

# Dealing with the Second Hardest Thing in Computer Science

Transforming Code Clarity Through  
Better Names

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Source code for these slides can be found [on GitHub](#).

# What you'll learn today

- Why naming impacts code quality and maintainability
- How naming improves software design and architecture
- Common naming pitfalls to avoid
- Practical strategies for clear, consistent, and meaningful names<sup>†</sup>
- Tools and techniques for better naming (AI, code review)



Transform naming from an afterthought into a deliberate practice.

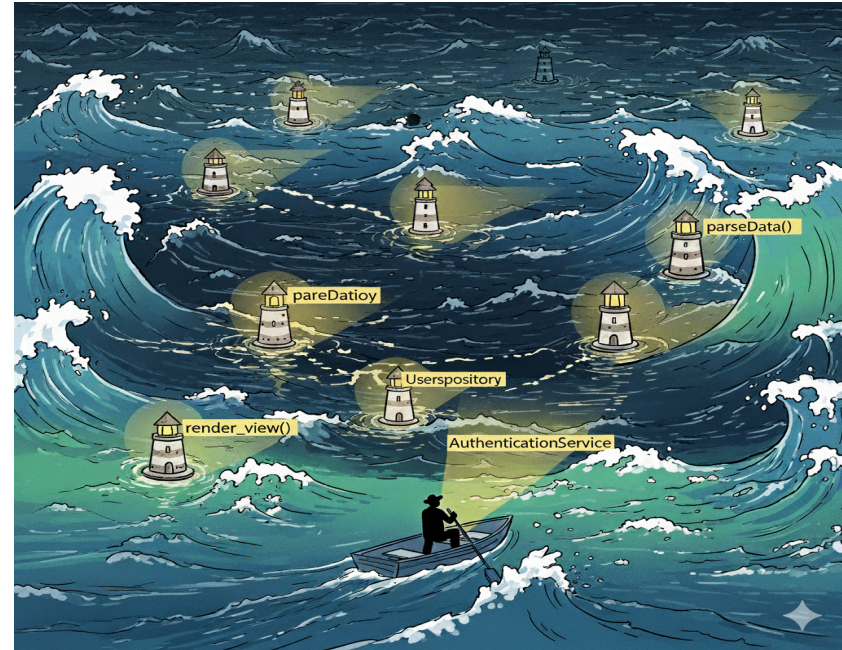
<sup>†</sup>Despite Python examples, all the mentioned strategies are **language-agnostic**.

