# Why and how to use generators for asynchronous programming

BEDROCK

Benoit Viguier

@b_viguier

ConFoo.CA
DEVELOPER CONFERENCE

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Misconception

Viguier
_viguier

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# Why and how to use generators for asynchronous programming

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@b_viguier

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London
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Warsaw
POLAND
BELAR
Celtic Sea
English Channel
Brussels
BELGIUM
LUX.
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Paris
Prague
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SLOVAKIA
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ROMANIA
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Lyon, France

BEDROCK

BR
BEDROCK
EXIT
BACK/
RETURN
MEDIA
GUIDE
TIMER
TEXT
Panasonic
TV

M6
GROUPE
RTL
GROUP

## PRODUCTION ET ACQUISITIONS DE CONTENUS

### TÉLÉVISION

- STUDIO 89 PRODUCTIONS
- C-PRODUCTIONS

### DIGITAL

- GOLDEN NETWORK

### CINÉMA

- SND – GROUPE M6
- M6 STUDIO
- M6 FILMS
- SNC – GROUPE M6

## MÉDIAS

### TÉLÉVISION EN CLAIR

- M6
- W9
- 6ter
- gulli

### TÉLÉVISION PAYANTE

- PARIS PREMIÈRE
- téva
- serieclub
- M6 Music
- Tiji
- canal J
- MCM TOP
- MCM
- RFM TV

### TÉLÉVISION INTERNATIONALE

- gulli GIRL
- gulli بالعربي
- gulli AFRICA
- Tiji RUSSIA

### RADIO

- RTL
- RTL2 – LE SON POP-ROCK
- fun radio – LE SON DANCEFLOOR

### DIGITAL

- gulli Replay
- 6play
- gulli MAX

## DIVERSIFICATIONS

- M6 INTERACTIONS
- M6 ÉDITIONS
- M6 ÉVÉNEMENTS
- M6 MUSIC LABEL
- gulli Parc
- Ventadis – Vente à distance - Groupe M6
- M6 boutique
- BEST of TV
- Leonis Corner
- JOIKKA
- M6 CRÉATIONS
- M6 DIGITAL SERVICES
- Radins.com
- iGraal
- odiso
- mindbaz – your emailing service
- MINDTARGET
- TURBO
- M6météo
- passeport santé
- Fourchette & Bikini
- cuisineaz
- CROQ'KILOS
- Comptoir Botanique
- déco.fr
- Panorabanques.com

## RÉGIE

- CTZAR {za:(r)}
- M6 PUBLICITÉ
- UNLIMITED

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6play › M6 W9 6ter funradio etc.

RTL play À VOUS DE VOIR › RTL TVI club RTL PLUG RTL etc.

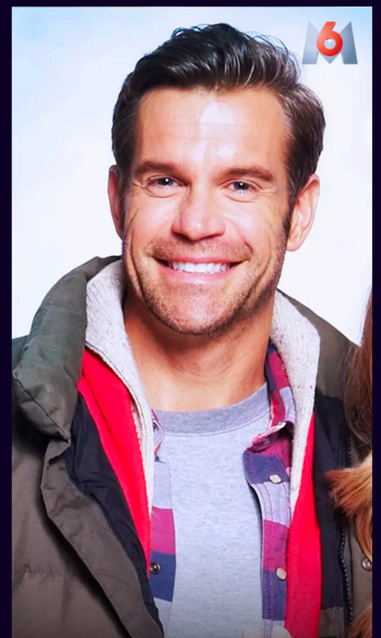
RTL most › RTL KLUB RTL etc.

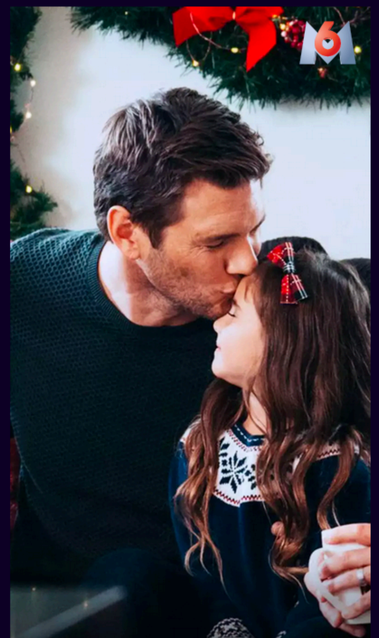
RTL PLAY › RTL 2 RTL Kockica DIGITAL CHAPTERS etc.

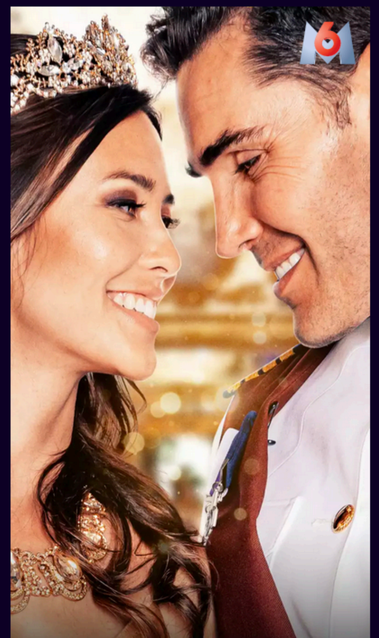
10 Million unique
users per month

# Programmes par genre

# Le Groupe M6 vous souhaite une bonne année !







# One year of asynchronous PHP in production

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**Tomorrow**, 13:00

# Asynchronous Programming

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# Tea for Two

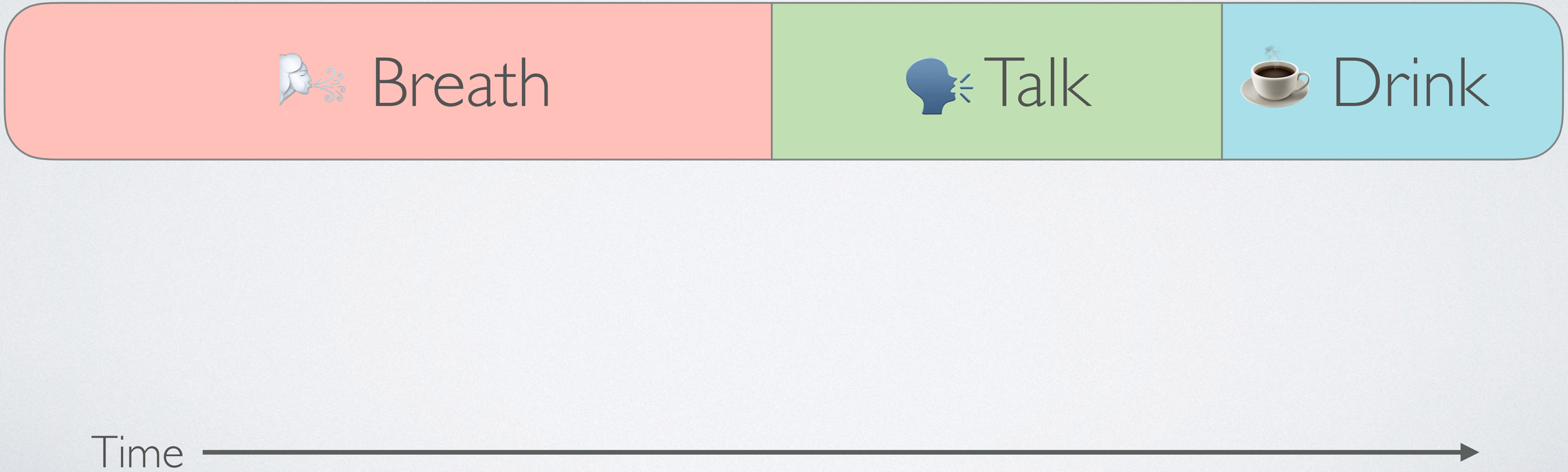
An illustrated example

# Tasks

- ☕ **Drink** Tea
- 🗣️ **Talk** with a friend
- 🌬️ **Breath** just… to live

Tea parlor ? Cafe
Talk/Catch up

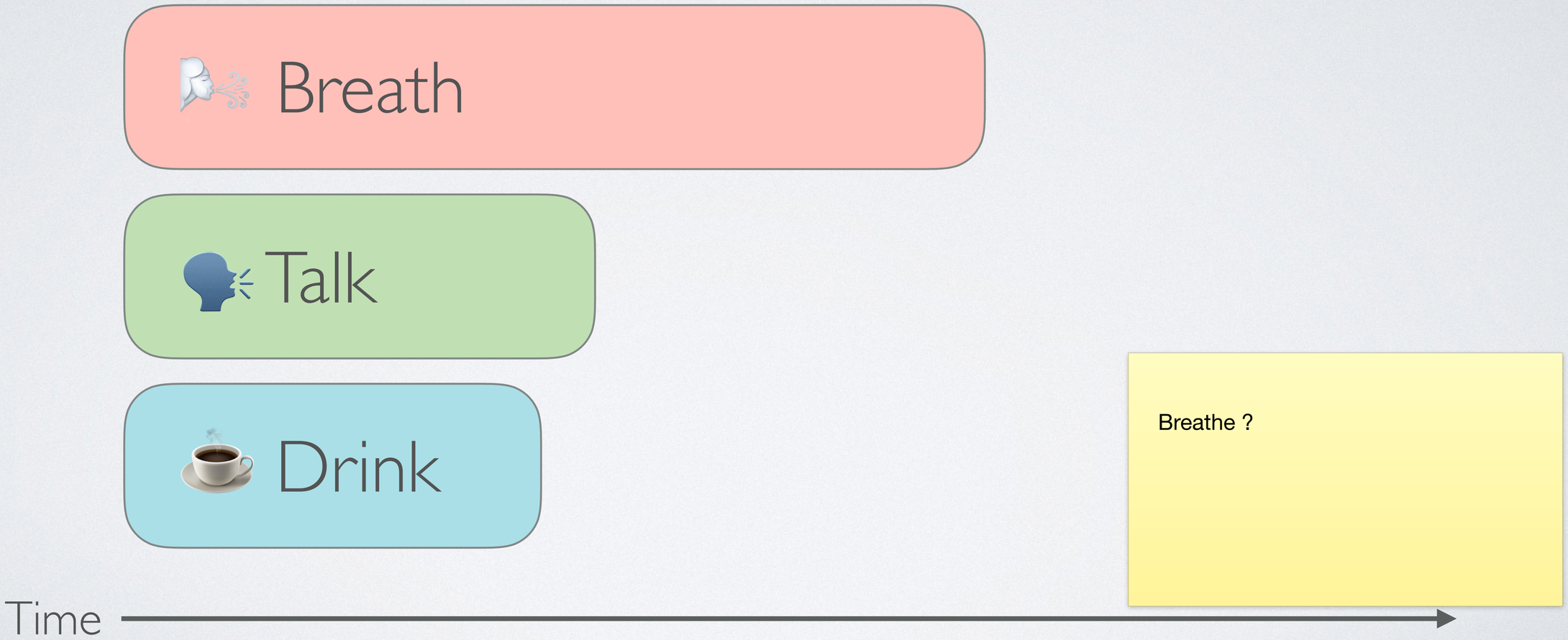
# Synchronous



# Concurrency

Starting next task before the current one ends

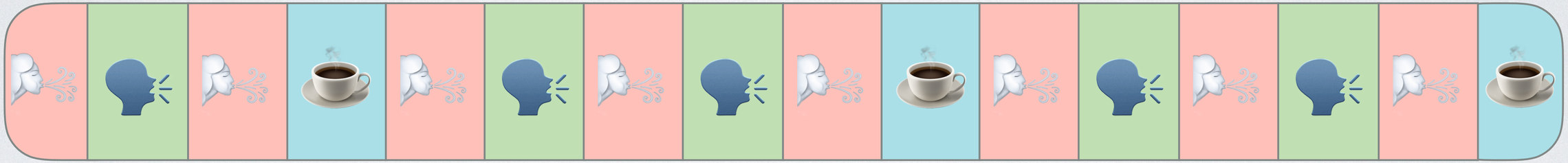
# Parallel



# Most languages are single threaded

… by default

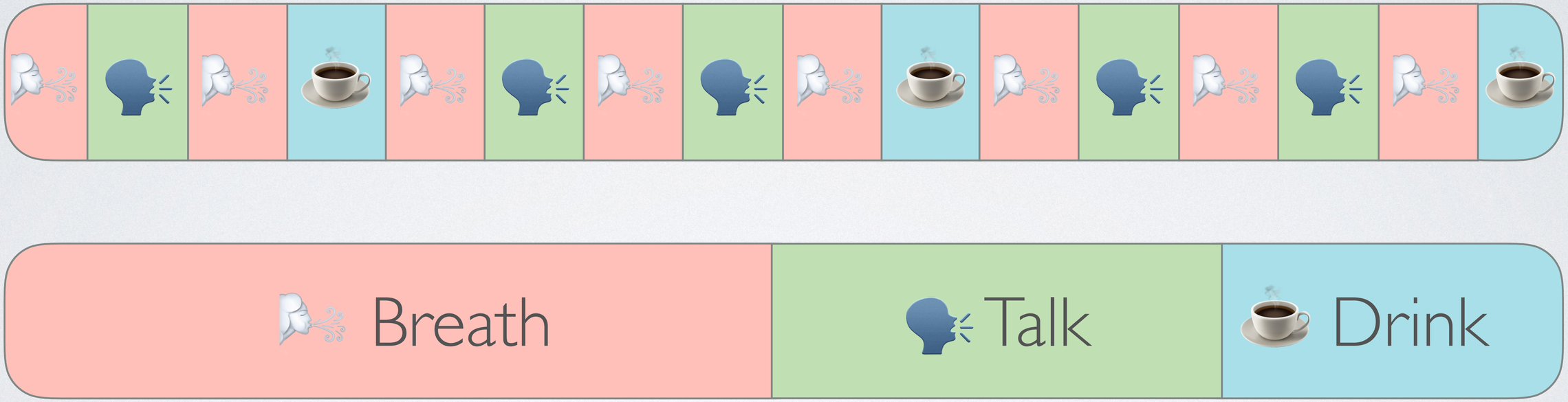
# Asynchronous



Time

Serials tasks (vs parallel)

# But… 🤔




Time →

Discuss / Talk

# Analyzing tasks

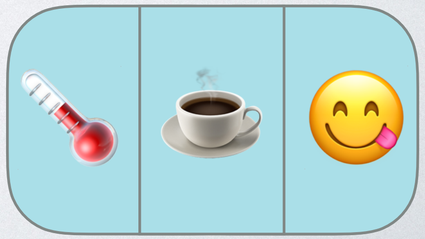
*Internal/External* operations

# **Drinking** Tea

Waiting for the right temperature

Drinking (actually)

