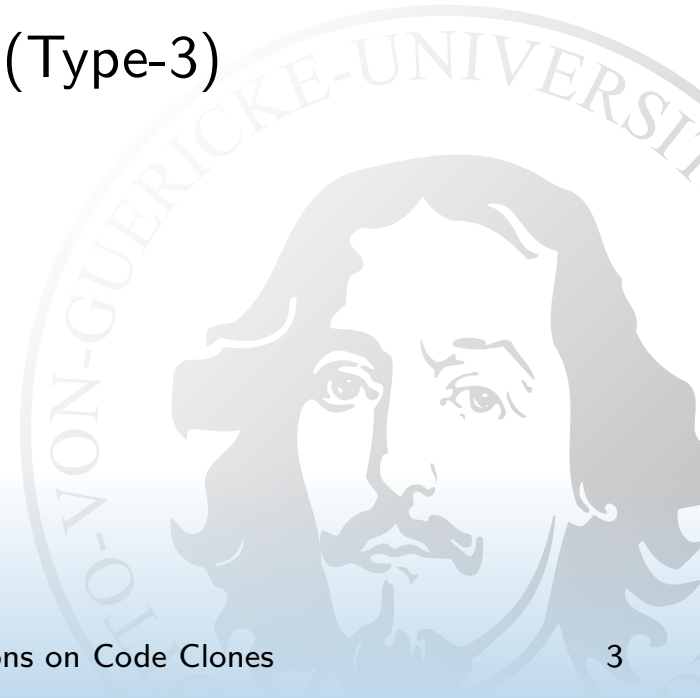
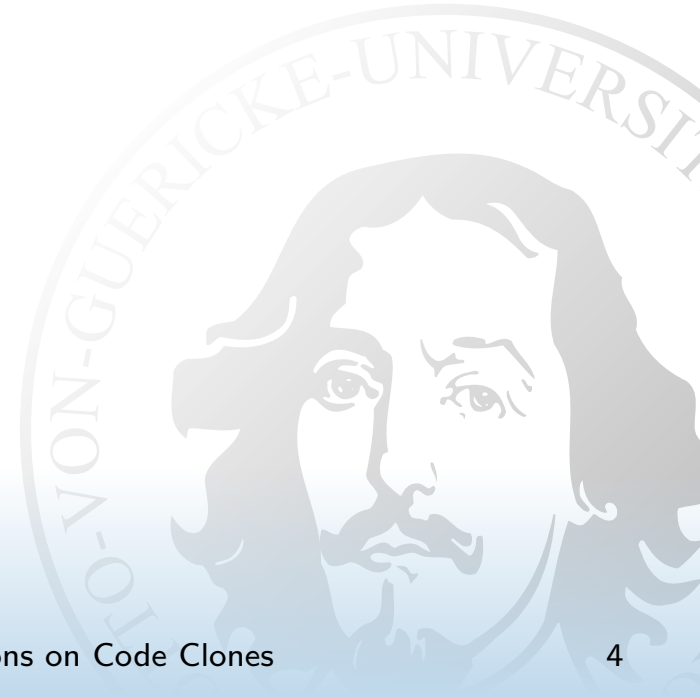
#ifdef clones (Type-3)



Motivation

Benefits and Drawbacks

- ***undisciplined*** annotations
  - high expressiveness
  - tangled source code, difficult to understand/modify
- ***disciplined*** annotations
  - improved readability, reduced programmer effort
  - lower expressiveness, prone to code clones



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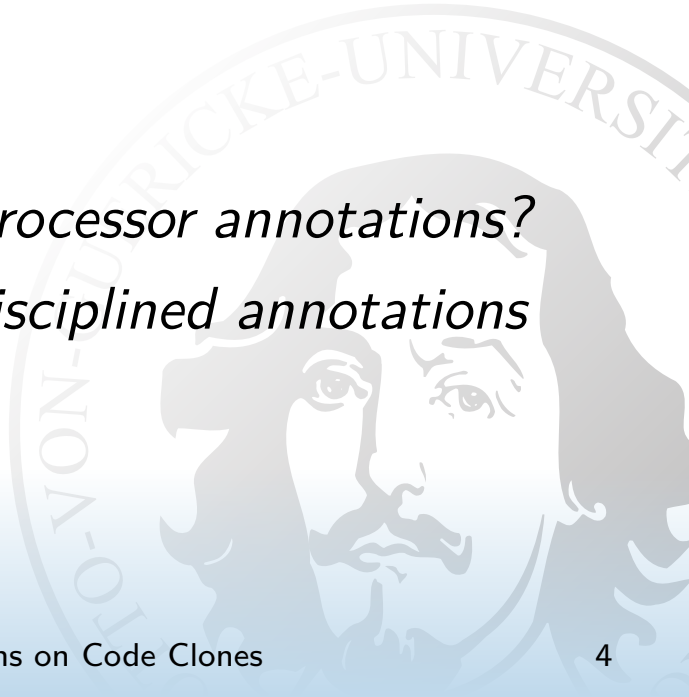
Research Questions:

RQ1 *To what extent code clones exist in preprocessor annotations?*

RQ2 *Differences between disciplined and undisciplined annotations wrt code clones?*



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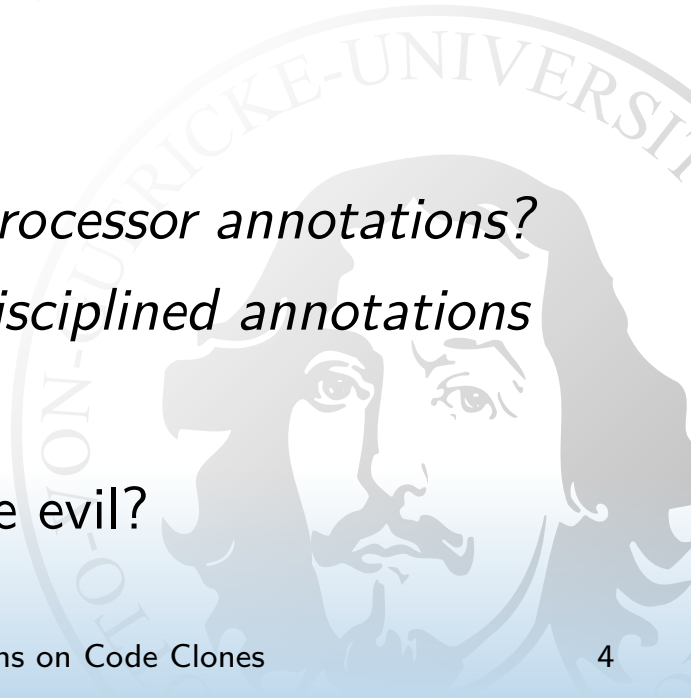
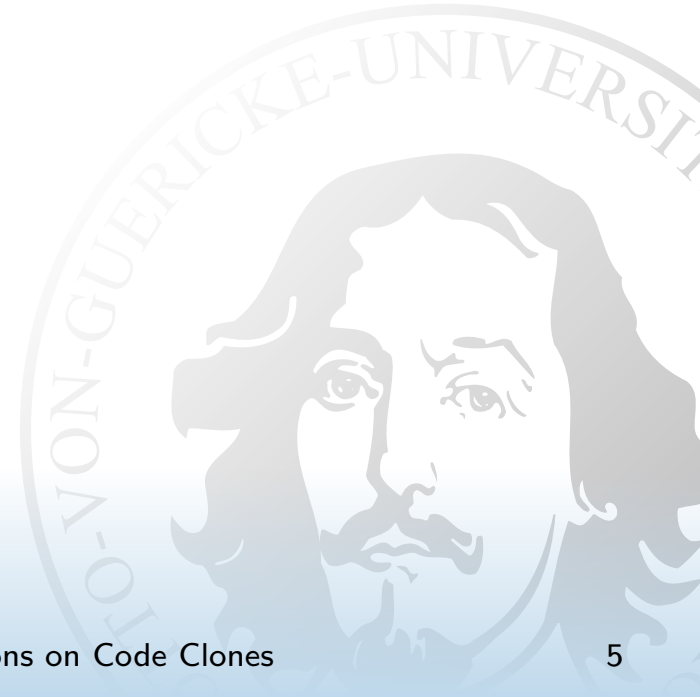
Big Picture: Which kind of annotation is more evil?



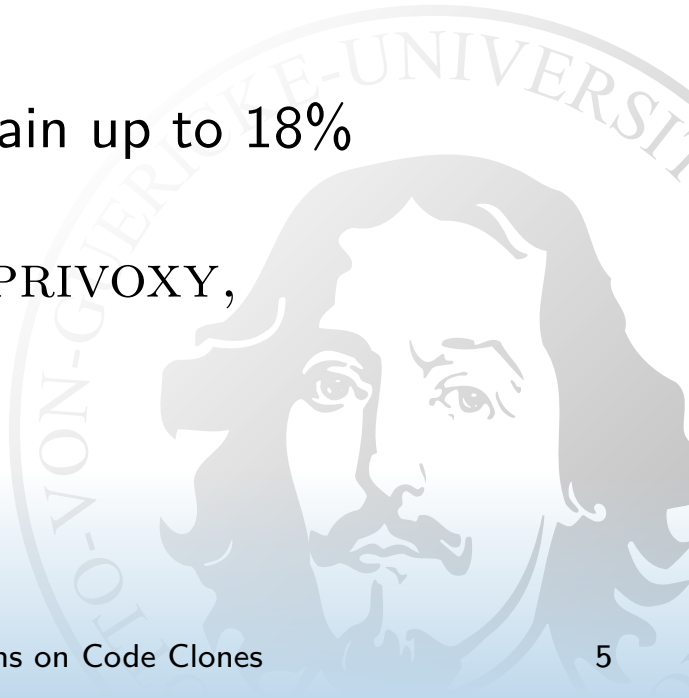
Case Study

- 15 open source systems in C programming language
- Size between 25 KLOC and 490 KLOC