**“There are only two hard things in Computer Science: cache invalidation and naming things.”**

- Phil Karlton

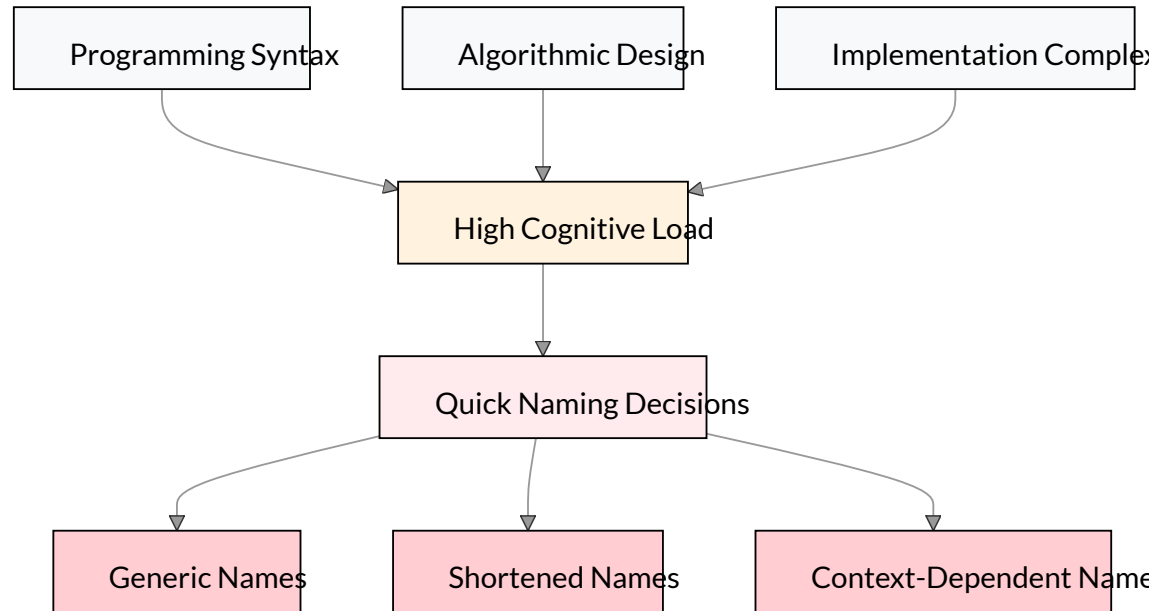
# Why naming matters

*Navigating the codebase with good names as beacons of clarity*



# Why naming is hard

Multiple cognitive demands exhaust mental capacity, leaving little for thoughtful naming.



**Result:** Naming becomes reactive rather than deliberate

# The hidden cost of poor naming

## Immediate consequences:

- Longer code reviews due to unclear intent
- Debugging becomes detective work
- Extensive onboarding needed for new team members

## Long-term impact:

- Technical debt accumulation from avoidance
- Higher bug introduction rates
- Risky refactoring due to uncertainty



### The multiplication effect

Poor naming spreads confusion throughout the entire system.

# Good names pay dividends

## Development velocity:

- †ode reviews focus on logic, not deciphering
- Faster component targeting during debugging
- †onfident feature development

## Maintenance benefits:

- Safe and predictable refactoring
- Root cause fixes over symptom patches
- Self-documenting code



### The investment mindset

Time spent on naming is not overhead—it's an investment that pays compound interest.

# Naming and good design

Illustrating benefits of thoughtful naming for software design using *function* as an example



# Following Unix philosophy

Unix Golden Rule: *“Do One Thing And Do It Well”*

Naming reveals if you’re following this rule.



## Doing multiple things

```
def extract_and_sort_estimates(model, sort="asc"):  
    # extract estimates  
    # sort table  
    pass
```



## Doing one thing each

```
def extract_estimates(model):  
    # extract estimates  
    pass  
  
def sort_estimates(table, sort="asc"):  
    # sort table  
    pass
```

**Warning:** Functions with `and` or `or` in names likely violate this principle!

# Function parameter names

**Parameter Naming Rule:** Boolean/flag parameters often signal functions doing multiple things

Parameter names can reveal design problems.



## Multiple behaviors

```
def convert_to_pdf(file, is_markdown=False):  
    if is_markdown:  
        # convert Markdown  
        pass  
    else:  
        # convert HTML  
        pass
```



## Single purpose each

```
def convert_md_to_pdf(file):  
    # convert Markdown  
    pass  
  
def convert_html_to_pdf(file):  
    # convert HTML  
    pass
```

**Insight:** If you need a flag parameter, consider splitting into separate functions

# Naming: The Do's and Don'ts

*“The beginning of wisdom is to call things by their proper name.” - Confucius*

# The Don'ts

You won't have to remember any of these rules if you follow the following principle:

**Names must be readable for the *reader*, not *author*, of code.**

Tip	Why	Bad	Good
<b>Confusion &amp; Similarity</b>			
Avoid imprecise opposites	Can be <b>confusing</b>	<code>begin/last</code>	<code>begin/end</code> or <code>first/last</code>
Don't use hard-to-distinguish characters	Look identical with certain fonts	<code>count0, counto</code>	<code>count_zero, count_letter</code>
Don't use similar names for different meanings	Easily confused, need 2+ letter difference	<code>PatientRecs, PatientReps</code>	<code>PatientRecords, PatientReports</code>
Avoid naming entities with homonyms	Leads to confusion in discussion	<code>waste, waist</code>	<code>garbage, body_circumference</code>
Don't use easily confused names	Too similar, mistaken identity	<code>nn, nnn</code>	<code>n_square, n_cube</code>
<b>Consistency &amp; Standards</b>			
Don't use inconsistent abbreviations	Choose one prefix and use consistently	<code>numColumns, noRows</code>	<code>numColumns, numRows</code>
Don't allow multiple English standards	Causes constant guessing	<code>centre, center</code> (mixed)	<code>center</code> (consistent)
Don't use misleading abbreviations	Conflicts with language conventions	<code>str</code> (for "structure")	<code>structure</code>
Avoid misleading names	Wrong info is worse than no info	<code>get_means()</code> (incorrectly implies precomputed)	<code>compute_means()</code> (correctly indicates computation)