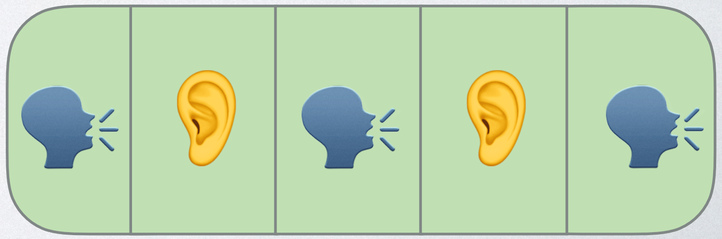
Enjoying



# **Talking** with a friend

Speaking, asking something

Listening

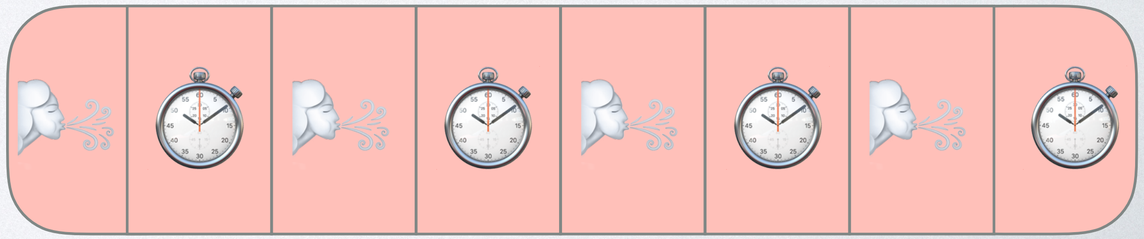


# Breathing

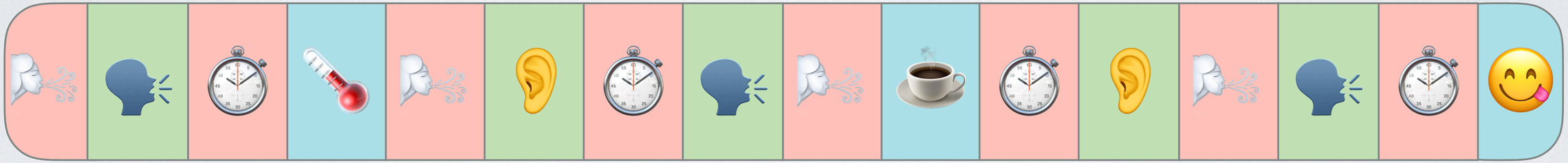
Breathing…

Waiting (a little)