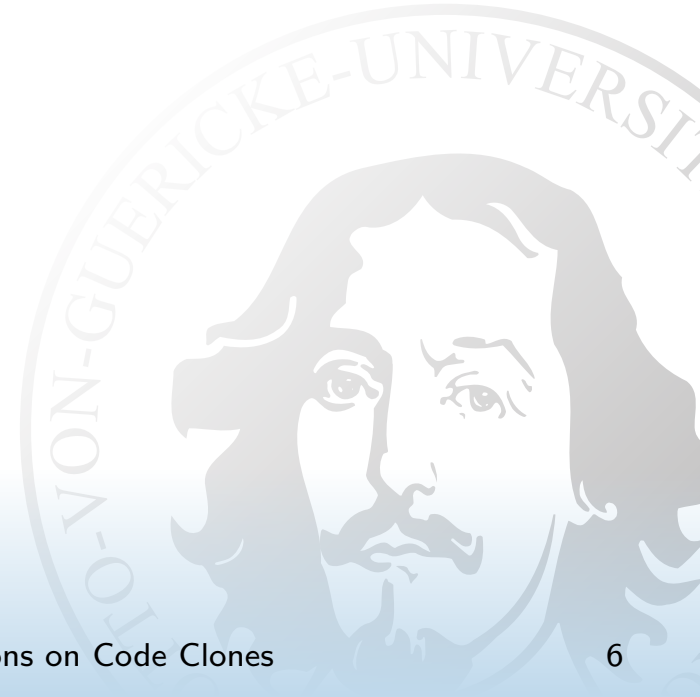
Case Study

- 15 open source systems in C programming language
- Size between 25 KLOC and 490 KLOC
- Split into two groups:
  1. Seven "disciplined" systems → almost no undisciplined annotations
     BERKELEYDB, DIA, GHOSTSCRIPT, LIGHTTPD, MINIX, PARROT, PYTHON
  2. Eight "undisciplined" systems → contain up to 18% undisciplined annotations
     CHEROKEE, GNUPLOT, LYNX, PHP, PRIVOXY, SENDMAIL, TCL, VIM



Subject Systems – Overview

- *Clone Coverage* – amount of code that contains code clones
- *#ifdef Coverage* – amount of code that is wrapped around by *#ifdefs*



