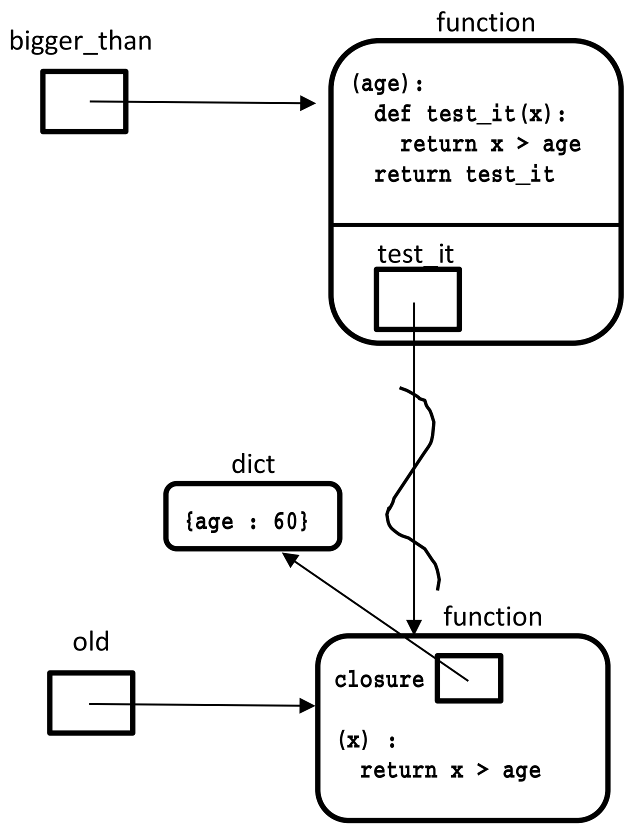
Picturing a Function returning a Function



```
def bigger_than ...
old = bigger_than(60)
print(old(65))
```

First, **bigger_than** is defined, which binds that name to a function object (with nothing yet filled in below the line: this function has been definted but hasn't been called yet).

Second, **bigger_than** is called with the argument **60**: it first binds **age** to **60** and then defines the local function **test_it**: which binds its name to a new function object (this binding is shown below the line in **bigger_than**).

Notice that the new function object test_it stores a **closure**: it refers to a **dict** with the name **age** bound to **60**, the only binding from the enclosing **bigger_than** function.

Then, **bigger_than** returns a reference to **test_it**'s function object, which is bound to the variable name **old** in the second assignment statement.