Tip	Why	Bad	Good
<b>Communication &amp; Clarity</b>			
Don't use pop-culture references	Not everyone knows them	<code>thats_what_she_said</code>	<code>female_birdsong_recording</code>
Don't use slang	Can't assume familiarity	<code>hit_the_road()</code>	<code>exit()</code>
Avoid unintended meanings	Check <a href="#">Urban dictionary</a>	<code>dump()</code>	<code>export_data()</code>
Don't use uncommon English words	Stick to common parlance	<code>commence_process()</code>	<code>start_process()</code>
Don't use unpronounceable names	Enables easier verbal communication	<code>genymdhms()</code>	<code>generate_timestamp()</code>
<b>Technical &amp; Maintainability</b>			
Don't misspell to save characters	Correct misspelling is harder to remember	<code>hilite</code>	<code>highlight</code>
Don't use commonly misspelled words	Slows you down, increases errors	<code>accumulate</code> variants	<code>sum, collect</code>
Don't use numeric suffixes for levels	Not informative	<code>level1, level2, level3</code>	<code>beginner, intermediate, advanced</code>
Don't use unsearchable names	Hard to find and replace	<code>a, f</code>	<code>arr, fun</code>
Don't prioritize grammar over clarity	Plural forms aid comprehension	<code>fish</code> (for multiple)	<code>fishes, peoples, feedbacks</code>

# The Do's

You won't have to remember any of these rules if you follow the following principle:

**Good names reveal intention and eliminate guesswork.**

# Names should be self-documenting

How good a name is can be assessed by how detailed the accompanying comment needs to be.

Poor names require more comments:

```
# function to convert temperature  
# from Fahrenheit to Celsius scale  
# temp is the temperature in Fahrenheit  
def unit_converter(temp: float):  
    pass
```

Good names are self-documenting:

```
def fahrenheit_to_celsius(temp_fahrenheit: float):  
    pass
```



Tip

Good names rarely require readers to read the documentation to understand what they represent.



# Names should be specific

Generic names are widely used and acceptable in short-lived contexts. However, as scope and complexity increase, specific names become essential for clarity.

For longer loops, use meaningful names instead of `i`, `j`, `k`:

```
# abstruse
inventory[i][j]
```

```
# crystal clear
inventory[warehouse][product]
```

All variables are temporary in some sense. Calling one `tmp` is inviting carelessness.

```
# generic name
tmp = a + b
result = tmp * 2
```

```
# more descriptive
sum_values = a + b
result = sum_values * 2
```



Tip

Even when you *think* you need generic names, you are better off using more descriptive names.

## Test function names should act as a comment

Unlike regular functions, long names are less problematic for test functions because they are not visible to users or called repeatedly throughout the codebase.

```
# bad: test_retrieve_commands
# good: test_all_saved_commands_should_be_retrieved
```

# Names should be difficult to misinterpret

Try your best to misinterpret candidate names and see if you succeed.

```
1 # ambiguous - what kind of size?
2 def get_size(
3     file_path: str,
4 ) -> int:
5     pass
```

How I interpret:

*“File size in bytes on disk”*

```
1 # clear - character count!
2 def get_character_count(
3     file_path: str,
4 ) -> int:
5     pass
```

In reality:

*“Number of characters in the file content”*



Tip

Precise and unambiguous names leave little room for misconstrual.

# Names should be appropriately abstract

Find the right level of detail and domain focus—precise enough to be clear, concise enough to be readable, and focused on *what* rather than *how*.

## Use context to eliminate redundancy:

```
# redundant in context
Router.run_router()
BeerShelf.beer_count
```

```
# leverages context
Router.run()
BeerShelf.count
```

## Avoid encoding implementation details in names:

```
# implementation details encoded
binary_search_users()
sql_query_products()
bonuses_pd # pandas DataFrame
hash_map_cache
```

```
# implementation independent
find_user()
fetch_products()
bonuses
cache
```

## Find the precision sweet spot:

```
# too imprecise → okay → good → unnecessarily precise
d → days → days_since_last_accident → days_since_last_accident_floor_4_lab_23
```



Tip

Good names focus on purpose, include critical details, and remain meaningful across implementations.

# Names should maintain standards

Standards **reduce cognitive burden**: readers can reuse knowledge across contexts.