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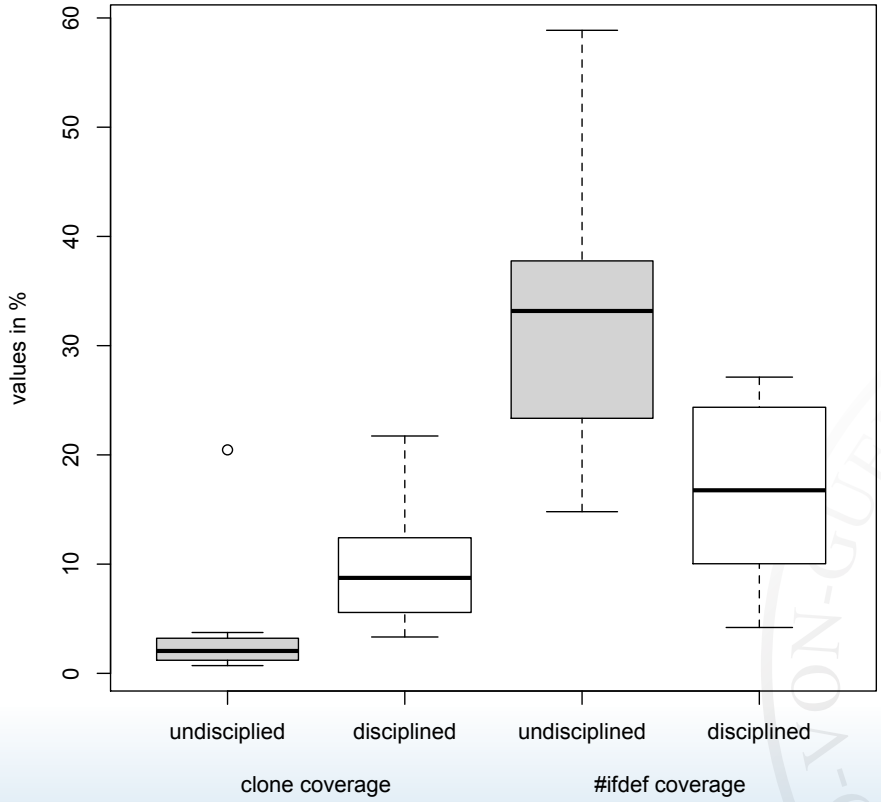
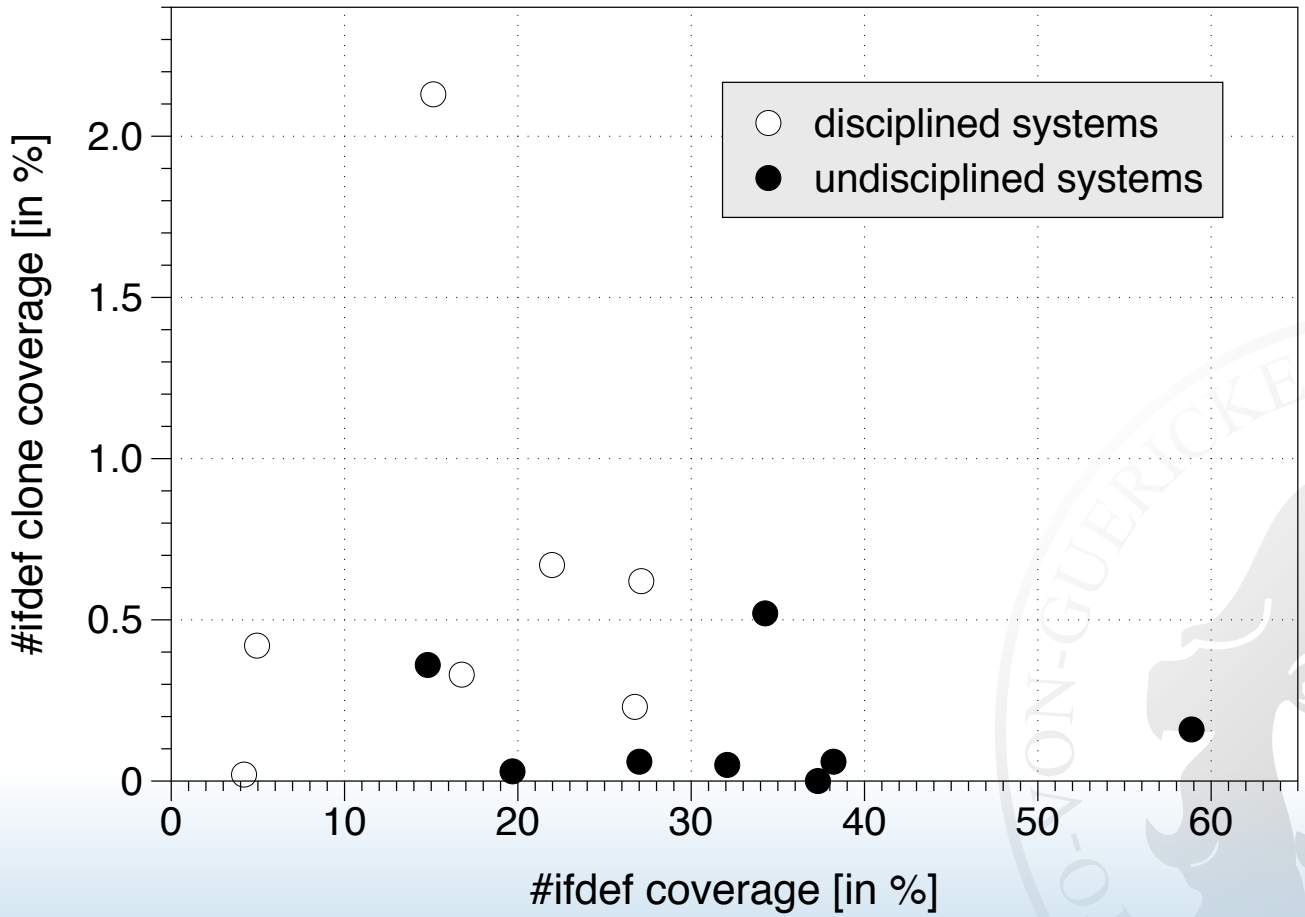