Breathing…

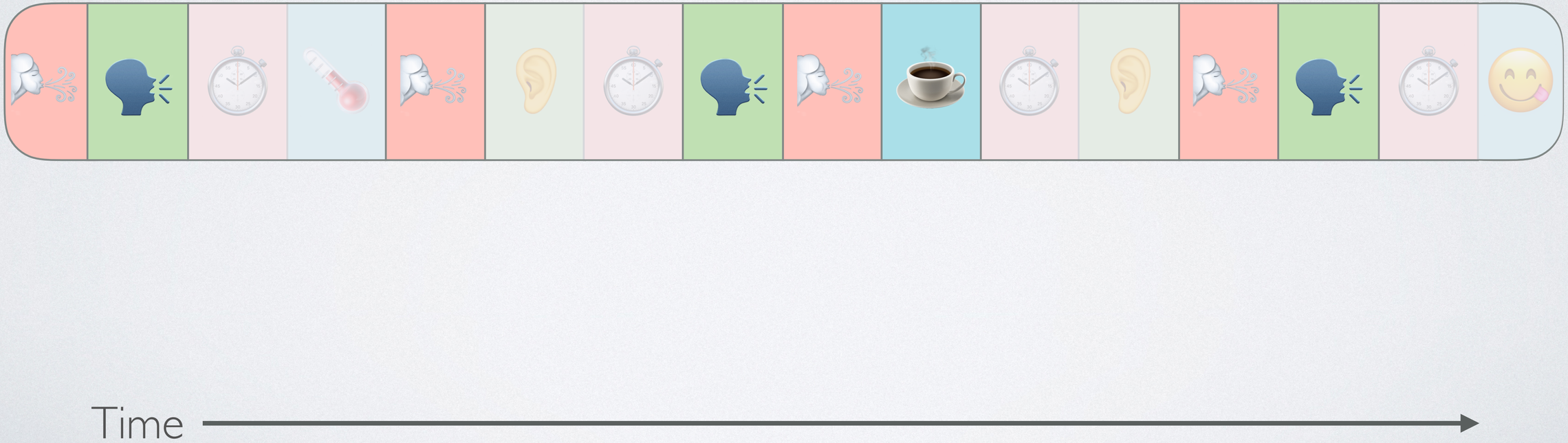


# Asynchronous

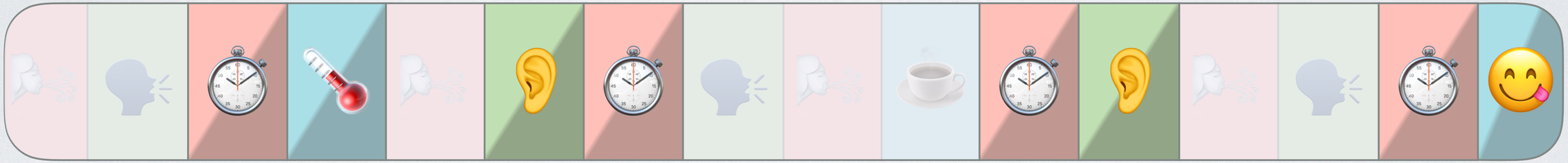


Time

# *Internal* operations



# *External* operations



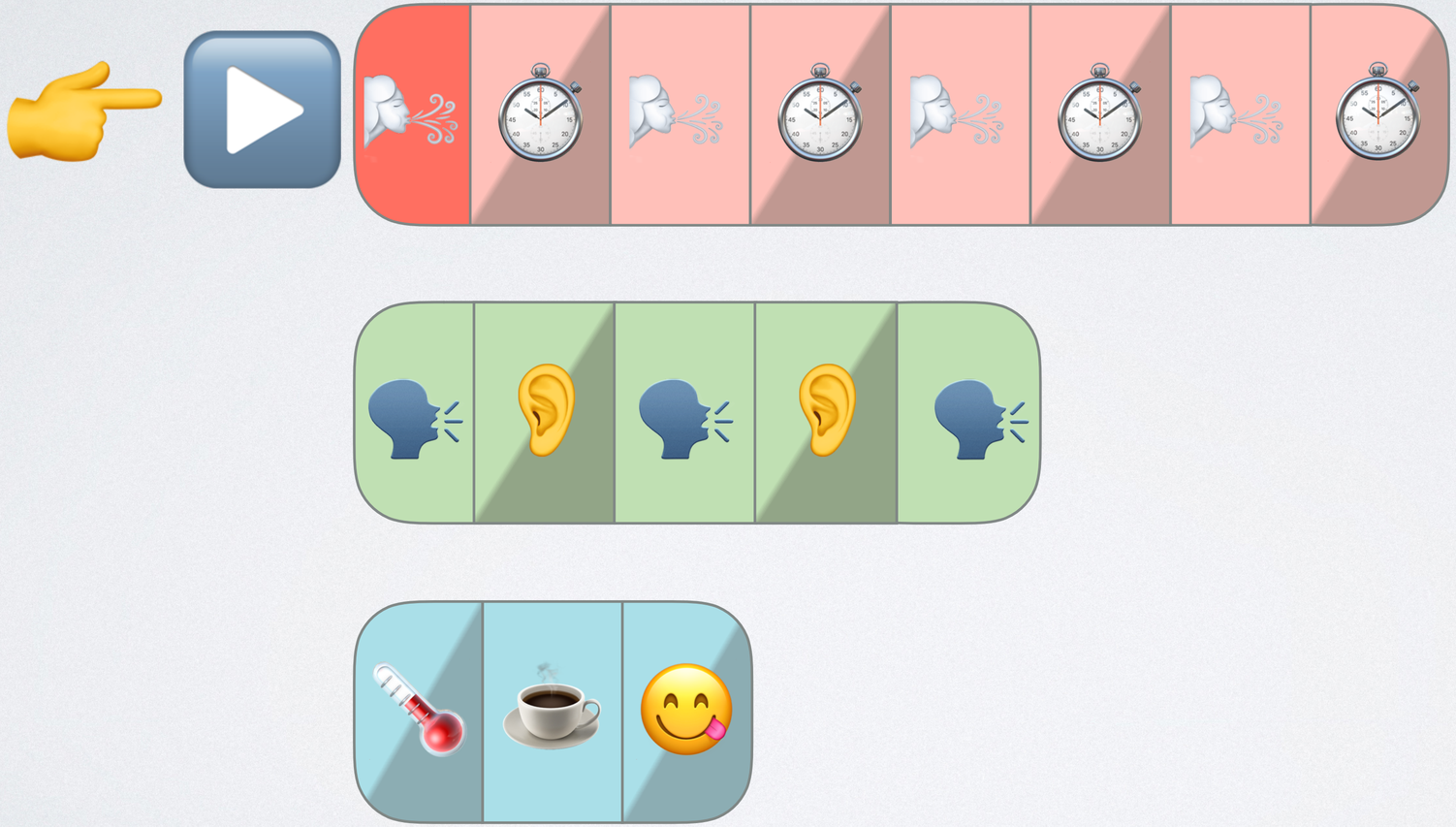
Time

# Dispatching execution

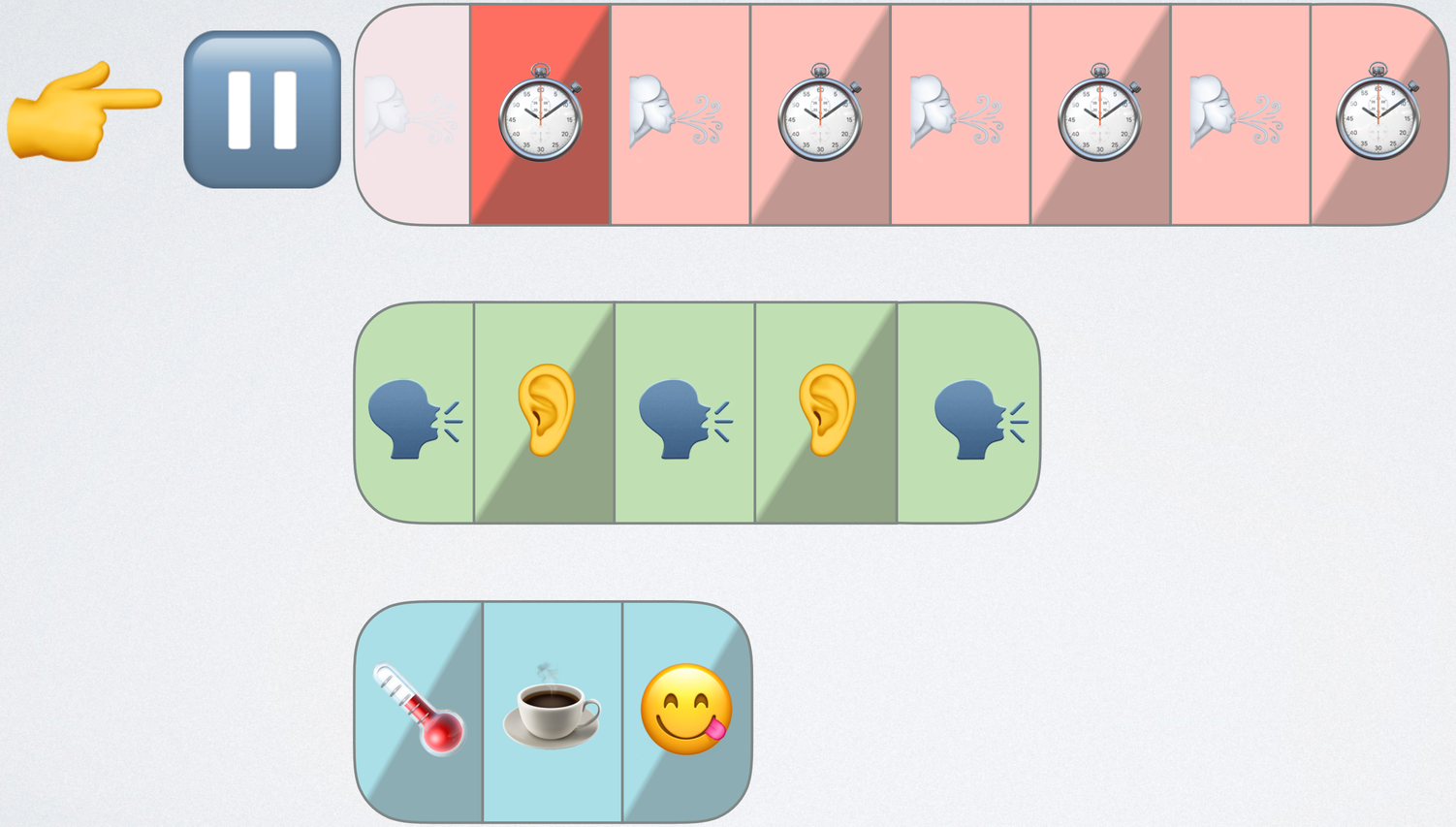
Event Loop

# Event Loop

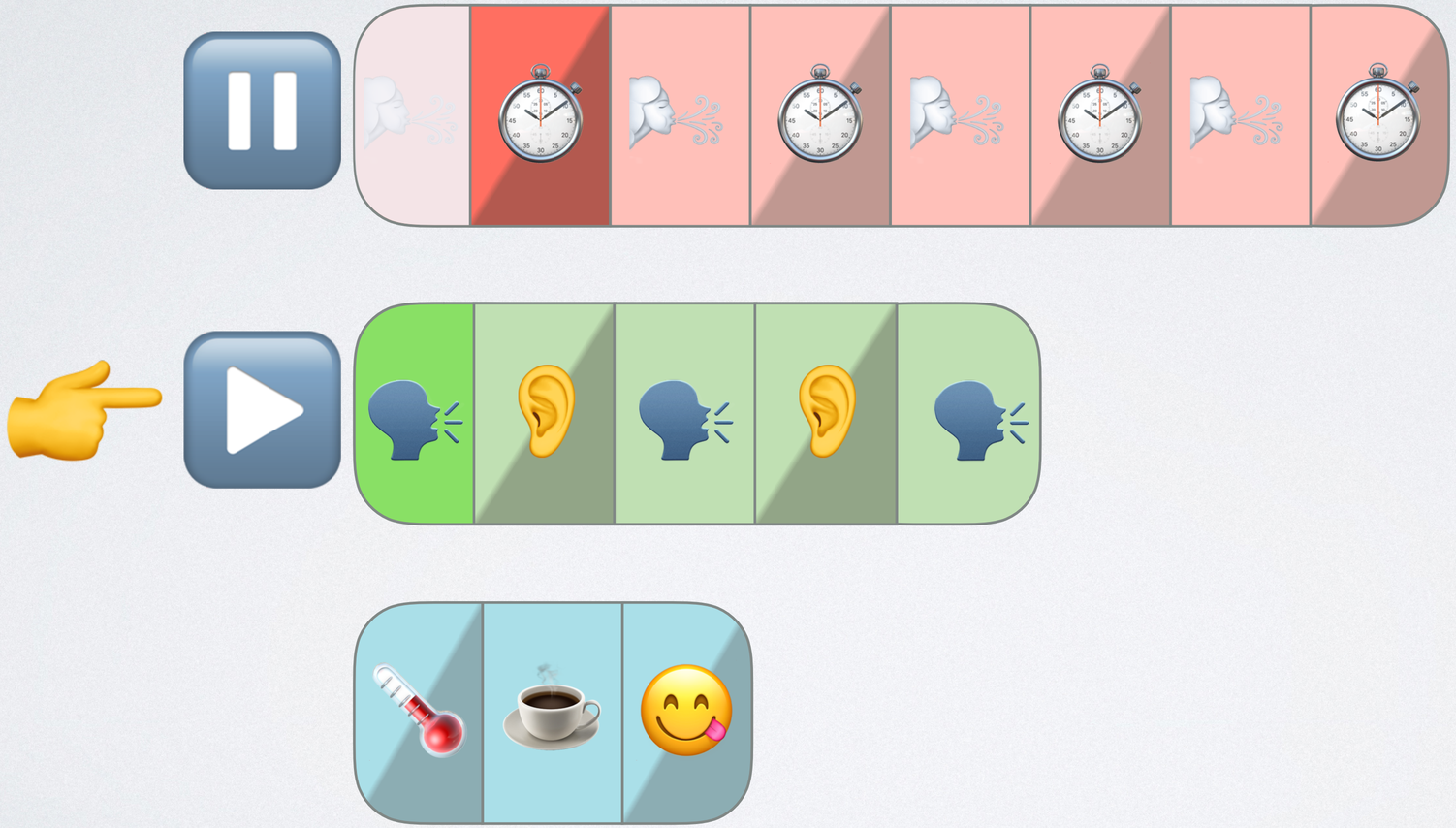
# Event Loop



# Event Loop



# Event Loop



# Event Loop

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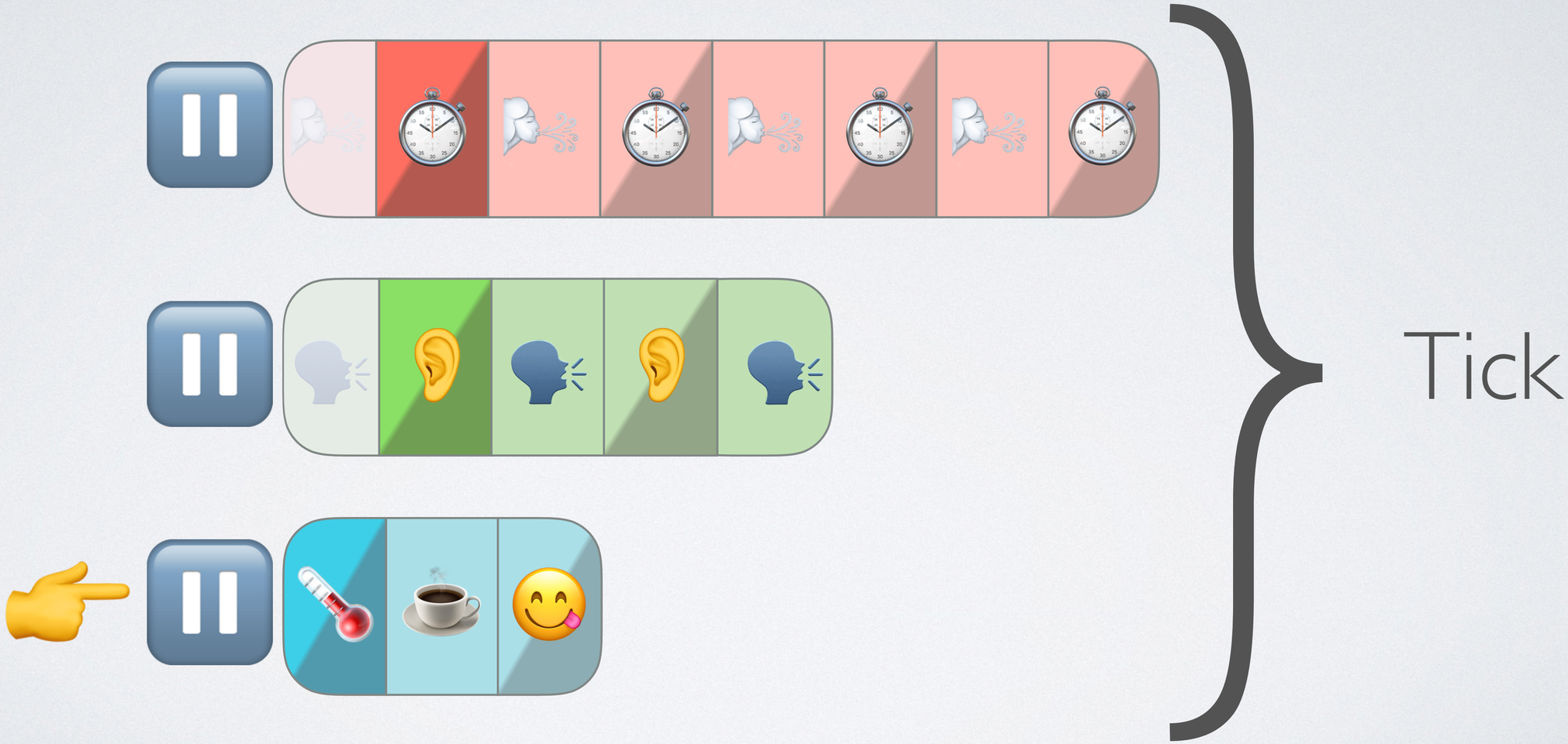

# Event **Loop**

# Event Loop

# Event Loop

# Event Loop

# Event Loop

# Event Loop

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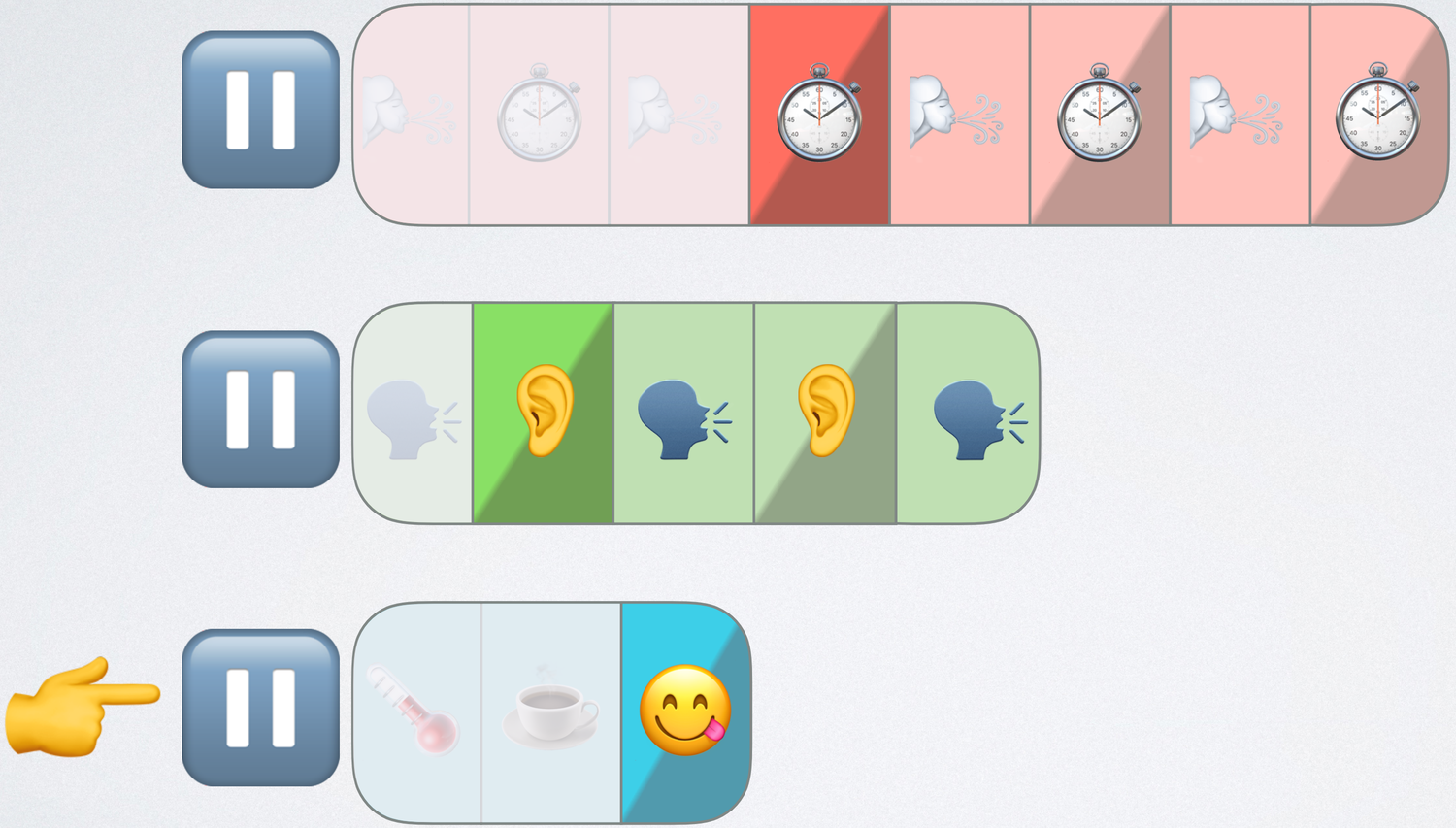
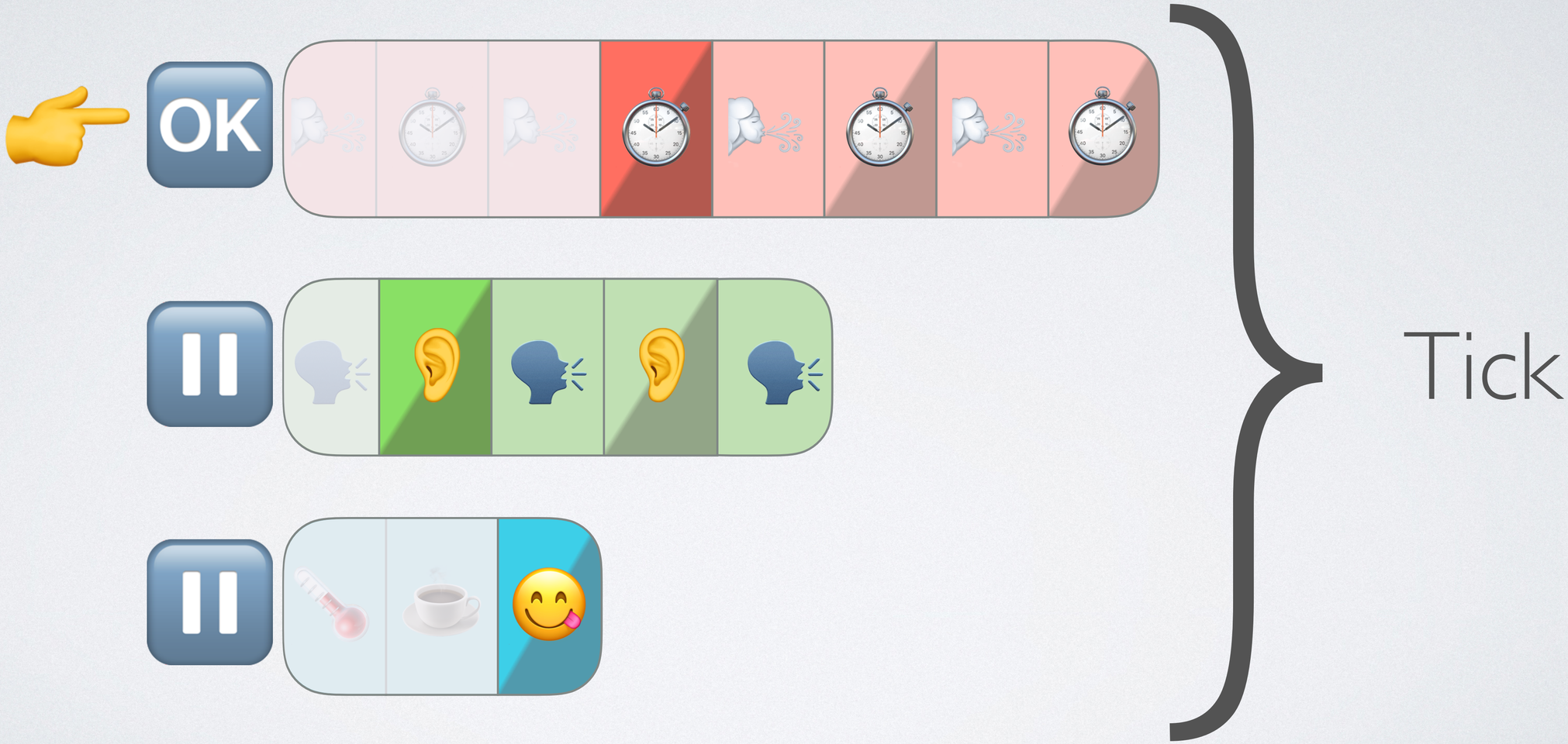