**Avoid conflicting meanings and maintain consistency:**

```
# inconsistent - size means different things
size = len(x.encode('utf-8')) # bytes
size = len(a)                 # elements

# inconsistent - different words, same concept
CreditCardAccount().retrieve_expenditure()
DebitCardAccount().fetch_expenditure()
```

```
# consistent - clear distinctions
byte_size = len(x.encode('utf-8'))
length = len(a)

# consistent - same word, same concept
CreditCardAccount().retrieve_expenditure()
DebitCardAccount().retrieve_expenditure()
```

**Follow language and domain conventions:**

```
# violates conventions
class playerEntity:
    self.HairColor = ""
```

```
# follows conventions
class PlayerEntity:
    self.hair_color = ""
```

**Use consistent prefixes for IDE tab completion:**

```
# bad - scattered when tab-completing
parse_json()
xml_reader()
csv_processor()
```

```
# good - groups related functions
parse_json()
parse_xml()
parse_csv()
```

Following a standard consistently is more important than *which* standard you adopt.

# Aside: Examples of Conventions

## Programming Language specific

Language	Variables	Functions	Classes	Constants
Scala	camelCase	camelCase	PascalCase	UPPER_SNAKE_CASE
Kotlin	camelCase	camelCase	PascalCase	UPPER_SNAKE_CASE
Rust	snake_case	snake_case	PascalCase	SCREAMING_SNAKE_CASE
Swift	camelCase	camelCase	PascalCase	camelCase
Elixir	snake_case	snake_case	PascalCase	@upper_snake_case

## Technology Stack specific

Layer	Convention	Examples
Database	snake_case	user_profiles, created_at
REST APIs	kebab-case/snake_case	/user-profiles, user_name
GraphQL	camelCase	userProfile, orderItems
CSS/HTML	kebab-case	.nav-menu, #main-content
DevOps	kebab-case	my-app-deployment
URLs/Routes	kebab-case	/api/user-accounts, /admin/user-settings
Event Names	camelCase/kebab-case	userSignedIn, order-completed

Consistency within each layer matters more than uniformity across layers

# Unnecessary details in names should be removed...

```
# okay
convert_to_string()
file_object
str_name # Hungarian notation
```

```
# better
to_string()
file
name
```

## Avoid redundancy

- In type names, avoid using *class*, *data*, *object*, and *type* (e.g. bad: `classShape`, good: `Shape`)
- In function names, avoid using *be*, *do*, *perform*, etc. (e.g. bad: `doAddition()`, good: `add()`)

# but important details should be kept!

```
# okay
child_height
password
id
address
```

```
# better
child_height_cm
plaintext_password
hex_id
ip_address
```

## Tip

If some information is critical to know, it should be part of the name.

# Boolean names should be clear

Names for Boolean variables or functions should make clear what true and false mean. This can be done using prefixes (**is**, **has**, **can**, etc.).

```
# not great
if child:
    if parent_supervision:
        watch_horror_movie = True
```

```
# better
if is_child:
    if has_parent_supervision:
        can_watch_horror_movie = True
```

In general, use positive terms for Booleans since they are easier to process.

```
# double negation - difficult
is_firewall_disabled = False
```

```
# better
is_firewall_enabled = True
```

However, if the variable is primarily used in its false state (e.g., `is_volcano_inactive`), the negative version can be easier to work with.



Tip

Boolean variable names should convey what true or false values represent.

# Choose domain-appropriate names

Select terminology that matches your context: computer science terms for technical concepts, problem domain terms for business logic.

## Use computer science terms for technical concepts:

```
# vague business language  
process_items_sequentially()  
store_thing_temporarily()
```

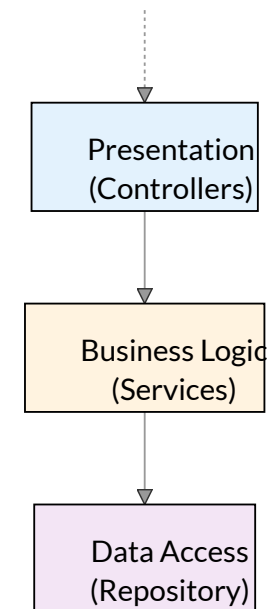
```
# precise CS terminology  
traverse_list()  
push_to_stack()
```

## Use problem domain terms for business concepts:

```
# generic technical terms  
validate_input_data()  
process_financial_records()
```

```
# domain-specific terms  
validate_loan_application()  
calculate_mortgage_payment()
```

Layered Architectur



Tip

Choose names that are meaningful to both developers and domain experts.