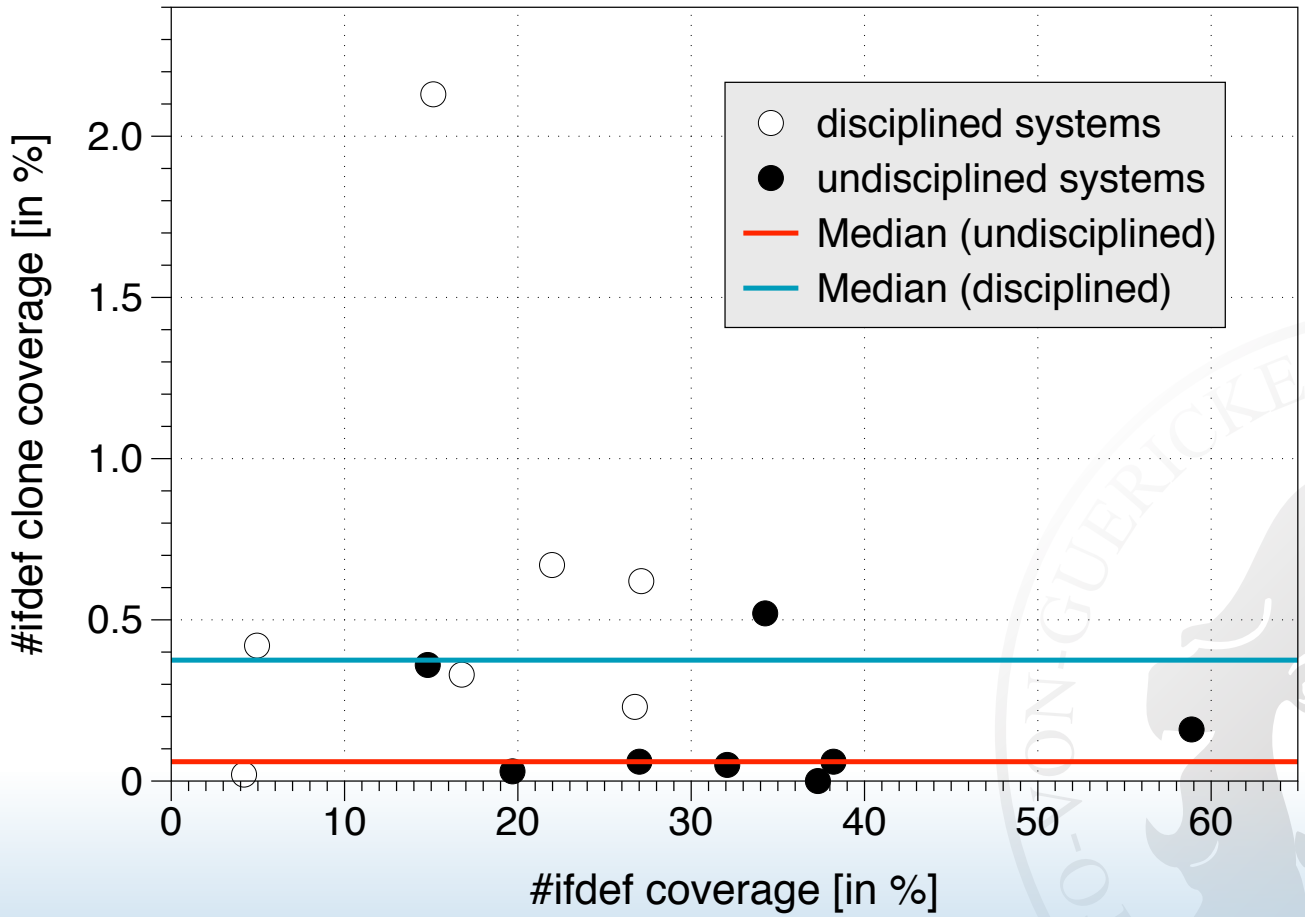
Results (I)

- How many clones occur within preprocessor annotations ?



Results (I)

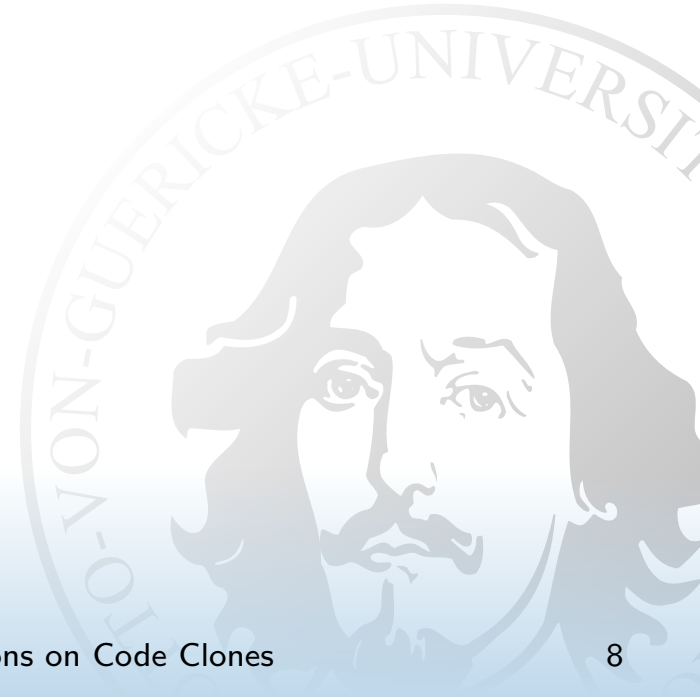
- How many clones occur within preprocessor annotations ?
- Does the kind of preprocessor annotation matter ?



Results (II)

Other correlations that influence the result ?

- Does code size matter ?