# Event Loop



# Event Loop

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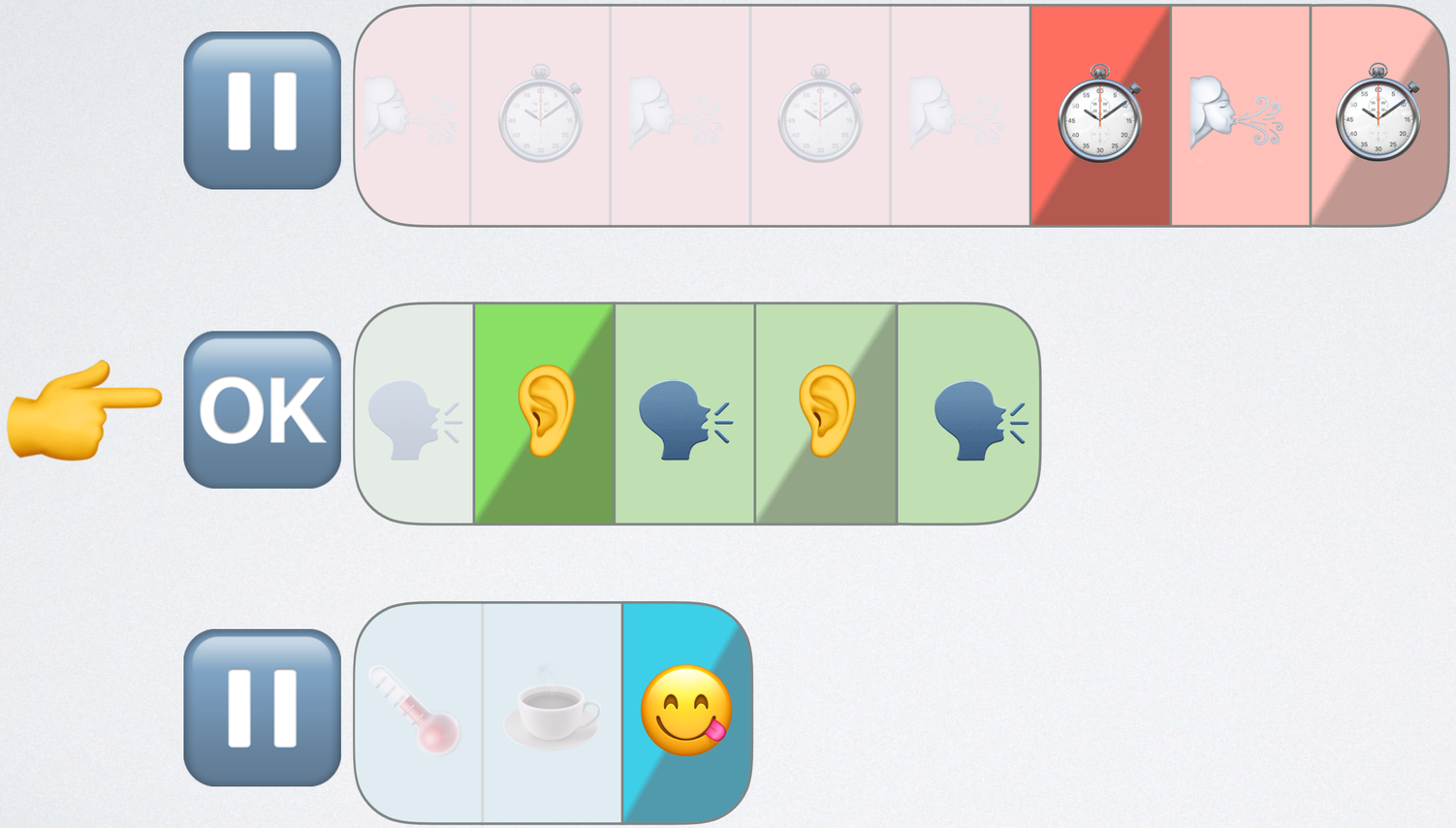
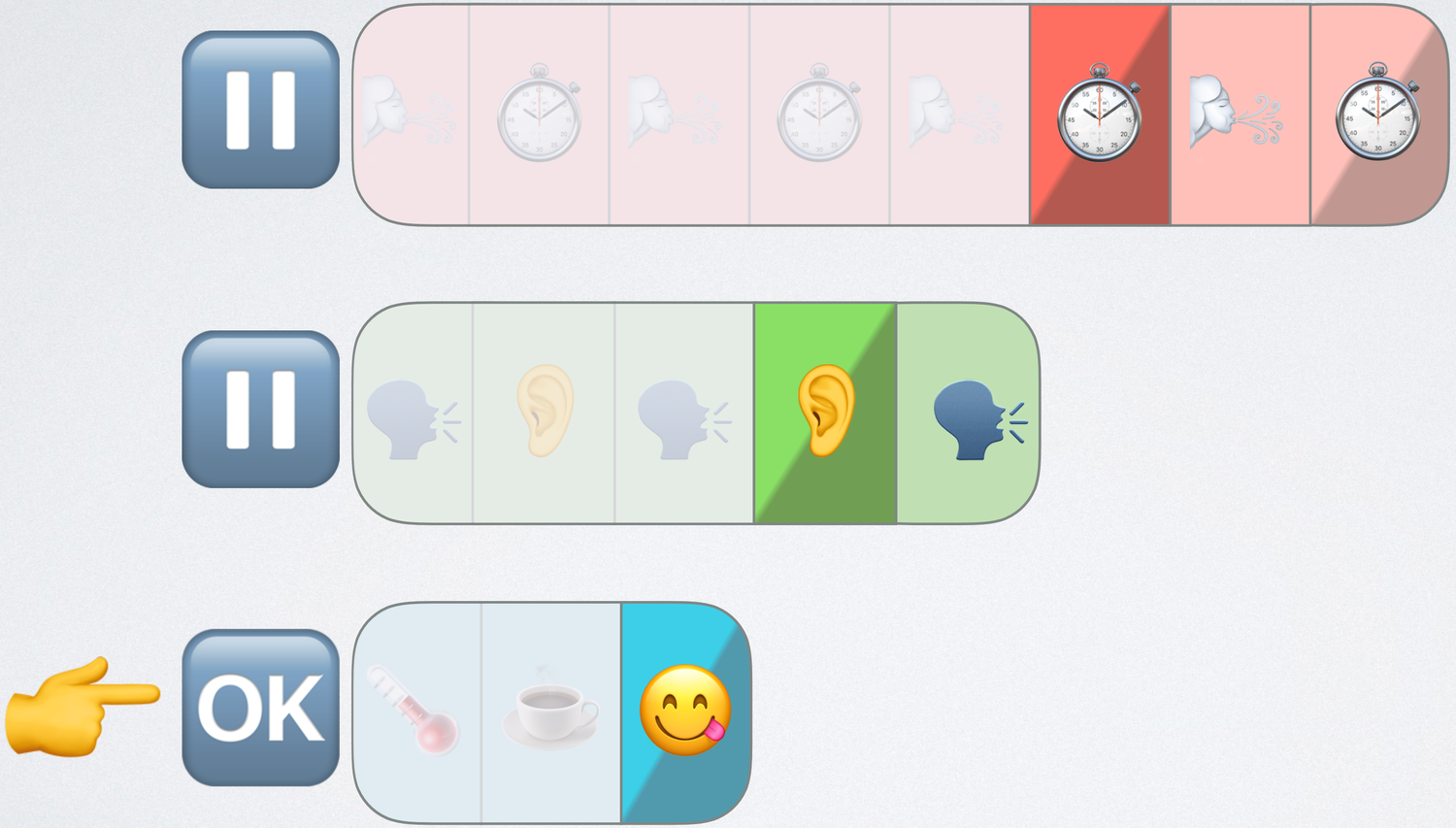


# Event Loop

# Event Loop



# Event Loop

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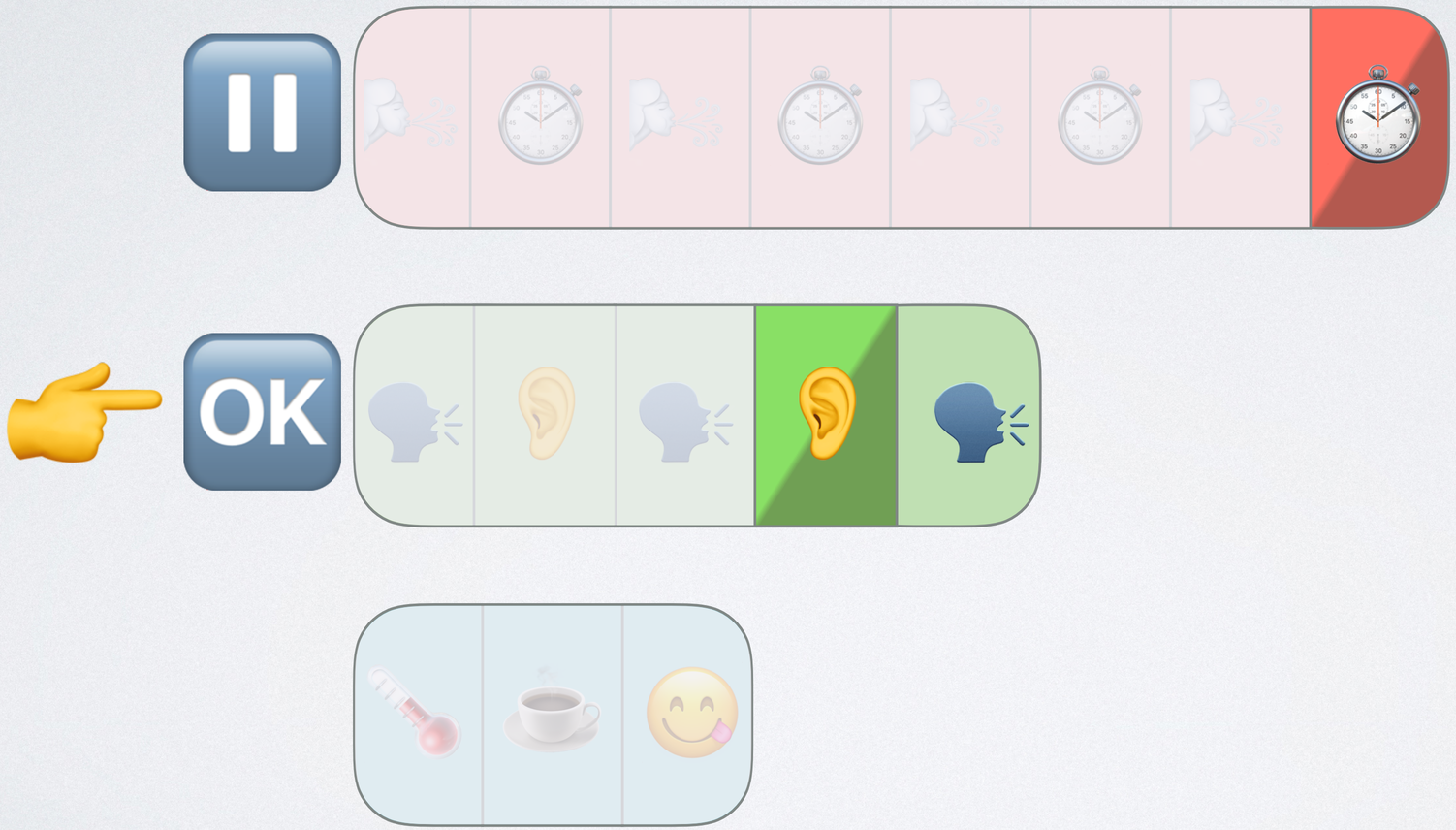
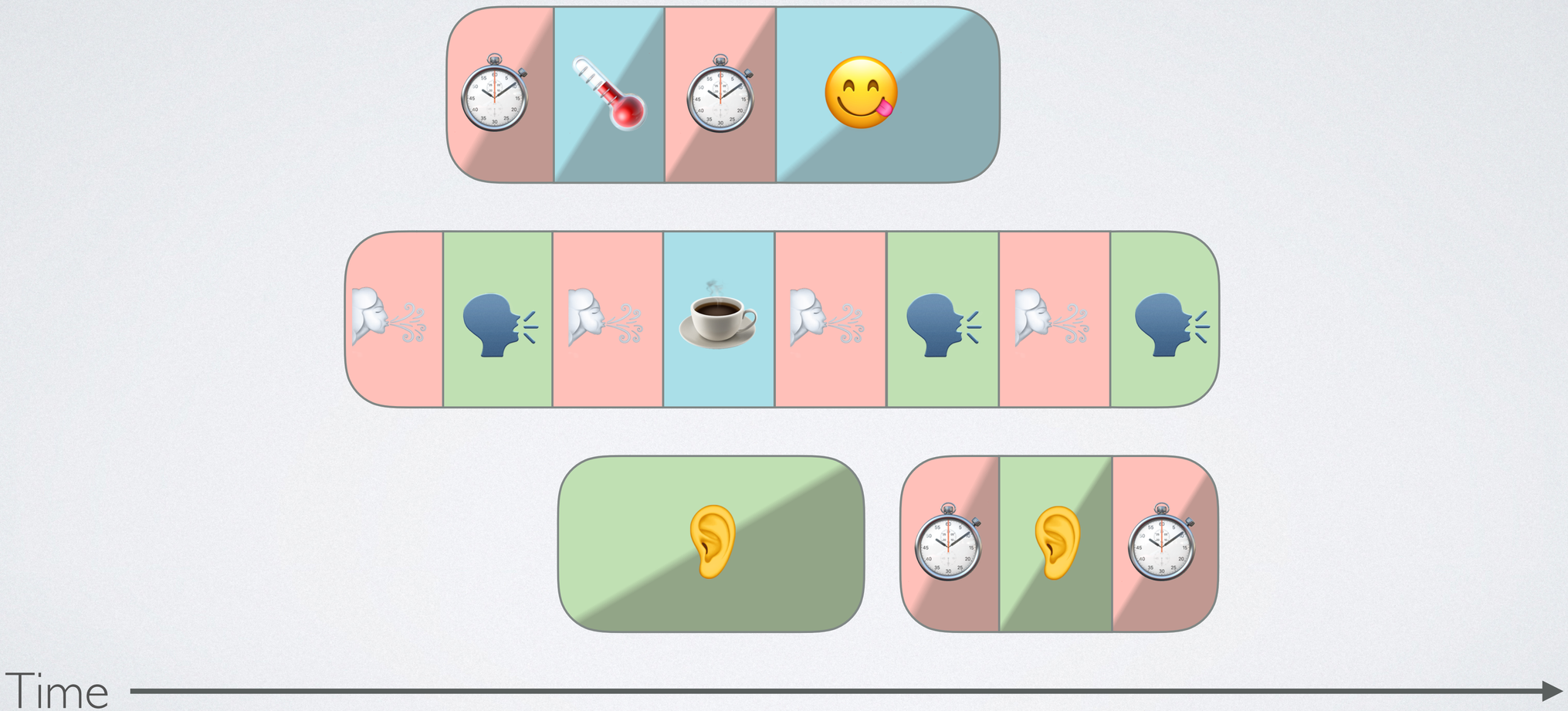