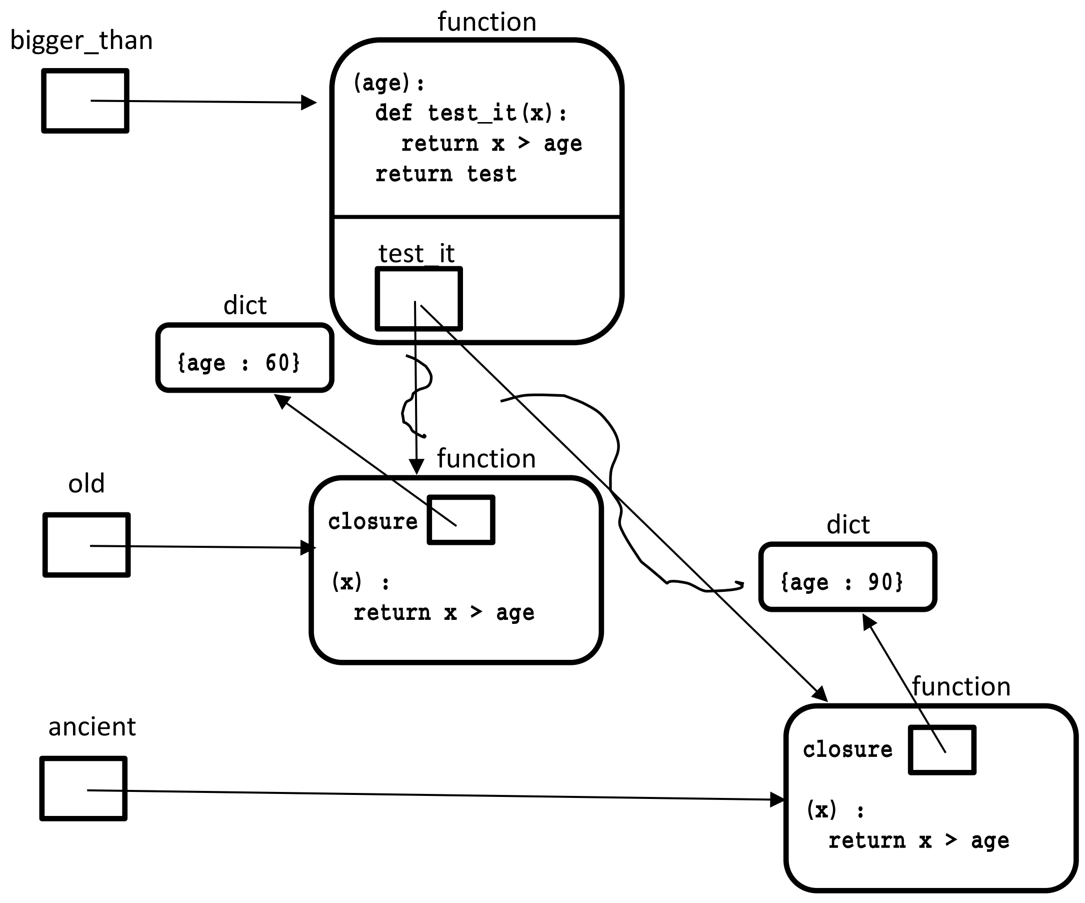
Finally, the call to **bigger_than** disappears (i.e., the information below the line disappears), but the name **old** remains bound to the function object originally bound to **test_it** from when **bigger_than** executed.

Third, **old** is called with the argument **65**. It binds **x** to **65** and then evaluates **x > age** (with **x** bound to the argument **65** and **age** bound to **60**, from the closure). This expression evaluates to **True**, which is printed.

Picturing a Function returning a Function (continued: 2 calls)

```
def bigger_than ...
old     = bigger_than(60)
ancient = bigger_than(90)
print(old(65),ancient(65))
```

Here is the result of calling **bigger_than** twice. Each call creates and returns a new function object with its own closure. The function object returned from the first call is bound to the name **old**, the function object returned from the second call is bound to the name **ancient**. In **print**, the first function call returns **True** and the second returns **False**.



An Example from the Notes

```
def f():
    prev = None

    def g1(x):
        nonlocal prev
        temp = prev
        prev = x+5
        return temp
    def g2(x):
        nonlocal prev
        temp = prev
        prev = 5*x
        return temp
    return g1,g2

f1,f2 = f()
f3,f4 = f()
print(f1(1))
print(f2(2))
print(f3(5))
print(f4(6))
```

When `f()` is called the **first** time, it returns references to the new `g1` and `g2` function objects created when `f` executes; these are bound to `f1` and `f2`. The enclosing scope of both of these function objects stores the name **`prev`** -local in the call to `f`- and its initial value is captured in the shared closure.