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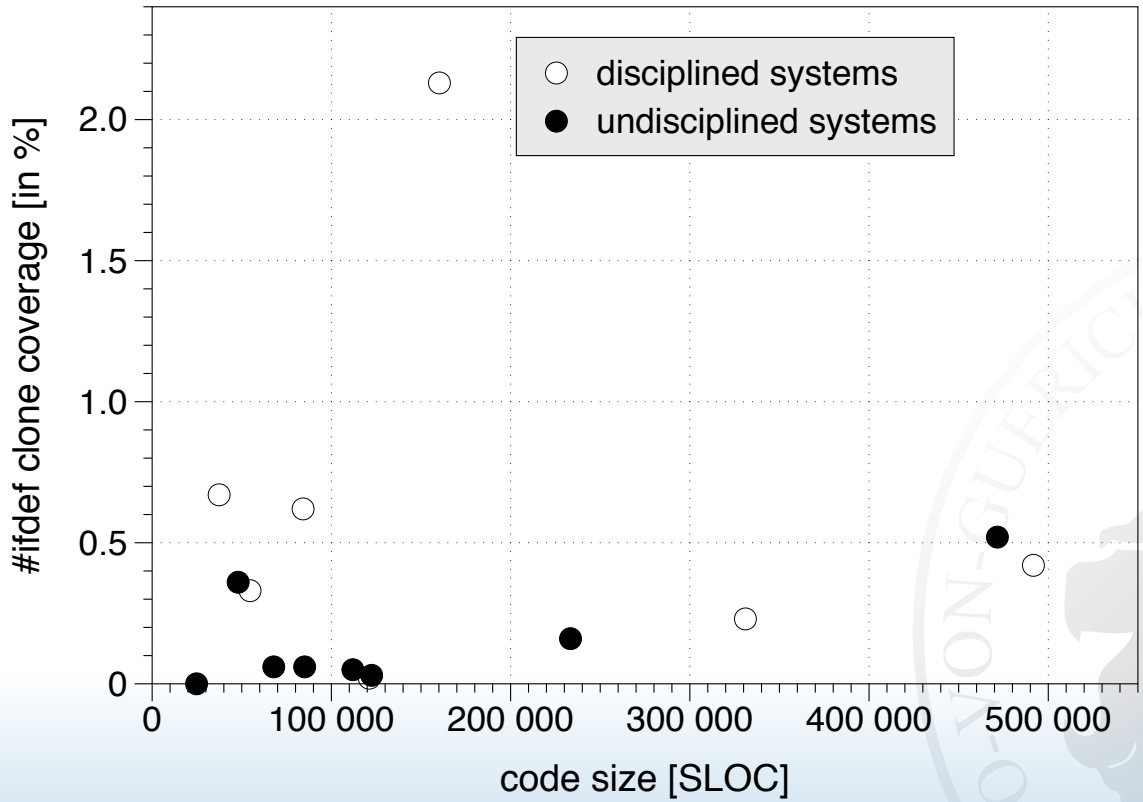

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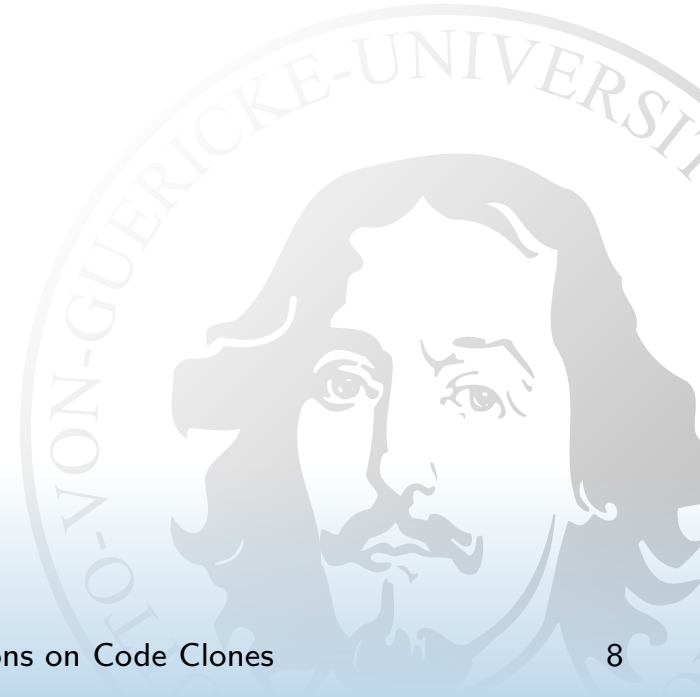