# Event Loop

# Event Loop

# Event Loop

# Asynchronous



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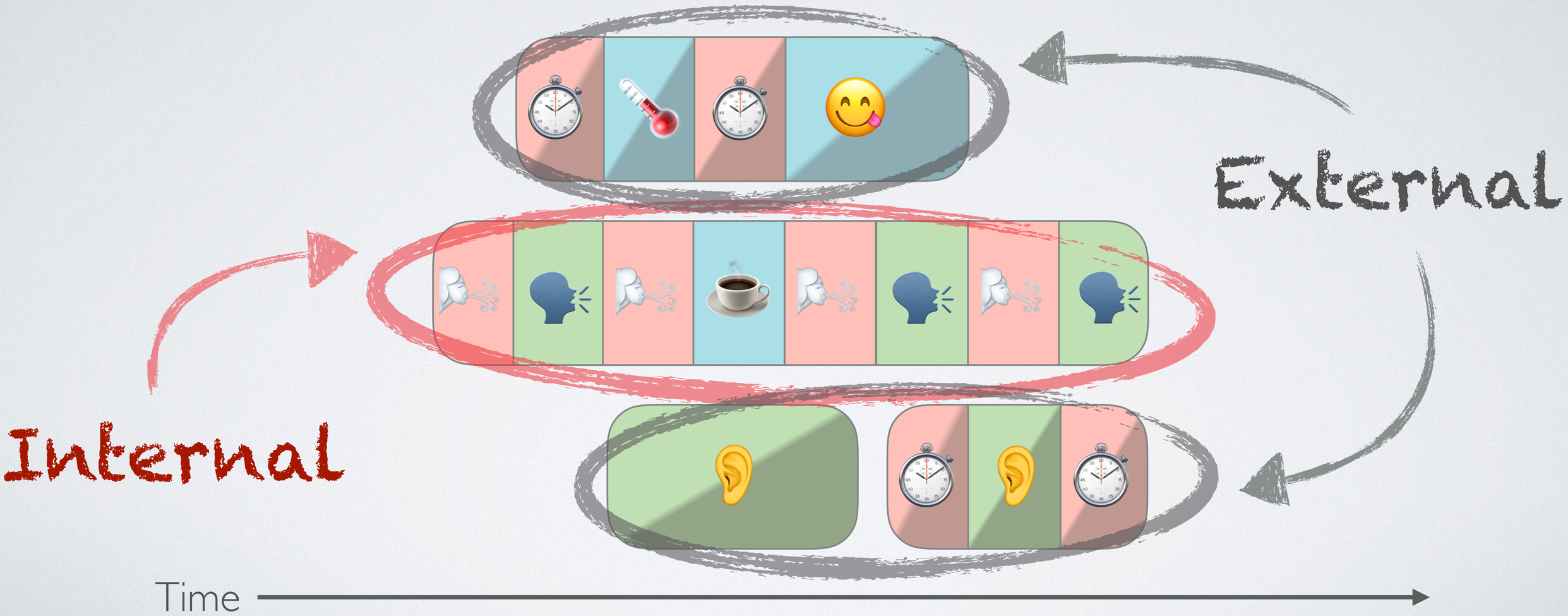

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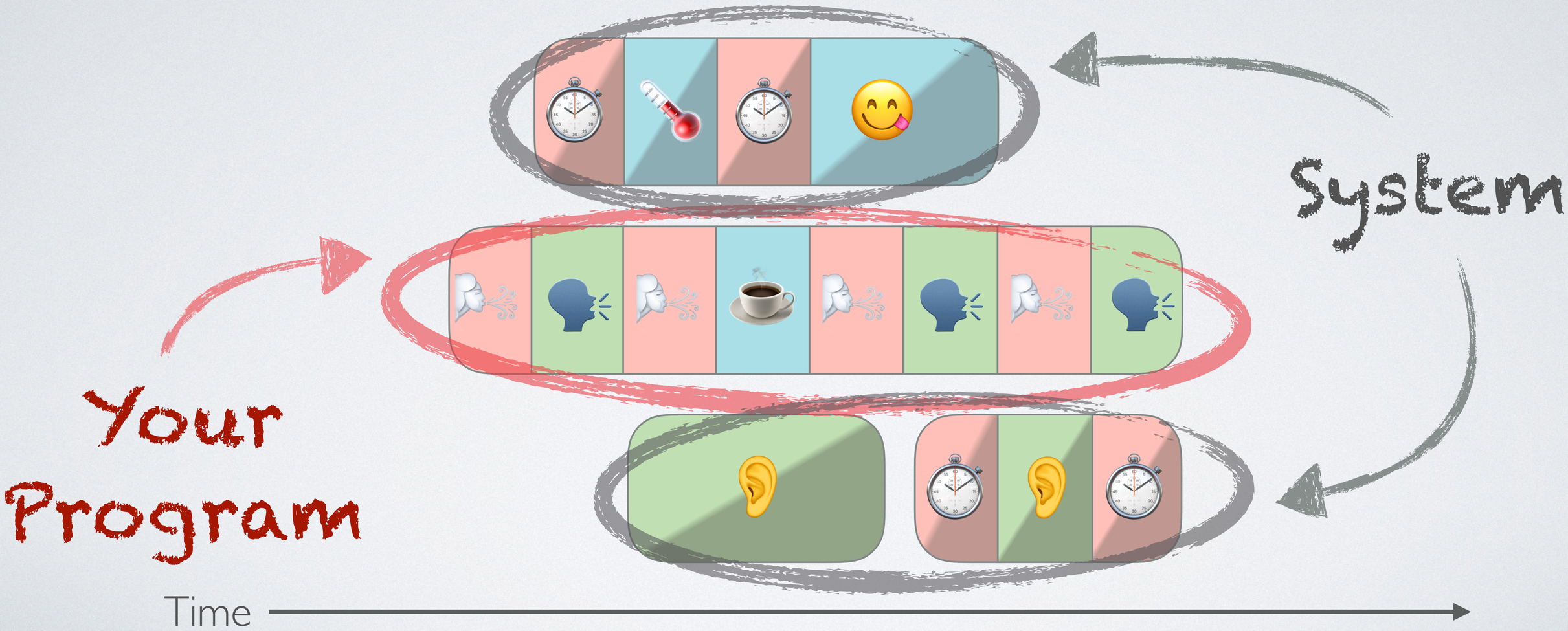

# How to dispatch code execution efficiently?

# Generators

Subset of coroutines

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PARENTAL

ADVISORY

EXPLICIT PHP

# Example

```
function gen_one_two_three() {
    for ($i = 1; $i <= 3; $i++) {
        yield $i;
    }
}

$generator = gen_one_two_three();
foreach ($generator as $value) {
    echo "$value\n";
}
```

# Starting with Generators

… by the weird part…

# Creation

```
// ❌ Does NOT work
$generator = new \Generator;

// PHP Fatal error:  Uncaught Error:
// The "Generator" class is reserved
// for internal use
// and cannot be manually instantiated
```

# Creation

```
function create(): \Generator
{
    yield;
}

$generator1 = create();
$generator2 = create();
```

# Only `yield` matters

```
function emptyGenerator(): \Generator
{
    return 1;
    yield; // Never reached…
}

$generator = emptyGenerator();
```

# Execution

```
function dyingGenerator(): \Generator
{
    die('hard');
    yield;
}
// The function is not executed…
$generator = dyingGenerator();
// Will die ‘hard’
$generator->valid();
```

```php
final class Generator implements Iterator {

    function rewind() {}
    function valid(): bool {}
    function current() {}
    function key() {}
    function next() {}

    function send($value) {}
    function throw(Throwable $exception) {}
    function getReturn() {}
}
```

Outside

```
$generator = createMyGenerator();
// Here, outside content
```

```
function createMyGenerator():
\Generator
{
    // Here, inside content
}
```

Inside

Outside

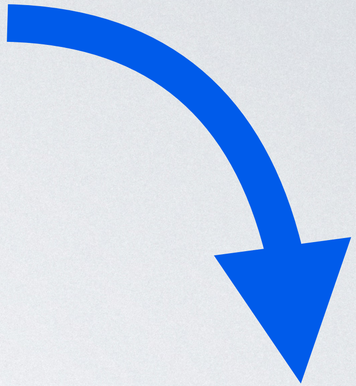
```
$value = $generator->current();
$key = $generator->key();
```

```
yield $key => $value;
```

Inside

Outside

```
$generator->send($value);
$generator->next();
```

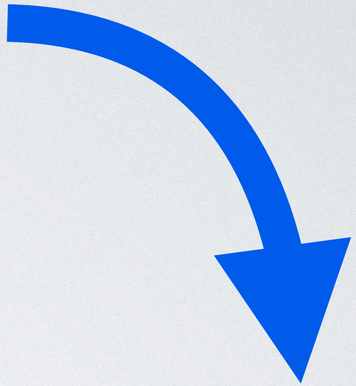


```
$value = yield;
$nullValue = yield;
```

Inside

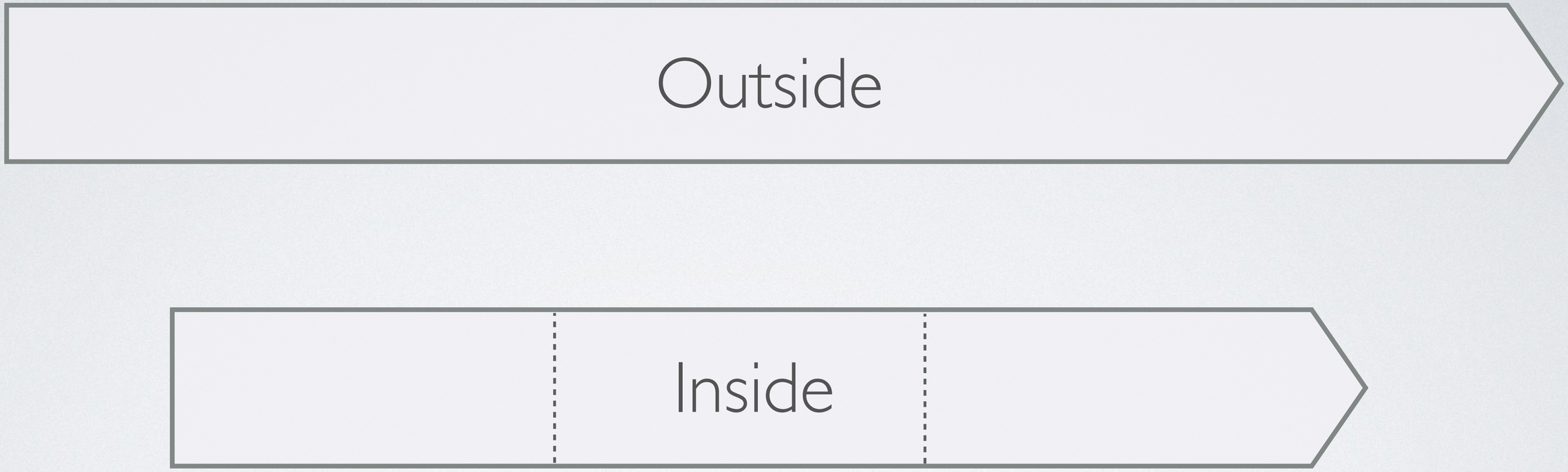
Outside

```
$v1 = $generator->current();
$v3 = $generator->send($v2);
```

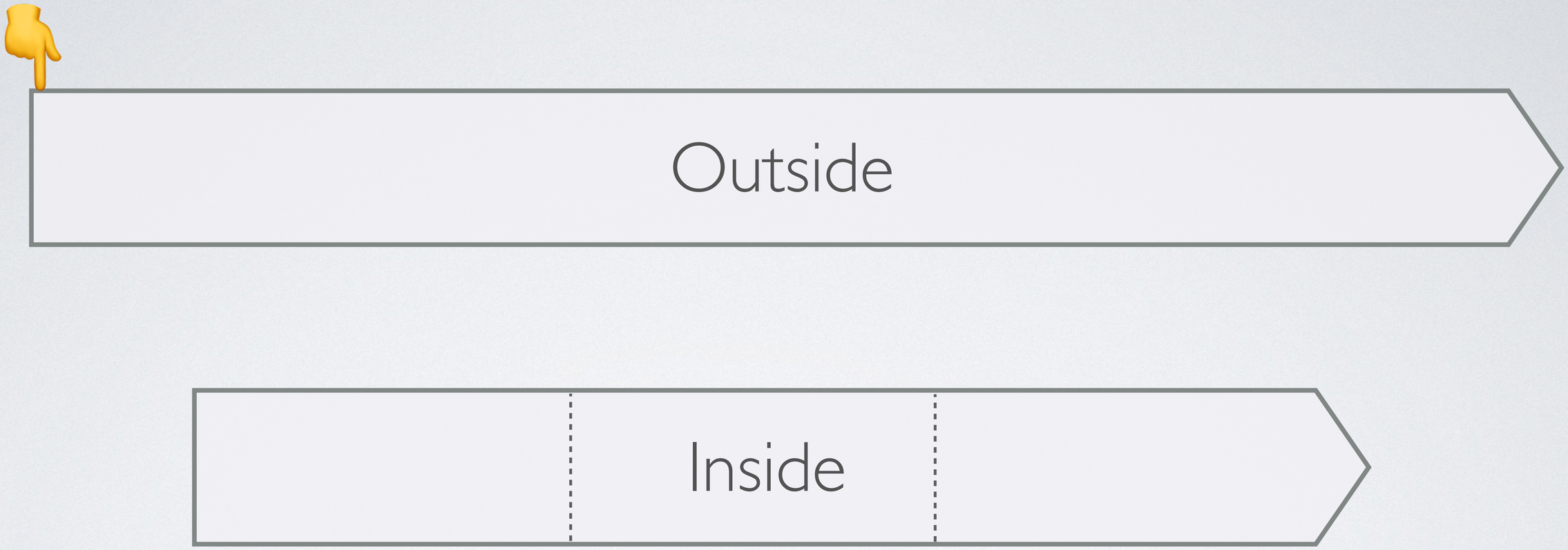


```
$v2 = yield $v1;
yield $v3;
```

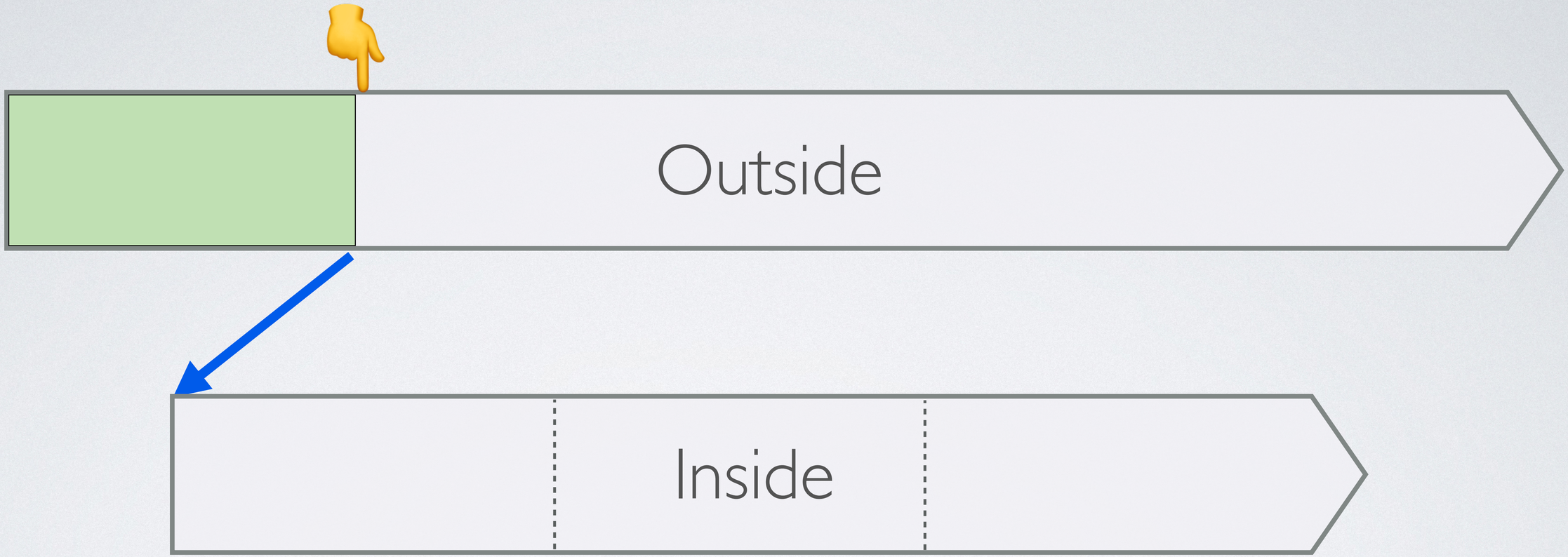
Inside


Outside
Inside

```
$generator = createMyGenerator()
```



```
$v1 = $generator->current()
```