# Use appropriate grammatical forms

Follow consistent patterns: nouns for entities and data, verbs for actions.

**Classes and objects should use nouns:**

```
# verb-based - confusing
class ProcessPayment:
    pass

class HandleError:
    pass
```

```
# noun-based - clear
class PaymentProcessor:
    pass

class ErrorHandler:
    pass
```

**Methods that return values use nouns, action methods use verbs:**

```
# inconsistent grammar
user.get_name()      # returns name
user.save()          # performs action
user.validate_age()  # returns boolean
```

```
# consistent grammar
user.name()          # returns name
user.save()          # performs action
user.is_adult()      # returns boolean
```



Tip

**Grammatical consistency helps readers predict what methods do without reading documentation.**

# Utilizing tools

# Naming limitations of linters

## What they **CAN** do:

- Enforce naming conventions
- † heck for reserved keywords
- Detect naming pattern violations
- Flag overly short or long names
- Ensure consistent formatting

## What they **CANNOT** do:

- Understand the intent behind your code
- Suggest meaningful names based on context
- Assess whether names represent what entities do
- Determine problem domain consistency
- Evaluate clarity for future developers

### The fundamental limitation

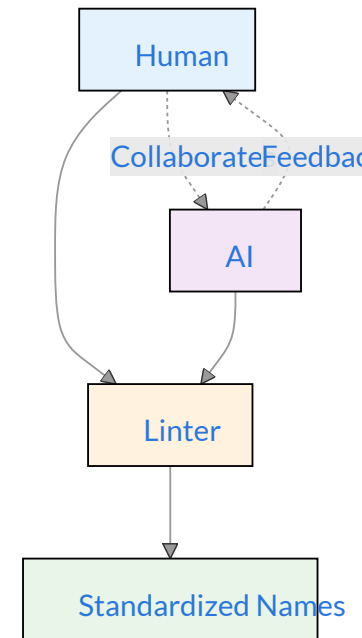
**Linters can enforce *syntax* but not *semantics*.** Good naming requires human understanding of both the problem and the solution.

# Generative AI tools can be valuable allies

AI tools have context of your entire codebase and can provide meaningful names.

## Why AI tools can help:

- Full context understanding of functions/classes
- Cross-domain pattern recognition
- Inconsistency detection across codebase
- Multiple naming suggestions with rationales