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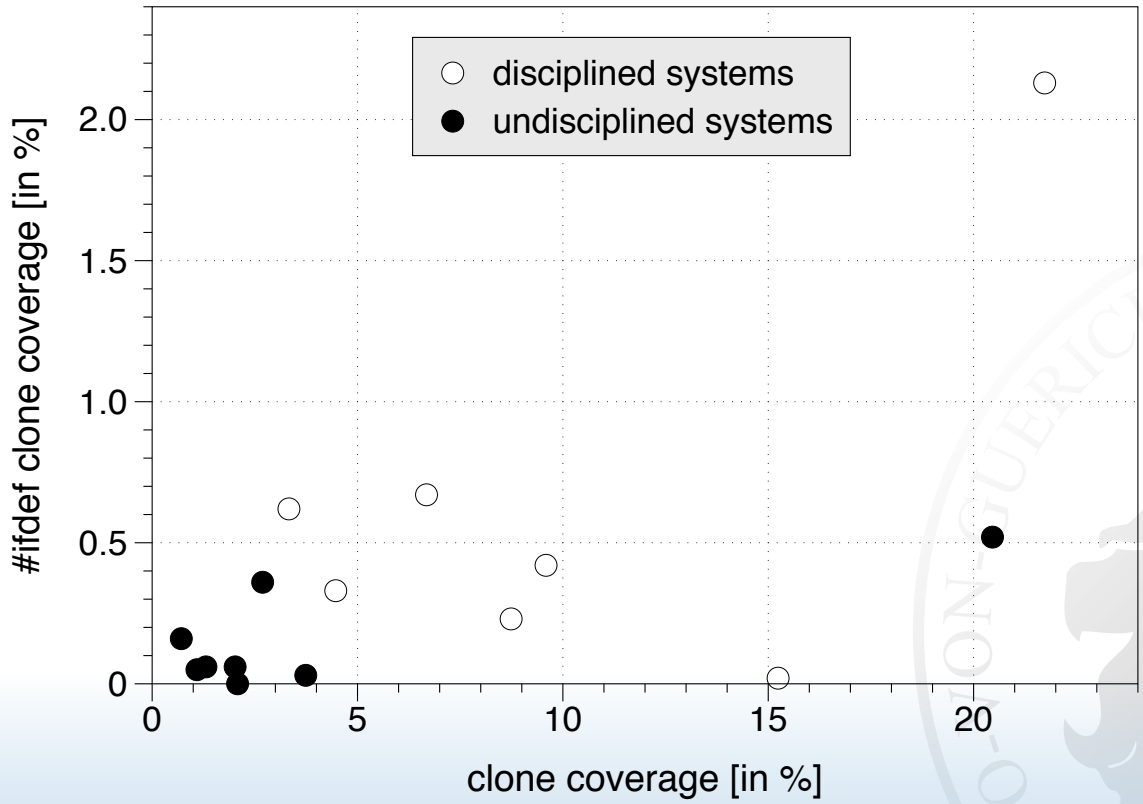

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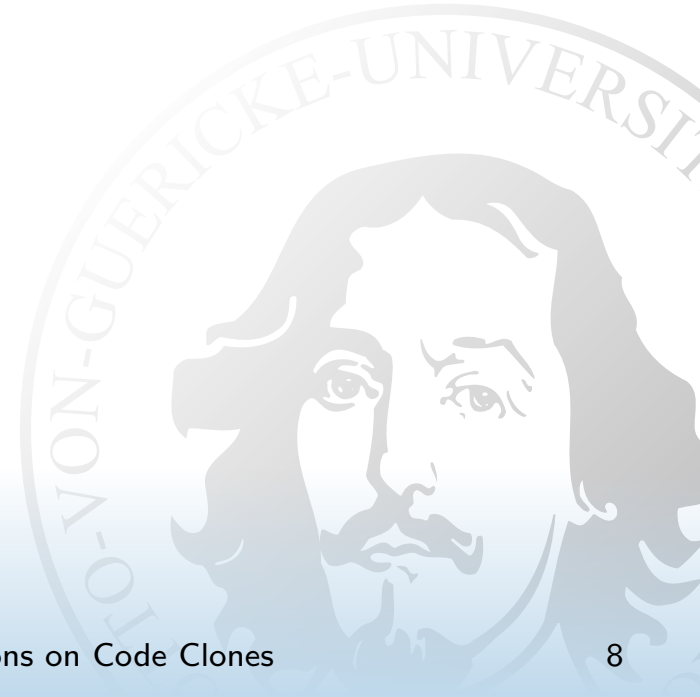