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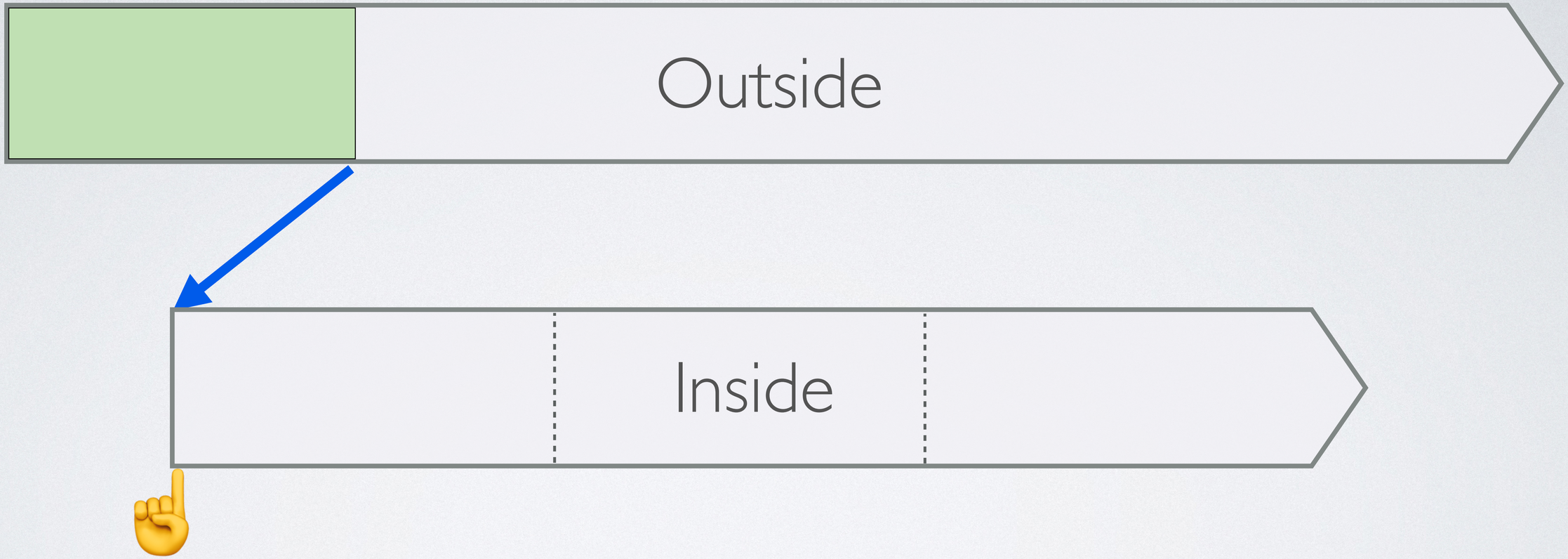
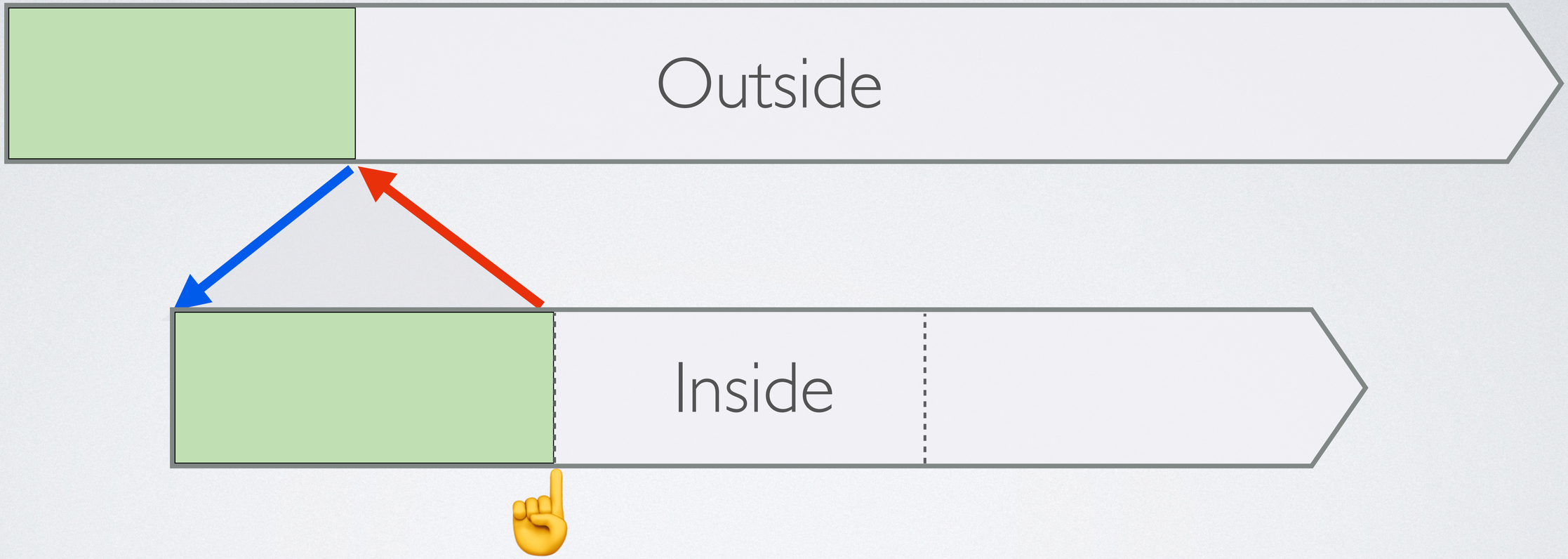
$v1 = $generator->current()
```



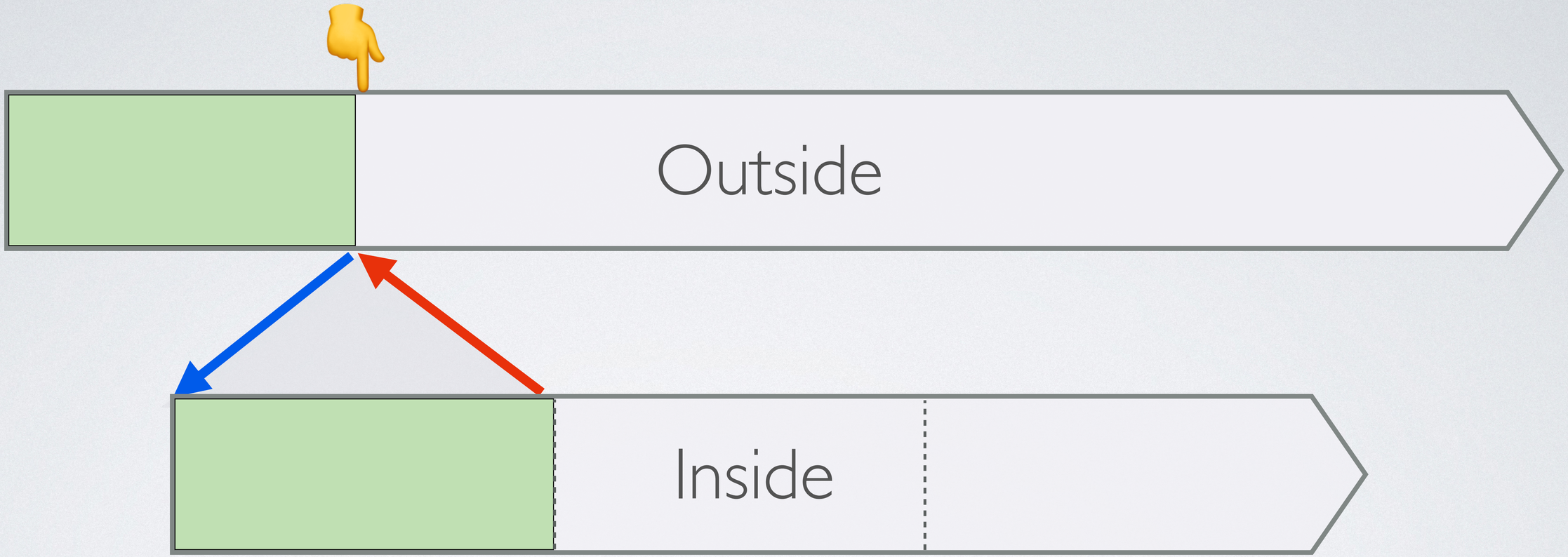

To handoff to

