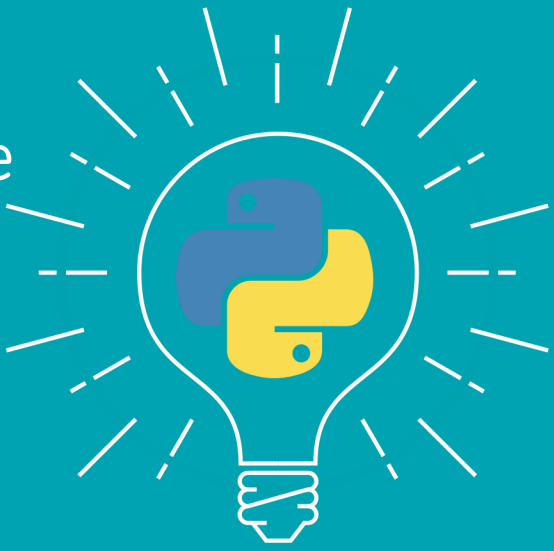
PYTHON TRICKS THE BOOK

A Buffet of Awesome Python Features



Dan Bader

Python Tricks: The Book

Dan Bader

What Pythonistas Say About *Python Tricks: The Book*

"I love love love the book. It's like having a seasoned tutor explaining, well, tricks! I'm learning Python on the job and I'm coming from powershell, which I learned on the job—so lots of new, great stuff. Whenever I get stuck in Python (usually with flask blueprints or I feel like my code could be more Pythonic) I post questions in our internal Python chat room.

I'm often amazed at some of the answers coworkers give me. Dict comprehensions, lambdas, and generators often pepper their feedback. I am always impressed and yet flabbergasted at how powerful Python is when you know these tricks and can implement them correctly.

Your book was exactly what I wanted to help get me from a bewildered powershell scripter to someone who knows how and when to use these Pythonic 'tricks' everyone has been talking about.

As someone who doesn't have my degree in CS it's nice to have the text to explain things that others might have learned when they were classically educated. I am really enjoying the book and am subscribed to the email as well, which is how I found out about the book."

— **Daniel Meyer**, Sr. Desktop Administrator at Tesla Inc.

"I first heard about your book from a co-worker who wanted to trick me with your example of how dictionaries are built. I was almost 100% sure about the reason why the end product was a much smaller/simpler dictionary but I must confess that I did not expect the outcome :)

He showed me the book via video conferencing and I sort of skimmed through it as he flipped the pages for me, and I was immediately curious to read more.

That same afternoon I purchased my own copy and proceeded to read your explanation for the way dictionaries are created in Python and later that day, as I met a different co-worker for coffee, I used the same trick on him :)

He then sprung a different question on the same principle, and because of the way you explained things in your book, I was able to *not* guess the result but correctly answer what the outcome would be. That means that you did a great job at explaining things :)

I am not new in Python and some of the concepts in some of the chapters are not new to me, but I must say that I do get something out of every chapter so far, so kudos for writing a very nice book and for doing a fantastic job at explaining concepts behind the tricks! I'm very much looking forward to the updates and I will certainly let my friends and co-workers know about your book."

— **Og Maciel**, Python Developer at Red Hat

"I really enjoyed reading Dan's book. He explains important Python aspects with clear examples (using two twin cats to explain `is` vs `==` for example).

It is not just code samples, it discusses relevant implementation details comprehensibly. What really matters though is that this book makes you write better Python code!

The book is actually responsible for recent new good Python habits I picked up, for example: using custom exceptions and ABC's (I found Dan's blog searching for abstract classes.) These new learnings alone are worth the price."

— **Bob Belderbos**, Engineer at Oracle & Co-Founder of PyBites

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Chapter 1

Introduction

1.1 What's a Python Trick?

> **Python Trick**: *A short Python code snippet meant as a teaching tool. A Python Trick either teaches an aspect of Python with a simple illustration, or it serves as a motivating example, enabling you to dig deeper and develop an intuitive understanding.*

Python Tricks started out as a short series of code screenshots that I shared on Twitter for a week. To my surprise, they got rave responses and were shared and retweeted for days on end.

More and more developers started asking me for a way to "get the whole series." Actually, I only had a few of these tricks lined up, spanning a variety of Python-related topics. There wasn't a master plan behind them. They were just a fun little Twitter experiment.

But from these inquiries I got the sense that my short-and-sweet code examples would be worth exploring as a teaching tool. Eventually I set out to create a few more Python Tricks and shared them in an

email series. Within a few days, several hundred Python developers had signed up and I was just blown away by that response.