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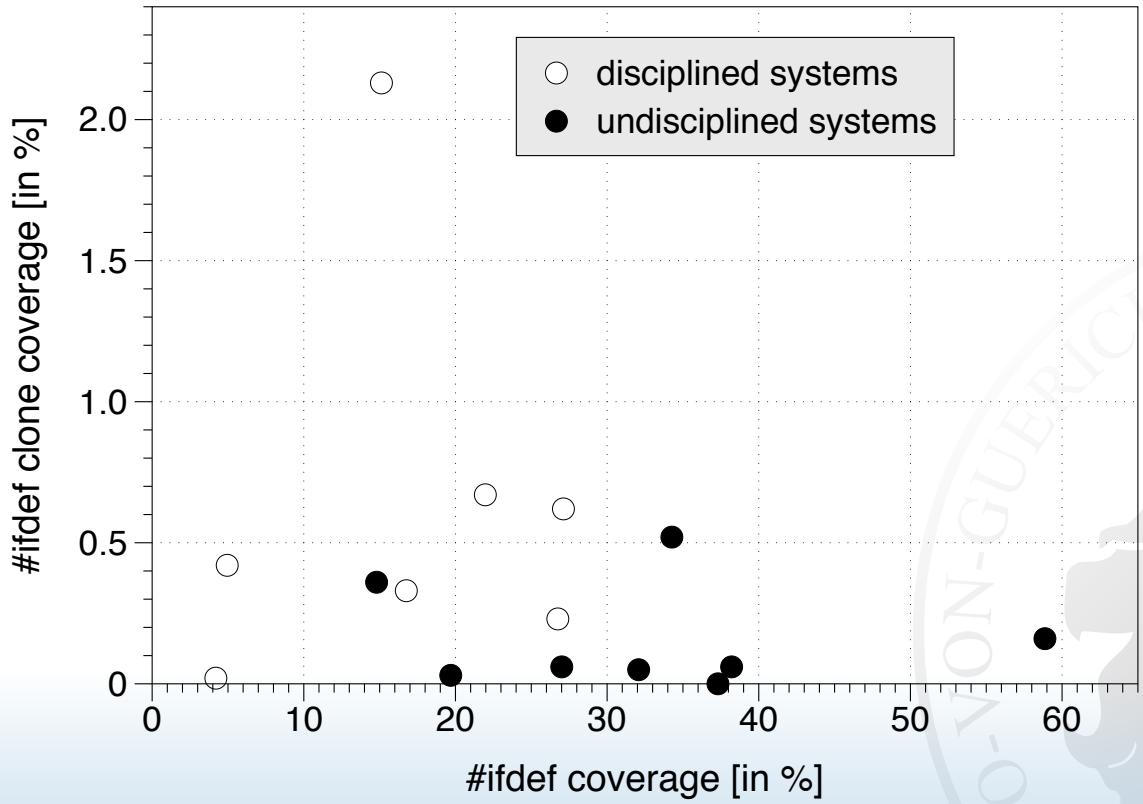

Conclusions

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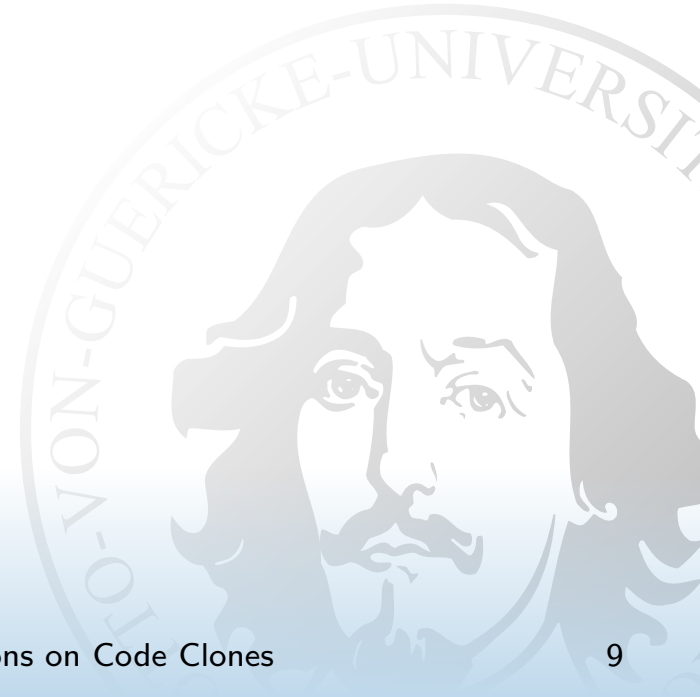
- Higher amount of *#ifdef clones* in disciplined systems
- No further correlations found



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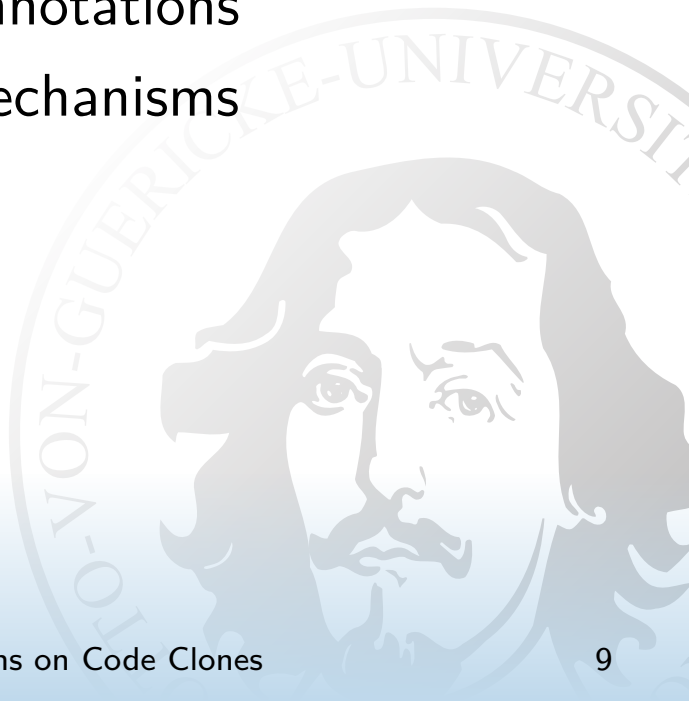
Future Work:

- Detailed analysis of *#ifdef clones*
- Study on harmfullness of undisciplined annotations
- Relation of code clones and variability mechanisms



Thank You !