```
$v1 = $generator->current()
```



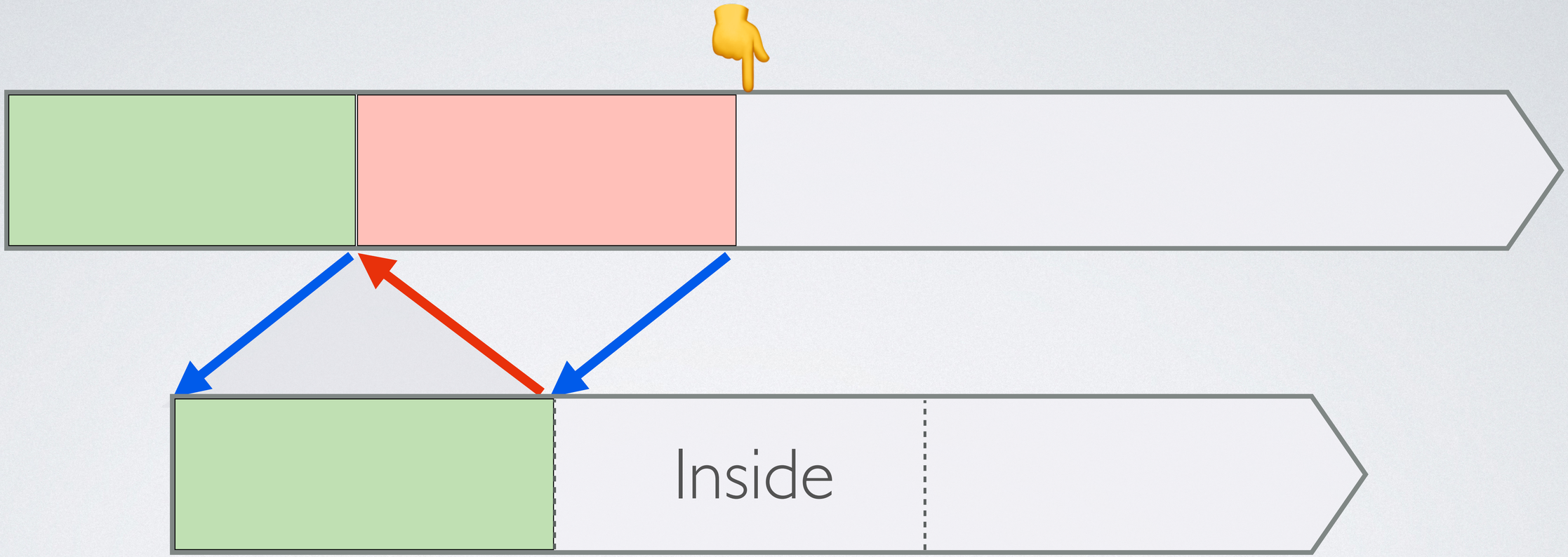

```
$v2 = yield $v1
```

```
$v1 = $generator->current()
```



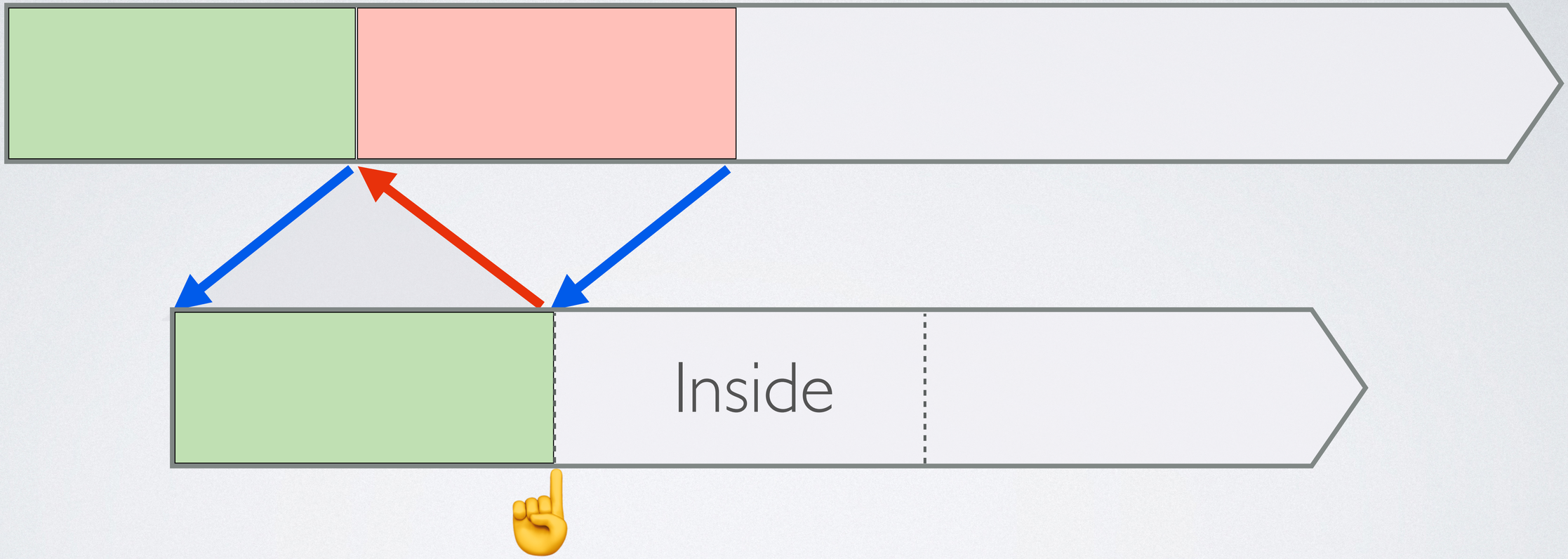

```
$v2 = yield $v1
```

```
$v3 = $generator->send($v2)
```



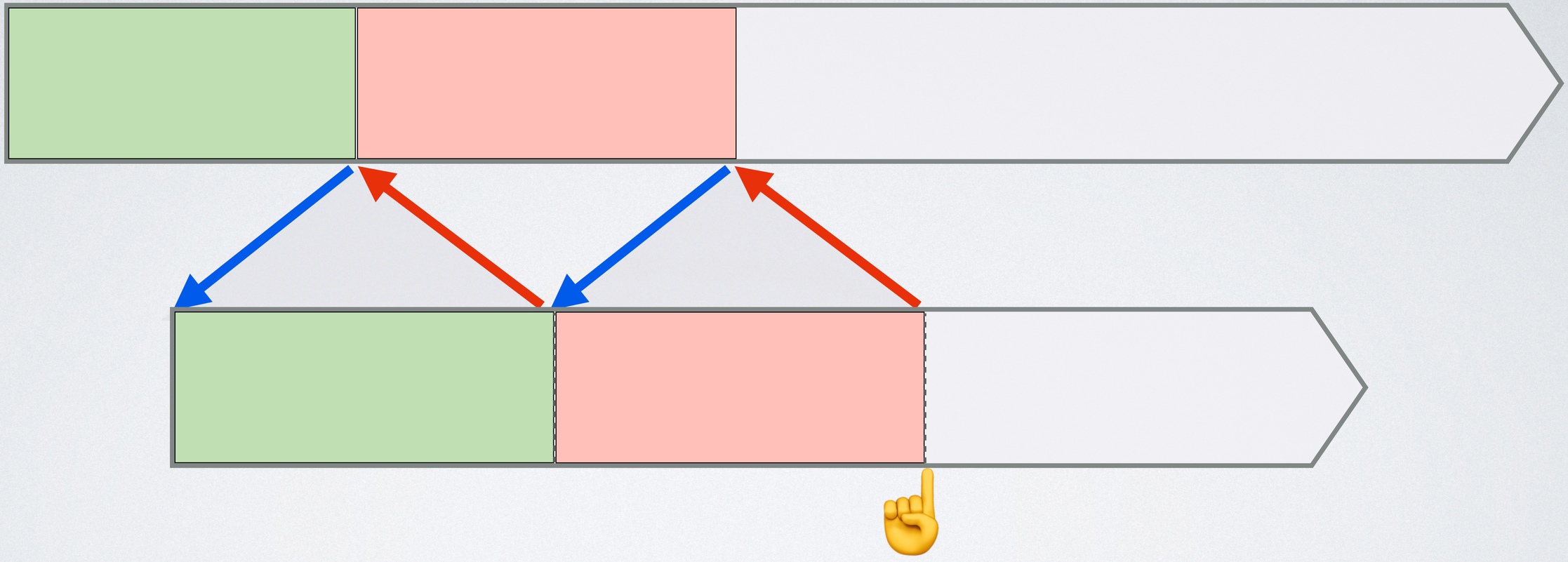

```
$v2 = yield $v1
```

```
$v3 = $generator->send($v2)
```



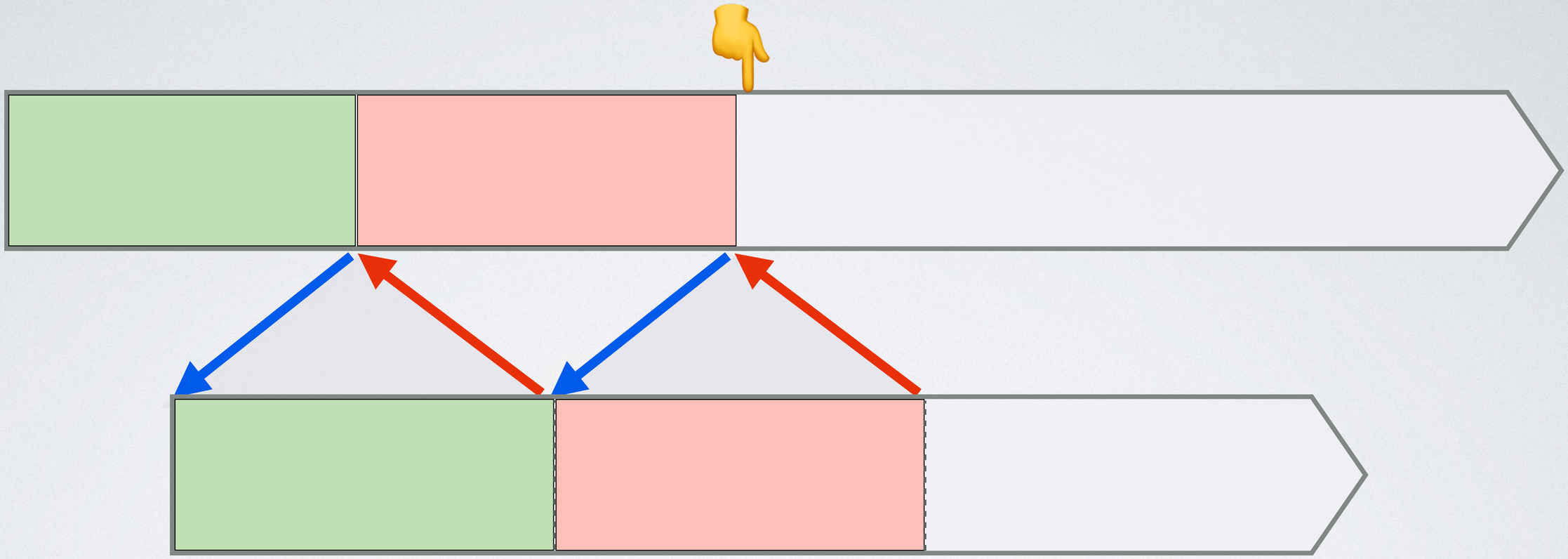

```
$v2 = yield $v1
```

```
$v3 = $generator->send($v2)
```



```
yield $v3
```

```
$v3 = $generator->send($v2)
```



```
yield $v3
```

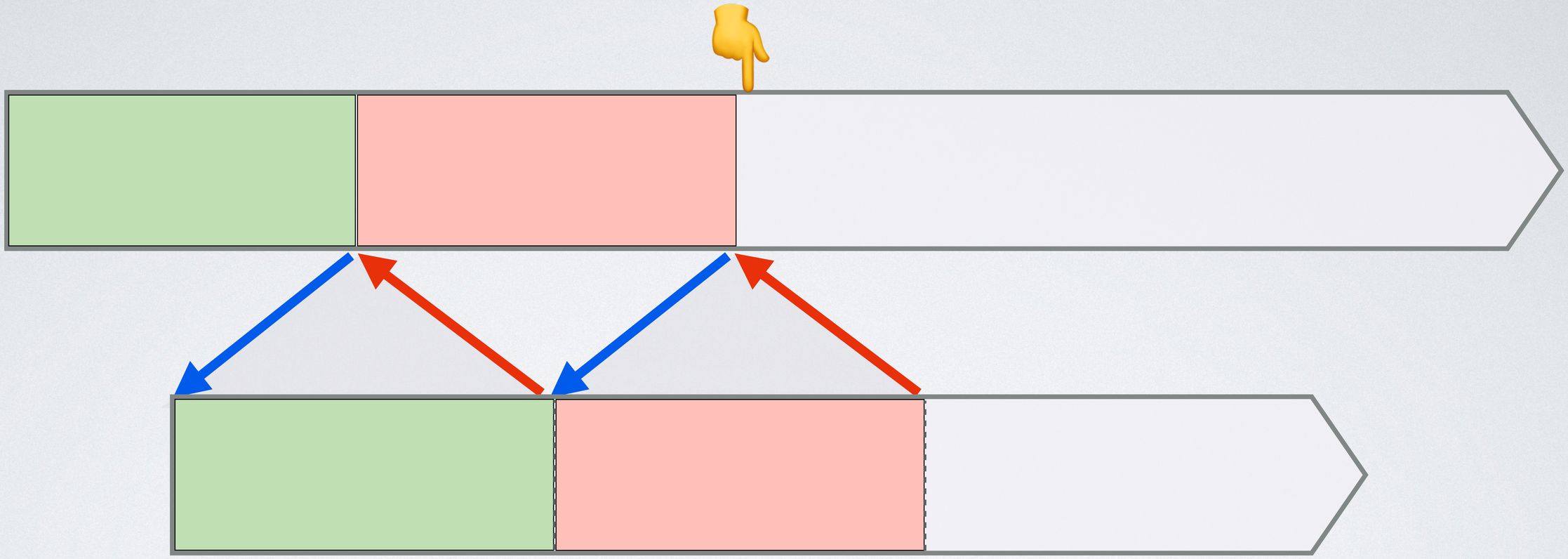
Outside

```
if (!$generator->valid()) {
  $value = $generator->getReturn();
}
```

```
return $value;
```

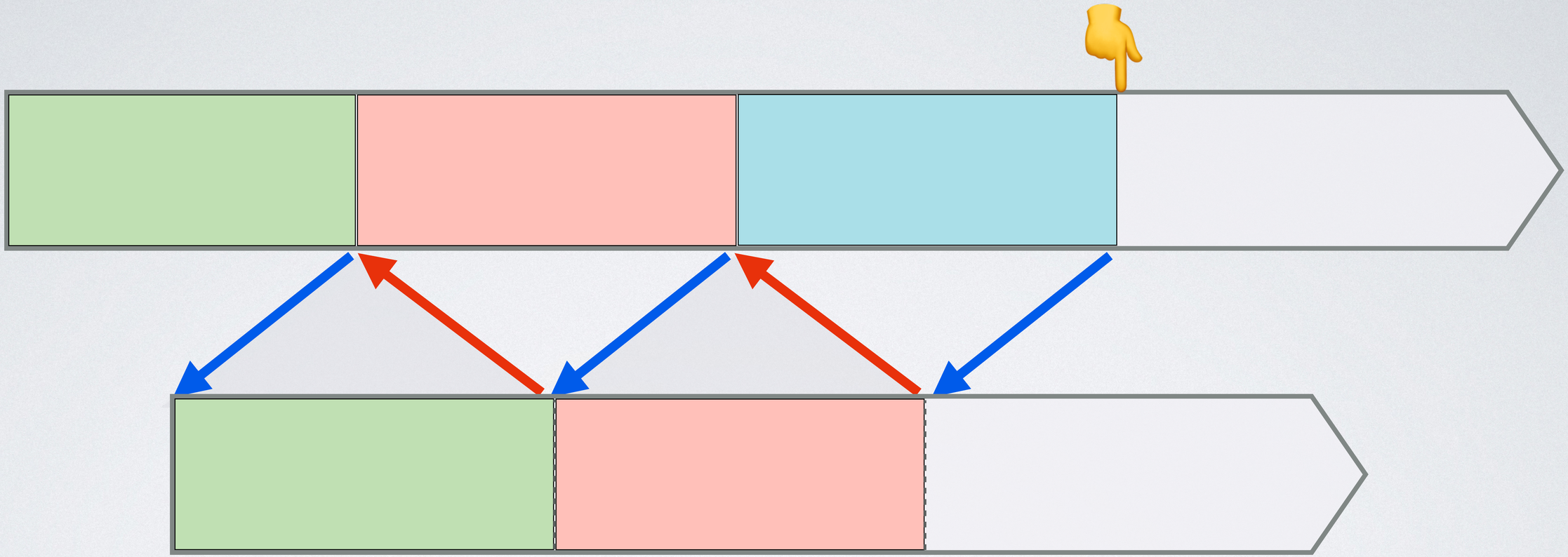
Inside

```
$v3 = $generator->send($v2)
```



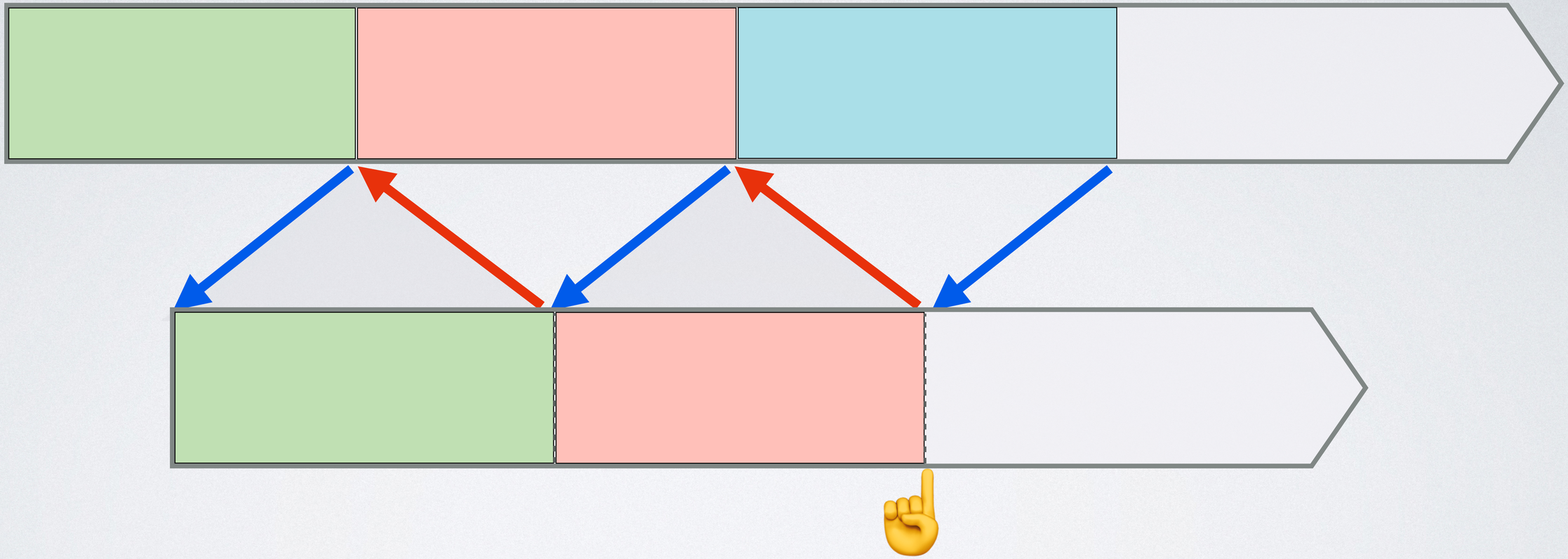
```
yield $v3
```