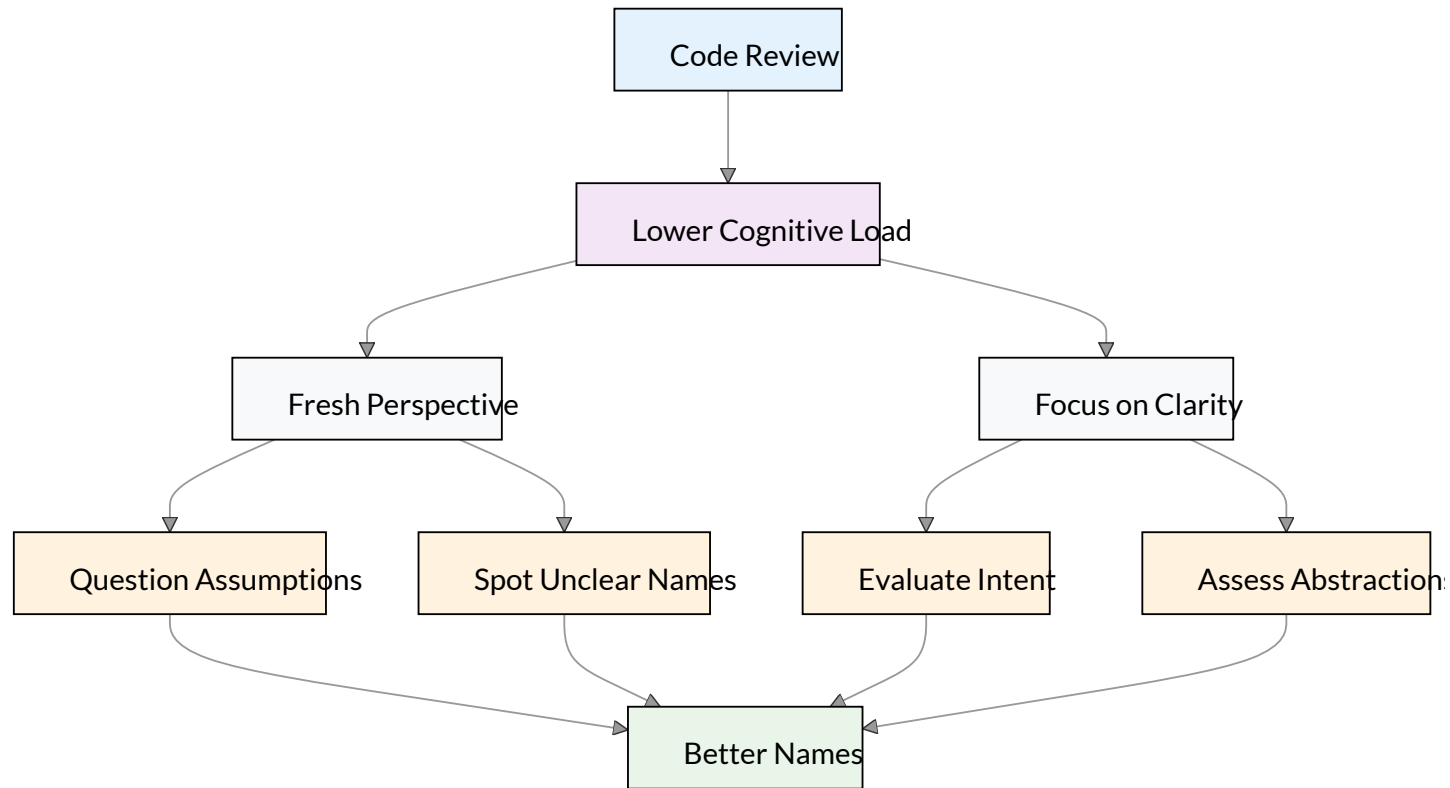


### Symbiotic Naming

Try to come up with good names yourself. Then, ask AI tools to validate, assess, or suggest improvements.

# Code Review: A fresh perspective

Lower cognitive load + fresh perspective = ideal conditions for better naming.



**Code review transforms naming from reactive to deliberate!**

# Benefits of good names

*“In your name I will hope, for your name is good.” - Psalms 52:9*

# *“What’s in a name?”* Well, everything!

- Intent-revealing names make the **code easier to read**.
- Trying to find good names forces you to detach from the problem-solving mindset and to **focus on the bigger picture** that motivates this change. This is critical for thoughtful software design.
- Searching for precise names requires clarity, and seeking such clarity **improves your own understanding** of the code.
- Naming precisely and consistently **reduces ambiguities and misunderstandings**, reducing the possibility of bugs.
- Good names **reduce the need for documentation**.
- Consistent naming **reduces cognitive overload** for the developers and makes the code more maintainable.

# Naming is hard, but worth it

Invest time in good names early—they pay dividends by reducing system complexity.

**The more you do it, the easier it will get!**

*“Using understandable names is a foundational step to producing quality software.” - Al Sweigart*




# Thank You

And Happy Naming! 😊

# TL;DR Summary

 **Principle:** Names are a form of abstraction

*“[T]he best names are those that focus attention on what is most important about the underlying entity, while omitting details that are less important.” - John Ousterhout*

 **Importance:** Names are at the core of software design

If you can't find a name that provides the right abstraction for the underlying entity, the design may be unclear.

 **Properties:** Good names are precise and consistent

If a name is good, it is difficult to miss out on critical information about the entity or to misunderstand what it represents.

# ICYMI: Available casing conventions

There are various casing conventions used for software development.

