

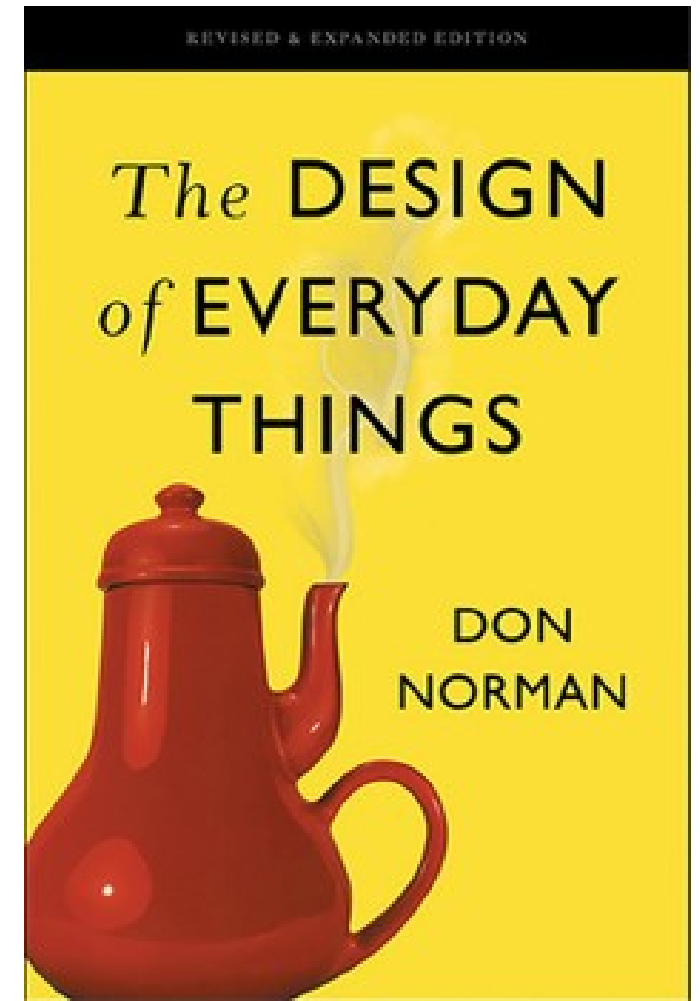
SWE 4743: Object-Oriented Design

Jeff Adkisson

Monday, Wednesday at 6:30 PM
Architecture, 175

“Good design is actually a lot harder to notice than poor design, in part because good designs fit our needs so well that the design is invisible.

Don Norman
*The Design of Everyday
Things*



PULL

No dogs
except guide dogs

PULL

Code makes
things work.
Design makes
things *last*.

Two identical features implemented:

- Version A: shipped fast, hard to change
- Version B: shipped thoughtfully, adapts for years

Most software cost is **not writing code**—it's *changing* it.

Design choices compound over time, for better or worse.

Good design lets *average developers* produce *excellent systems*.

Why do so many successful systems still get rewritten?

Month 1 - Works! We shipped so fast!
Vibe coding ROCKS!

Month 6 - Still okay, slightly difficult to maintain...

Year 2 - Pain, every "enhancement" breaks something, so buggy...

Year 5 — Rewrite discussion, so brittle nothing can be added, ugh...

Design debt doesn't hurt immediately—*that's why it's dangerous.*

- Early success often masks structural problems.
- OO design exists to manage **long-lived complexity**, not toy programs.

Design Is About Change, Not Features

Initial requirements don't kill systems -
changing requirements do.

Object oriented design techniques exist
to *localize change*.

Single responsibility, open-closed
principle, dependency inversion all
answer the same question:

“Where should this change go?”

Your most important reader is *future developers*, not the compiler.

- Code is **read far more** than it is written.
- Good design communicates intent, boundaries, and invariants.
- Classes and interfaces are *sentences*, not just containers.

Design is how you talk to
people you'll never meet.

--- or if you stick around long enough ---

Design is how *future you*
can avoid hating *past you*.

Good design
limits what you
can do...
on purpose!

- Encapsulation is about *preventing misuse*.
- Constraints reduce cognitive load.

Well-designed systems make
wrong code hard to write.

The Tragedy of “Just One More If”

- Most design failures start small and seem reasonable.

- **Today:**

- if (type == A) { ... }
- else if (type == B) { ... }
- else if (type == C) { ... }

- **Soon:**

- *18 more conditions, cases, tweaks, requirements, etc.*

- Design erosion happens incrementally.
- OO design provides *escape hatches* before conditionals explode.
- Patterns often emerge *after* pain—this course helps you see them earlier.

Design
distinguishes
programmers
from
software
engineers.

- Industry rewards people who can manage complexity.
- Design skill is what scales your impact.
- Languages and frameworks change—design principles do not.
- Compare:
 “Can you implement this?”
 “Can you evolve this safely?”

- Job title progression
 - Junior →
 - Senior →
 - Architect

Abstraction Is Choosing What Not to Care About

Without Abstraction

Every detail is visible everywhere



More things to think about



Harder to change safely

With Abstraction

Important ideas are *visible* and unimportant details are *hidden*



Fewer things to think about



Changes stay localized

ABSTRACTIO N

Korean War Veterans Memorial, 1995
Frank Gaylord
Washington, DC



ABSTRACTIO N

The Walking Man, 1960
Alberto Giacometti
Museum of Modern Art (MoMA), New York



ABSTRACTIO N

Unique Forms of Continuity in Space (1913)
Umberto Boccioni
Museum of Modern Art (MoMA), New York



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Fewer things to think about



Changes stay localized

What you
do not see
is the point

- Every abstraction hides or eliminates irrelevant information.
- In other words, good design discards the *right* details.
- Bad design discards the wrong ones—or none at all.

**Abstraction is
selective blindness.**

Abstraction Comparison: The Linux File System API

The Actual Linux API...

- `int fd = open("data.txt", O_RDONLY);`
- `read(fd, buffer, 4096);`
- `write(fd, buffer, 4096);`
- `close(fd);`

What it abstracts

- Persistent storage
- Sequential & random access
- Durability
- Naming (paths)

What it hides

- Disk blocks
- SSD vs HDD
- Caching
- Journaling
- RAID
- Network storage
- Failure recovery

Hypothetical Bad Abstraction

- `int disk = openDisk(0);`
- `int block = allocateBlock(disk);`
- `writeBlock(disk, block, buffer);`
- `flushCache(disk);`

What it exposes

- Block sizes
- Disk layout
- Caching policy
- Storage hardware
- Write ordering

What it forces

- Every program to manage storage details
- Widespread changes when hardware changes
- High cognitive load
- Fragile code

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**Good abstractions
let you reason about
what you want to
accomplish...
not *how* it is
achieved.**

“Any fool can write code that
a computer can understand.
Good programmers write
code that humans can
understand.”

Martin Fowler