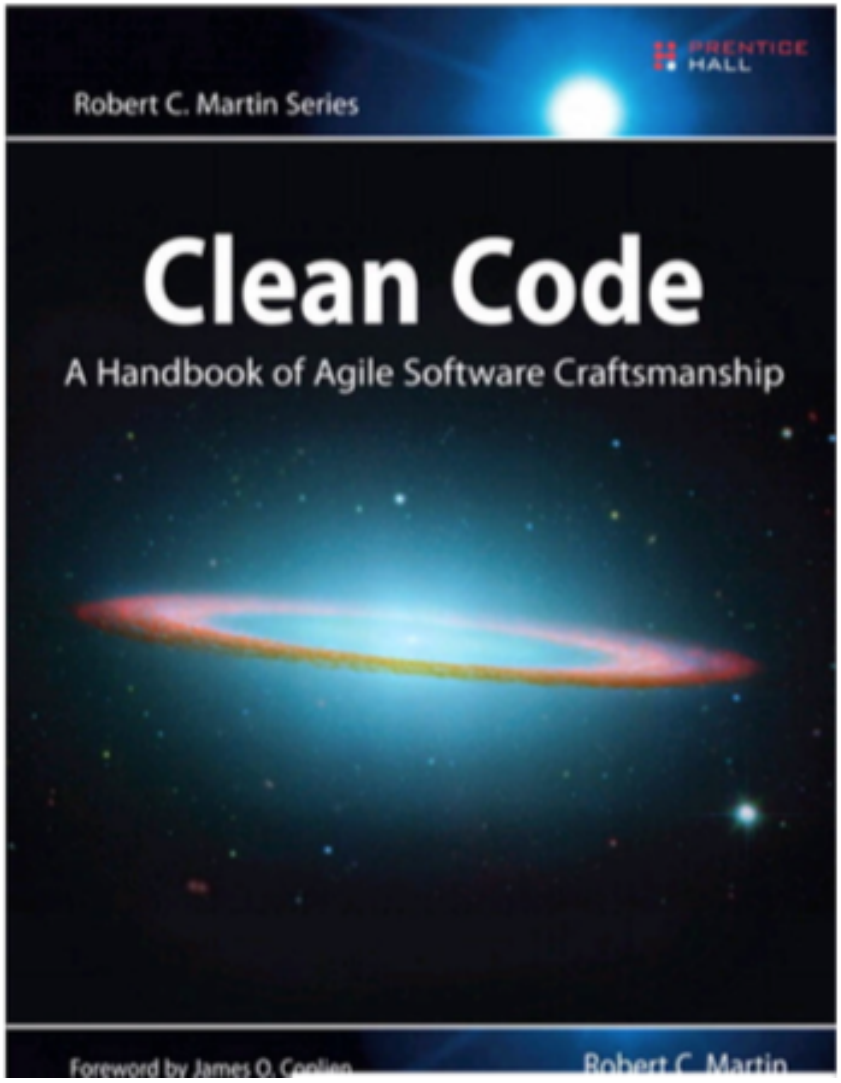
Clean Code



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Clean Code

What is "clean code?"

- Elegant and efficient. – Bjarne Stroustrup
- Simple and direct. Readable. – Grady Booch
- Understandable by others, tested, literate. – Dave Thomas
- Code works pretty much as expected. Beatuful code looks like the language was made for the problem. – Ward Cunningham

Why do we care abou clean code?

- Messes are costly. Quick and dirty to get it done ends up not getting it done and you will not enjoy it. It's lose-lose!
- We are professionals who care about our craft.

The Boy Scout Rule

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Meaningful Names

- The name of a variable, method, or class should reveal its purpose.
- If you feel the need to comment on the name itself, pick a better name.
- Code with a dictionary close at hand.

Don't ever do this!

```
1 int d; // elapsed time in days
```

Much better:

```
1 int elapsedTimeInDays;
2 int daysSinceCreation;
3 int daysSinceModification;
4 int fileAgeInDays;
```

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Avoid Disinformative Names

Avoid names with baggage, unless you want the baggage.

- `hp` not a good name for hypotenuse. `hp` could also be Hewlett-Packard or horsepower.

Don't hint at implementation details in a variable name.

- Prefer accounts to accountList.
- Note: certainly do want to indicate that a variable is a collection by giving it a plural name.

Superbad: using O, 0, l, and 1.

```
1  int a = l;
2  if ( O == l )
3      a=O1;
4  else
5      l=01;
```

Don't think you'll never see code like this? Sadly, you will.