Over the following days and weeks, a steady stream of Python developers reached out to me. They thanked me for making a part of the language they were struggling to understand *click* for them. Hearing this feedback felt awesome. I thought these Python Tricks were just code screenshots, but some people were getting a lot of value out of them.

That's when I decided to double down on my Python Tricks experiment and expanded it into a series of around 30 emails. Each of these was still just a a headline and a code screenshot, and I soon realized the limits of that format. Around this time, a blind Python developer emailed me, disappointed to find that these Python Tricks were delivered as images he couldn't read with his screen reader.

Clearly, I needed to invest more time into this project to make it more appealing and more accessible to a wider audience. So, I sat down to re-create the whole series of Python Tricks emails in plain text and with proper HTML-based syntax highlighting. That new iteration of Python Tricks chugged along nicely for a while. Based on the responses I got, developers seemed happy they could finally copy and paste the code samples in order to play around with them.

As more and more developers signed up for the email series, I started noticing a pattern in the replies and questions I received. Some Tricks worked well as motivational examples by themselves. However, for the more complex ones there was no narrator to guide readers or to give them additional resources to develop a deeper understanding.

Let's just say this was another big area of improvement. My mission statement for dbader.org is to *help Python developers become more awesome*—and this was clearly an opportunity to get closer to that

goal.

I decided to take the best and most valuable Python Tricks from the email course, and I started writing a new kind of Python book around them:

- A book that teaches the coolest aspects of the language with short and easy-to-digest examples.
- A book that works like a buffet of awesome Python features (yum!) and keeps motivation levels high.
- A book that takes you by the hand to guide you and help you deepen your understanding of Python.

This book is really a labor of love for me and also a huge experiment. I hope you'll enjoy reading it and learn something about Python in the process!

— Dan Bader

1.2 What This Book Will Do for You

My goal for this book is to make you a better—more effective, more knowledgeable, more practical—Python developer. You might be wondering, *How will reading this book help me achieve all that?*

Python Tricks is not a step-by-step Python tutorial. It is not an entry-level Python course. If you're in the beginning stages of learning Python, the book alone won't transform you into a professional Python developer. Reading it will still be beneficial to you, but you need to make sure you're working with some other resources to build up your foundational Python skills.

You'll get the most out of this book if you already have some knowledge of Python, and you want to get to the next level. It will work

great for you if you've been coding Python for a while and you're ready to go deeper, to round out your knowledge, and to make your code more Pythonic.

Reading *Python Tricks* will also be great for you if you already have experience with other programming languages and you're looking to get up to speed with Python. You'll discover a ton of practical tips and design patterns that'll make you a more effective and skilled Python coder.

1.3 How to Read This Book

The best way to read *Python Tricks: The Book* is to treat it like a buffet of awesome Python features. Each Python Trick in the book is self-contained, so it's completely okay to jump straight to the ones that look the most interesting. In fact, I would encourage you to do just that.

Of course, you can also read through all the Python Tricks in the order they're laid out in the book. That way you won't miss any of them, and you'll know you've seen it all when you arrive at the final page.

Some of these tricks will be easy to understand right away, and you'll have no trouble incorporating them into your day to day work just by reading the chapter. Other tricks might require a bit more time to crack.

If you're having trouble making a particular trick work in your own programs, it helps to play through each of the code examples in a Python interpreter session.

If that doesn't make things click, then please feel free to reach out to me, so I can help you out and improve the explanation in this book. In the long run, that benefits not just you but all Pythonistas reading this book.

Chapter 2

Sample Chapters

2.1 Object Comparisons: “is” vs “==”

When I was a kid, our neighbors had two twin cats. They looked seemingly identical—the same charcoal fur and the same piercing green eyes. Some personality quirks aside, you couldn’t tell them apart just from looking at them. But of course, they were two different cats, two separate beings, even though they looked exactly the same.

That brings me to the difference in meaning between *equal* and *identical*. And this difference is crucial to understanding how Python’s `is` and == comparison operators behave.

The == operator compares by checking for *equality*: if these cats were Python objects and we compared them with the == operator, we’d get “both cats are equal” as an answer.

The `is` operator, however, compares *identities*: if we compared our cats with the `is` operator, we’d get “these are two different cats” as an answer.

But before I get all tangled up in this ball of twine made of a cat analogies, let’s take a look at some real Python code.

First, we’ll create a new list object and name it `a`, and then define another variable `b` that points to the same list object:

```
>>> a = [1, 2, 3]
>>> b = a
```

Let’s inspect these two variables. We can see that they point to identical-looking lists:

```
>>> a
[1, 2, 3]
```

```
>>> b
[1, 2, 3]
```

Because the two list objects look the same, we'll get the expected result when we compare them for equality using the == operator:

```
>>> a == b
True
```

However, that doesn't tell us whether `a` and `b` are actually pointing to the same object. Of course, we know they do because we assigned them earlier, but suppose we didn't know—how might we find out?