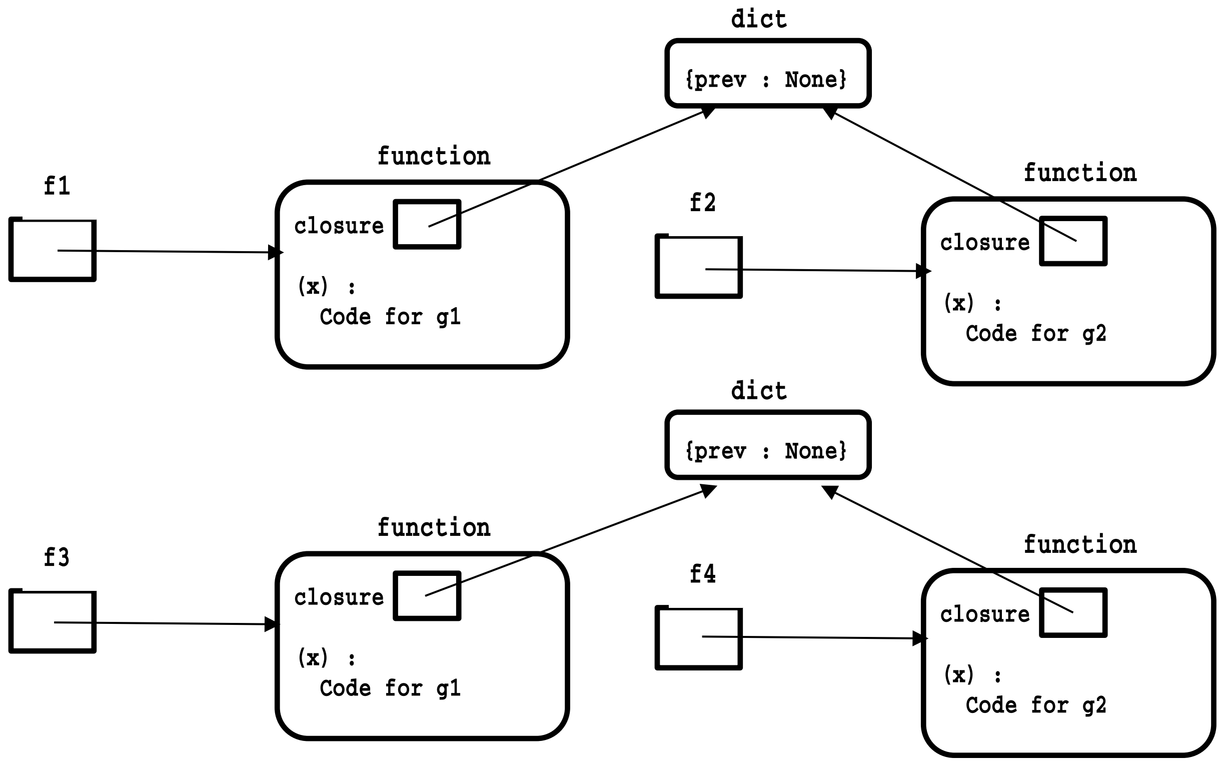
When `f()` is called the **second** time, it again returns references to the new `g1` and `g2` function objects created when `f` executes (new function objects declared in `f`); these in turn are bound to `f3` and `f4`. The enclosing scope of both of these function objects stores the name **`prev`** -local in the new call to `f`- and its initial value is captured in the shared closure.

Calling `f1(1)` stores into **`temp`** the value of **`prev`** in its function object's closure (`None`), reassociates **`prev`** with `6`, and returns `None`, which it prints in the console.

Calling `f2(2)` stores into **`temp`** the value of **`prev`** in its function object's closure (the one shared with `f1`, now `6`), reassociates that **`prev`** with `10`, and returns `6`, which it prints in the console.

Calling `f3(5)` stores into **`temp`** the value of **`prev`** in its function object's closure (`None`), reassociates that **`prev`** with `10`, and returns `None`, which it prints in the console.

Calling `f4(6)` stores into **`temp`** the value of **`prev`** in its function object's closure (the one shared with `f1`, now `10`), resets that **`prev`** to `30`, and returns `10`, which it prints in the console.


dict
{prev : None}
f1
function
closure
(x) :
Code for g1
f2
function
closure
(x) :
Code for g2
dict
{prev : None}
f3
function
closure
(x) :
Code for g1
f4
function
closure
(x) :
Code for g2