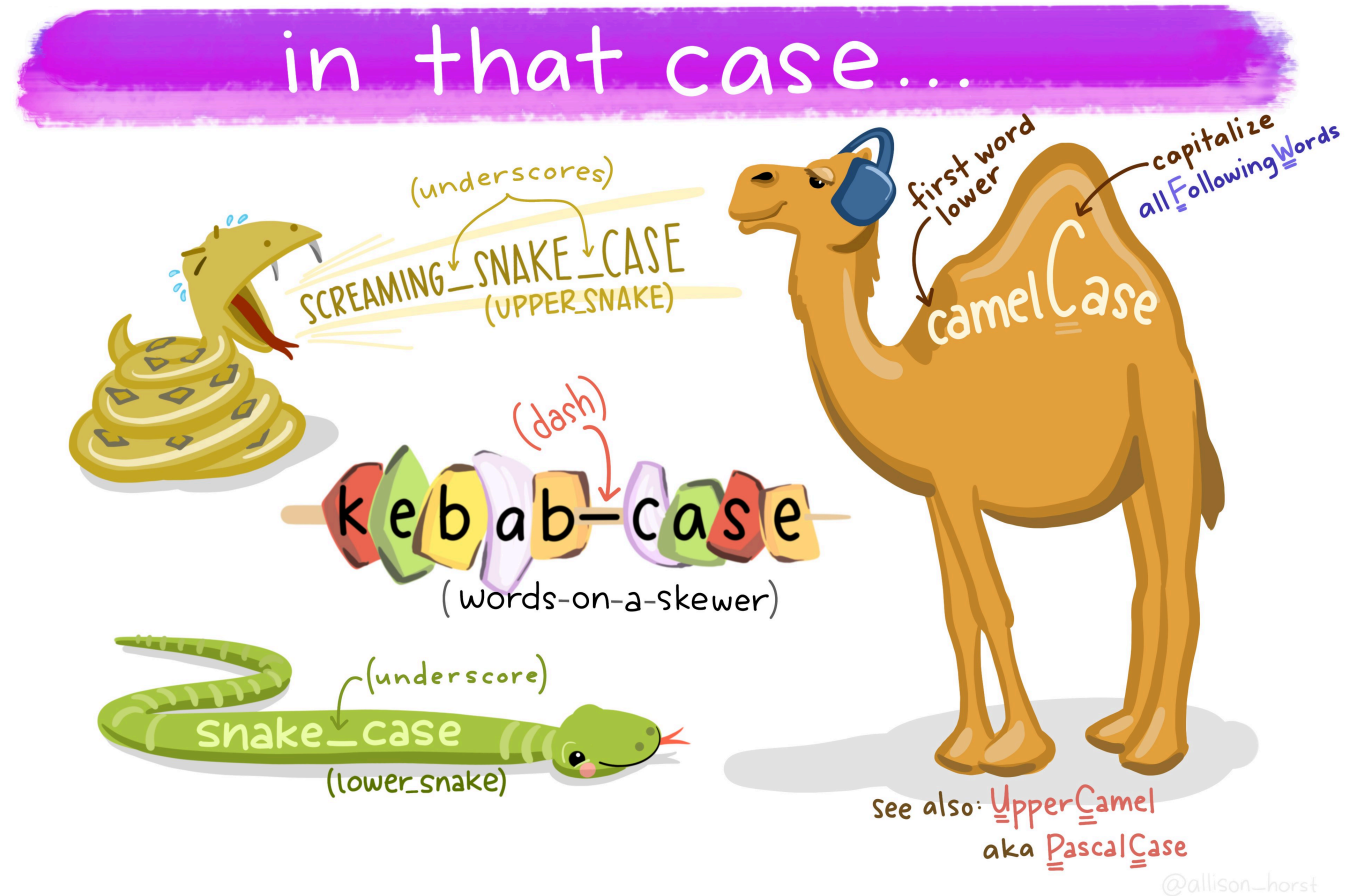


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# Further Reading

For a more detailed discussion about how to name things, see the following references.

# References

- McConnell, S. (2004). *Code Complete*. Microsoft Press. (pp. 259-290)
- Boswell, D., & Foucher, T. (2011). *The Art of Readable Code*. O'Reilly Media, Inc. (pp. 7-31)
- Martin, R. C. (2009). *Clean Code*. Pearson Education. (pp. 17-52)
- Hermans, F. (2021). *The Programmer's Brain*. Manning Publications. (pp. 127-146)
- Ousterhout, J. K. (2018). *A Philosophy of Software Design*. Palo Alto: Yaknyam Press. (pp. 121-129)
- Goodliffe, P. (2007). *Code Craft*. No Starch Press. (pp. 39-56)
- Padolsey, J. (2020). *Clean Code in JavaScript*. Packt Publishing. (pp. 93-111)
- Thomas, D., & Hunt, A. (2019). *The Pragmatic Programmer*. Addison-Wesley Professional. (pp. 238-242)
- [Ottinger's Rules for Variable and Class Naming](#)
- For a good example of organizational naming guidelines, see [Google C++ Style Guide](#).

# For more

If you are interested in good programming and software development practices, check out my other [slide decks](#).

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