The answer is to compare both variables with the `is` operator. This confirms that both variables are in fact pointing to one list object:

```
>>> a is b
True
```

Let's see what happens when we create an identical copy of our list object. We can do that by calling `list()` on the existing list to create a copy we'll name `c`:

```
>>> c = list(a)
```

Again you'll see that the new list we just created looks identical to the list object pointed to by `a` and `b`:

```
>>> c
[1, 2, 3]
```

Now this is where it gets interesting. Let's compare our list copy `c` with the initial list `a` using the == operator. What answer do you expect to see?

```
>>> a == c
True
```

Okay, I hope this was what you expected. What this result tells us is that `c` and `a` have the same contents. They're considered equal by Python. But are they actually pointing to the same object? Let's find out with the `is` operator:

```
>>> a is c
False
```

Boom—this is where we get a different result. Python is telling us that `c` and `a` are pointing to two different objects, even though their contents might be the same.

So, to recap, let's try and break down the difference between `is` and == into two short definitions:

- An `is` expression evaluates to `True` if two variables point to the same (identical) object.
- An == expression evaluates to `True` if the objects referred to by the variables are equal (have the same contents).

Just remember to think of twin cats (dogs should work, too) whenever you need to decide between using `is` and == in Python. If you do that, you'll be fine.

2.2 Complacent Comma Placement

Here's a handy tip for when you're adding and removing items from a list, dict, or set constant in Python: Just end all of your lines with a comma.

Not sure what I'm talking about? Let me give you a quick example. Imagine you've got this list of names in your code:

```
>>> names = ['Alice', 'Bob', 'Dilbert']
```

Whenever you make a change to this list of names, it'll be hard to tell what was modified by looking at a Git diff, for example. Most source control systems are line-based and have a hard time highlighting multiple changes to one line.

A quick fix for that is to adopt a code style where you spread out list, dict, or set constants across multiple lines, like so:

```
>>> names = [
...     'Alice',
...     'Bob',
...     'Dilbert'
... ]
```

That way there's one item per line, making it perfectly clear which one was added, removed, or modified when you view a diff in your source control system. It's a small change but it can help you avoid silly mistakes and speed up code reviews.

Now, there's two editing cases that can still cause some confusion. Whenever you add a new item at the end or remove the last item, you'll have to update the comma placement manually to get consistent formatting.

Let's say you'd like to add another name (*Jane*) to that list. If you add *Jane*, you'll need to fix the comma placement after the *Dilbert* line to avoid a nasty error:

```
>>> names = [
...     'Alice',
...     'Bob',
...     'Dilbert' # <- Missing comma!
...     'Jane'
]
```

When you inspect the contents of that list, brace yourself for a surprise:

```
>>> names
['Alice', 'Bob', 'DilbertJane']
```

As you can see, Python *merged* the strings *Dilbert* and *Jane* into the *DilbertJane*. This is intentional and documented behavior, but it's also a fantastic way to shoot yourself in the foot by introducing hard-to-catch bugs into your programs:

> "Multiple adjacent string or bytes literals (delimited by whitespace), possibly using different quoting conventions, are allowed, and their meaning is the same as their concatenation." [1]

Literal string concatenation is a useful feature in some cases. For example, you can use it to reduce the number of backslashes needed and to split long strings across lines. On the other hand, we've just

[1] cf. Python Docs: "String literal concatenation"

experienced how it can quickly turn into a liability. Now, how do we fix this situation?

Adding the missing comma after *Dilbert* prevents the two strings from getting merged, but it also makes it harder to see what was modified in the Git diff again... Did someone add a new name? Did someone change Dilbert's name? We've just come full circle and returned to the original problem.

Luckily, Python's syntax allows for some leeway to solve this comma placement issue once and for all. You just need to train yourself to adopt a code style that avoids it. Let me show you how.

Python allows you to end every line (including the last line) in a list, dict, or set constant with a comma. That way, you can just remember to always end your items with a comma and thus avoid the comma placement fixes that would otherwise be required.

Here's what the final example would look like:

```
>>> names = [
...     'Alice',
...     'Bob',
...     'Dilbert',
... ]
```

Did you spot the comma after *Dilbert*? That'll make it easy to add or remove new items without having to update the comma placement. It keeps your lines consistent, your source control diffs clean, and your code reviewers happy. Hey, sometimes the magic is in the little things, right?

Key Takeaways

- Smart formatting and comma placement can make your list, dict, or set constants easier to maintain.

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