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Avoid Encodings

Modern type systems and programming tools make encodings even more unnecessary. So, AVOID ENCODINGS! Consider:

```
1  public class Part {
2    private String m_dsc; // The textual descriptio
3    void setName(String name) {
4      m_dsc = name;
5    }
6  }
```

The `m_` is useless clutter. Much better to write:

```
1  public class Part {
2    private String description;
3    void setDescription(String description) {
4      this.description = description;
5    }
6  }
```

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Clean Fuctions

Functions Should be Small and Do one Thing Only

How smallis small? A few lines, 5 or 10. "A screen-full" is no longer meaningful with large monitors and small fonts.

Some signs a function is doing too much:

- "Sections" within a function, often delimited by blank lines.
- Deeply nested logic.
- Many parameters.
  "If you have a procedure with ten parameters, you probably missed some." – Alan Perlis

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Writing Functions that Do One Thing

One level of abstraction per function.

- A function that implements a higher-level algorithm should call helper functions to execute the steps of the algorithm.

Write code using the stepdown rule.

- Code should read like a narrative from top to bottom.
- Read a higher level function to get the big picture, the functions below it to get the details.

Example of stepdown rule/newspaper metaphor:

```
1  private void createGui() {
2    add(createDataEntryPanel(), BorderLayout.NORTH);
3    add(createButtonPanel(), BorderLayout.SOUTH);
4    setJMenuBar(createMenuBar());
5  }
6  private JPanel createDataEntryPanel() { ... }
7  private JPanel createButtonPanel() { ... }
8  private JMenuBar createMenuBar() { ... }
```

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Function Parameters

Common one parameter forms

- Predicate functions: `boolean fileExists"("MyFile)`
- Transformations: `InputStream fileOpen"("MyFile)`
- Events: `void passwordAttemptFailedNtimes(int attempts)`

Higher numbers of function parameters are harder to get right. Even one argument functions can be problematic. Consider flag argumets:

Instead of

- `render(boolean isSuite)`, a call to which would look like `render(true)`,

write two methods, like

- `renderForSuite()` and `renderForSingleTest()`

Keep in mind that in OOP, every instance method call has an implicit argument: the object on which it is invoked.

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Minimizing the Number of Arguments

Use objects. Instead of

```
1 public void doSomethingWithEmployee(String name,
2                                     double pay,
3                                     Date hireDate)
```

Represent employee with a class:

```
1 public void doSomethingWith(Employee employee)
```

Use var-args for multiple parameters playing the same role:

```
1 public int max(int ... numbers)
2 public String format(String format, Object... args)
```

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Avoid Side Effects

What's wrong with this function?

```
1  public class UserValidator {
2    private Cryptographer cryptographer;
3    public boolean checkPassword(String userName, String password) {
4      User user = UserGateway.findByName(userName);
5      if (user != User.NULL) {
6        String codedPhrase = user.getPhraseEncodedByPassword();
7        String phrase = cryptographer.decrypt(codedPhrase, password);
8        if ("Valid Password".equals(phrase)) {
9          Session.initialize();
10         return true; }
11     }
12     return false; }
13 }
```

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Avoid Side Effects

What's wrong with this function?

```
1  public class UserValidator {
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4      User user = UserGateway.findByName(userName);
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7        String phrase = cryptographer.decrypt(codedPhrase, password);
8        if ("Valid Password".equals(phrase)) {
9          Session.initialize();
10         return true; }
11     }
12     return false; }
13 }
```

Has the side effect of initializing the session. Might erase an existing session, or might create temporal coupling: can only check password for user that doesn't have an existing session.

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Command Query Separation

Consider:

```
1 public boolean set(String attribute, String value);
```

We're setting values and querying . . . something, leading to very bad idioms like

```
1 if (set("username", "unclebob"))...
```

Better to separate commands from queries:

```
1 if (attributeExists("username")) {
2   setAttribute("username", "unclebob");
3   ...
4 }
```

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Prefer Exceptions to Error Codes

Error codes force mixing of error handling with main logic :

```
1  if (deletePage(page) == E_OK) {
2    if (registry.deleteReference(page.name) == E_OK) {
3      if (configKeys.deleteKey(page.name.makeKey()) == E_OK){
4        logger.log("page deleted");
5      } else {
6        logger.log("configKey not deleted");
7      }
8    } else {
9      logger.log("deleteReference from registry failed"); }
10 } else {
11   logger.log("delete failed"); return E_ERROR;
12 }
```

Let language features help you:

```
1  try {
2    deletePage(page);
3    registry.deleteReference(page.name);
4    configKeys.deleteKey(page.name.makeKey());
5  } catch (Exception e) {
6    logger.log(e.getMessage());
7  }
```

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Extract Try/Catch Blocks

You can make your code even clearer by extracting try/catch statements into functions of their own:

```
1  public void delete(Page page) {
2    try {
3      deletePageAndAllReferences(page); }
4    catch (Exception e) {
5      logError(e);
6    }
7  }
8  private void deletePageAndAllReferences(Page page) throws Exception {
9    deletePage(page);
10   registry.deleteReference(page.name);
11   configKeys.deleteKey(page.name.makeKey());
12 }
13 private void logError(Exception e) {
14   logger.log(e.getMessage());
15 }
```

Clean Comments

Comments are (usually) evil.

- Most comments are compensation for failures to express ideas in code.
- Comments become baggage when chunks of code move.
- Comments become stale when code changes.

Result: comments lie.

Comments don't make up for bad code. If you feel the need for a comment to explain some code, put effort into improving the code, not authoring comments for it.

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Good Names Can Obviate Comments

```
1 // Check to see if the employee is eligible for full benefits
2 if ((employee.flags & HOURLY_FLAG) && (employee.age > 65))
```

We're representing a business rule as a boolean expression and naming it in a comment. Use the language to express this idea:

```
1 if (employee.isEligibleForFullBenefits())
```

Now if the business rule changes, we know exactly where to change the code that represents it, and the code can be reused. (What does "reused" mean?)

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Clean Formatting

> *Code should be written for human beings to understand, and only incidentally for machines to execute. – Hal Abelson and Gerald Sussman, SICP*
>
> *The purpose of a computer program is to tell other people what you want the computer to do. – Donald Knuth*

The purpose of formatting is to facilitate communication. The formatting of code conveys information to the reader.

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Vertical Formatting

- Newspaper metaphor
- Vertical openness between concepts Vertical density
- Vertical distance
- Vertical ordering

Vertical Openness Between Concepts

Notice how vertical openness helps us locate concepts in the code more quickly.

```
1  package fitnesse.wikitext.widgets;
2
3  import java.util.regex.*;
4
5  public class BoldWidget extends ParentWidget {
6
7    public static final String REGEXP = "'''.+?";
8
9    private static final Pattern pattern = Pattern.compile("'''(.+?)'''",
10     Pattern.MULTILINE + Pattern.DOTALL
11   );
12
13   public BoldWidget(ParentWidget parent, String text) throws Exception {
14     super(parent);
15     Matcher match = pattern.matcher(text);
16     match.find();
17     addChildWidgets(match.group(1));
18   }
19 }
```

Vertical Openness Between Concepts

If we leave out the blank lines:

```
1  package fitnesse.wikitext.widgets;
2  import java.util.regex.*;
3  public class BoldWidget extends ParentWidget {
4    public static final String REGEXP = "'''.+?";
5    private static final Pattern pattern = Pattern.compile("'''(.+?)'''",
6      Pattern.MULTILINE + Pattern.DOTALL
7    );
8    public BoldWidget(ParentWidget parent, String text) throws Exception {
9      super(parent);
10     Matcher match = pattern.matcher(text);
11     match.find();
12     addChildWidgets(match.group(1));
13   }
14 }
```

- It's harder to distinguish the package statement, the beginning and end of the imports, and the class declaration.
- It's harder to locate where the instance variables end and methods begin.

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Vertical Density

Openness separates concepts. Density implies association. Consider:

```
1  public class ReporterConfig {
2    /** The class name of the reporter listener */
3    private String className;
4
5    /** The properties of the reporter listener */
6    private List<Property> properties = new ArrayList<Property>();
7
8    public void addProperty(Property property) {
9      properties.add(property);
10 }
```

The vertical openness (and bad comments) misleads the reader.
Better to use closeness to convey relatedness:

```
1  public class ReporterConfig {
2    private String className;
3    private List<Property> properties = new ArrayList<Property>();
4
5    public void addProperty(Property property) {
6      properties.add(property);
7    }
8  }
```

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Vertical Distance and Ordering

Concepts that are closely related should be vertically close to each other.

- Variables should be declared as close to their usage as possible.
- Instance variables should be declared at the top of the class.
- Dependent functions: callers should be above callees.

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Horizontal Openness and Density

- Keep lines short. Uncle Bob says 120, but he's wrong. Keep your lines at 80 characters or fewer if possible (sometimes it is impossible, but very rarely).
- Put spaces around $=$ to accentuate the distinction between the LHS and RHS.
- Don't put spaces between method names and parens, or parens and paramter lists - they're closely related, so should be close.
- Use spaces to accentuate operator precedence, e.g., no space between unary operators and their operands, space between binary operators and their operands.
- Don't try to horizontally align lists of assignments – it draws attention to the wrong thing and can be misleading, e.g., encouraging the reader to read down a column.
- Always indent scopes (classes, methods, blocks).

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Team Rules

- Every team should agree on a coding standard and everyone should adhere to it.
- Don't modify a file just to change the formatting, but if you are modifying it anyway, go ahead and fix the formatting of the code you modify.
- Code formatting standards tend to get religious. My rule: make your code look like the language inventor's code.
- If the language you're using has a code convention (like Java's), use it!

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