```
$generator->next()
```



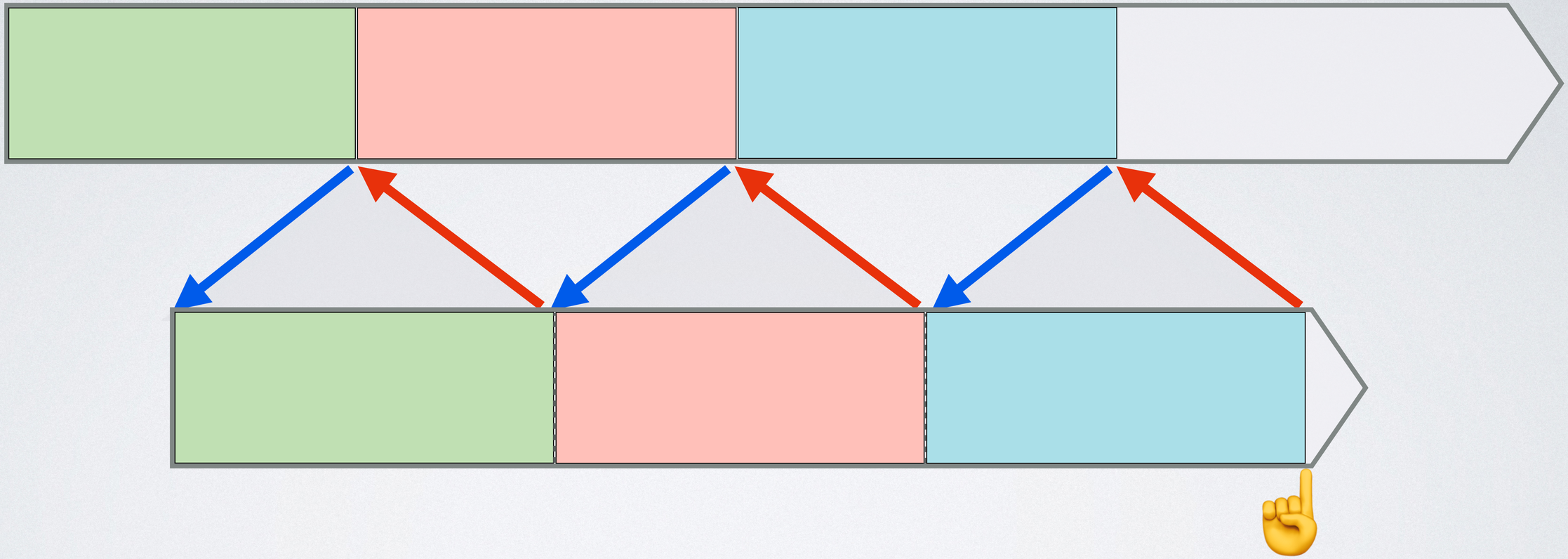
```
yield $v3
```

```
$generator->next()
```



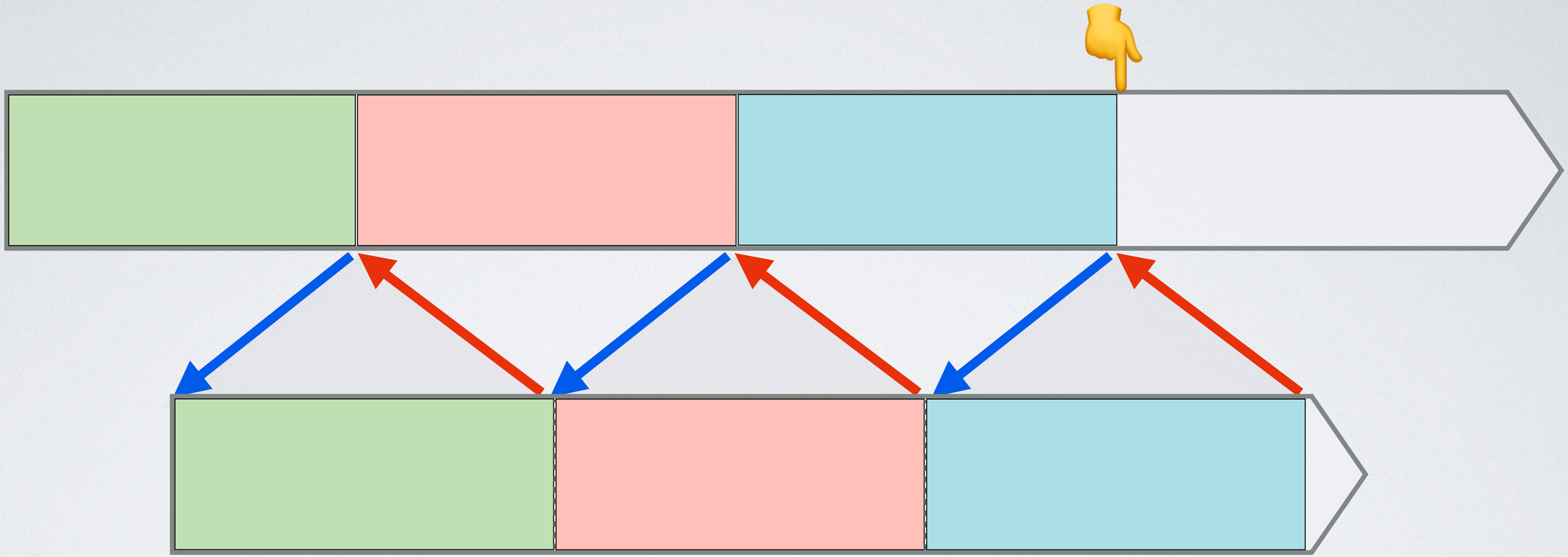
```
yield $v3
```

```
$generator->next()
```



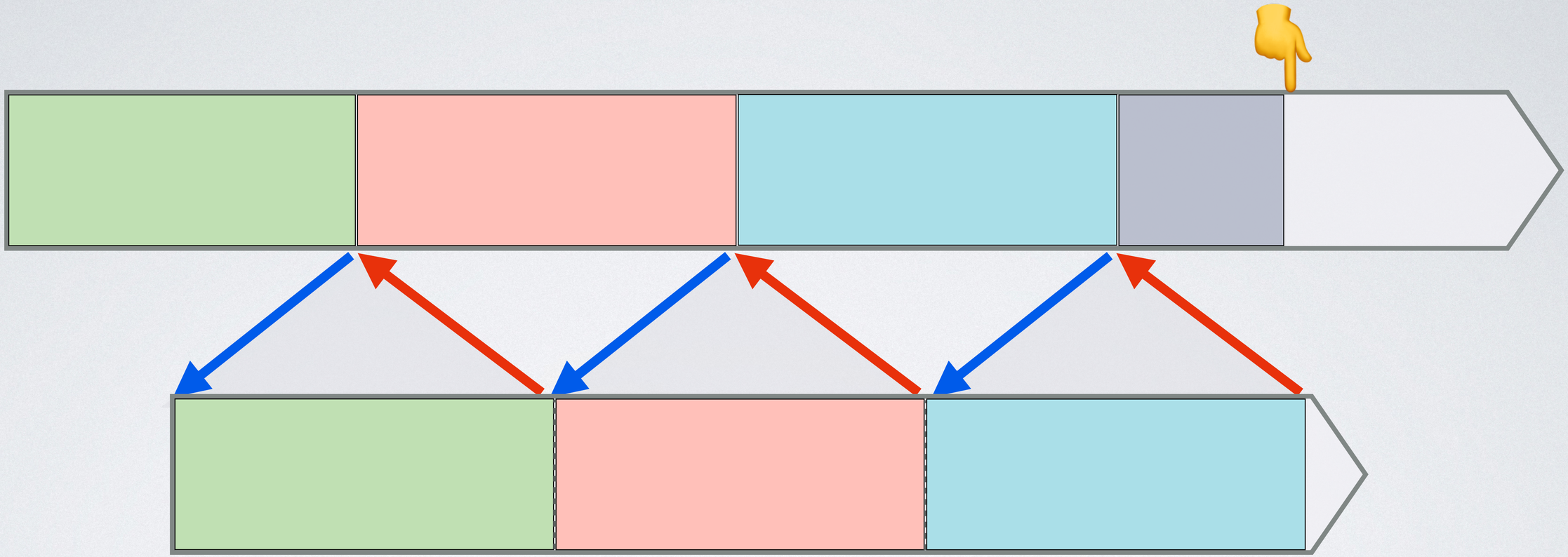
```
return $value;
```

```
$generator->next()
```



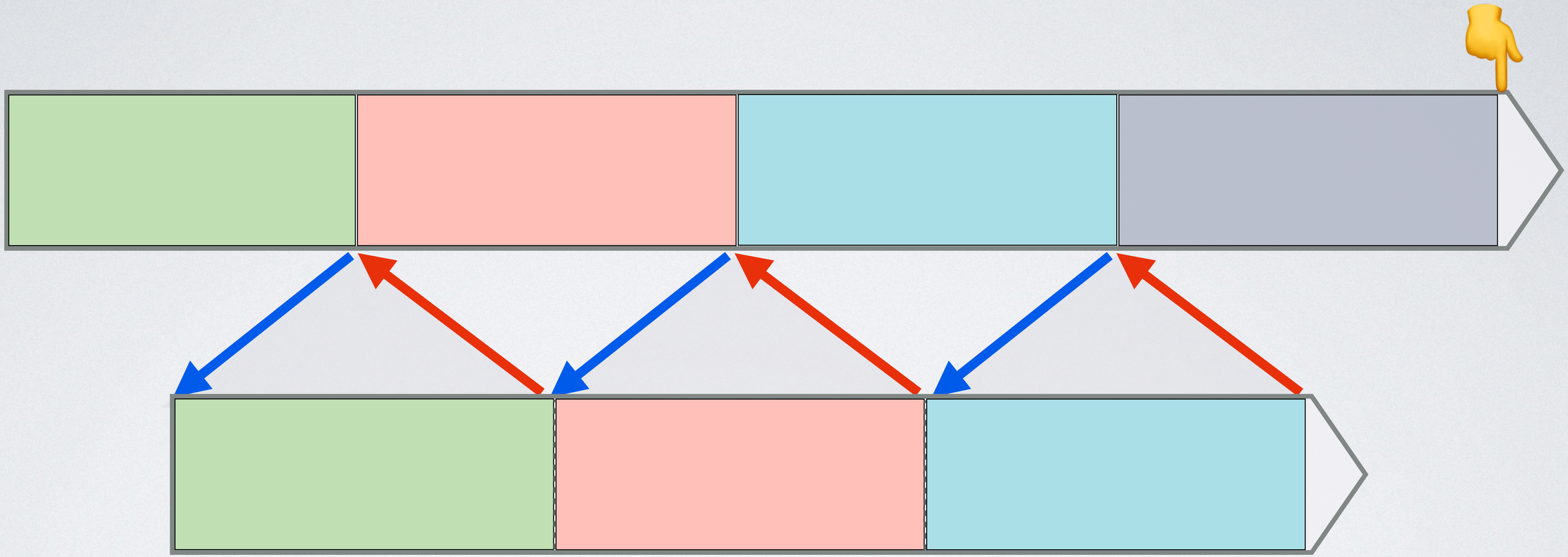
```
return $value;
```

```
!$generator->valid()
```



```
return $value;
```

```
$value = $generator->getReturn()
```



```
return $value;
```

Outside

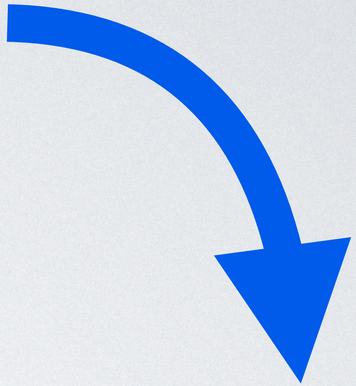
```
try {
    $generator->next();
} catch (\Exception $exception)
{}
```

```
yield;
throw new \Exception();
```

Inside

Outside

```
$generator->throw($exception);
```



```
try {
    yield;
} catch (\Exception $exception)
{}
```

Inside

# Why using Generators for Asynchronous Programming

Let the magic happen

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Benoit Viguier

@b_viguier

ConFoo.CA
DEVELOPER CONFERENCE

# Promises

# Synchronous

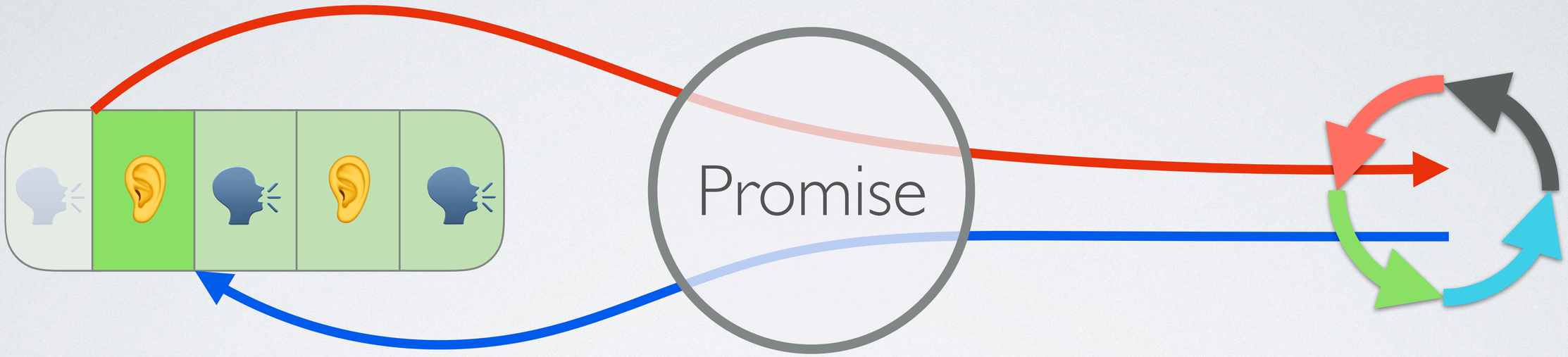
```
function talk(string $question1, string $question2)
{
    /** @var string $response */
    $response = askQuestion($question1);
    echo $response;

    /** @var string $response */
    $response = askQuestion($question2);
    echo $response;
}
```

# Synchronous

```
function askQuestion(string $question): string
{
    // …
}
```

Waiting for a result…




Here your result!

# Asynchronous

```
function askQuestion(string $question): Promise
{
    // …
}
```

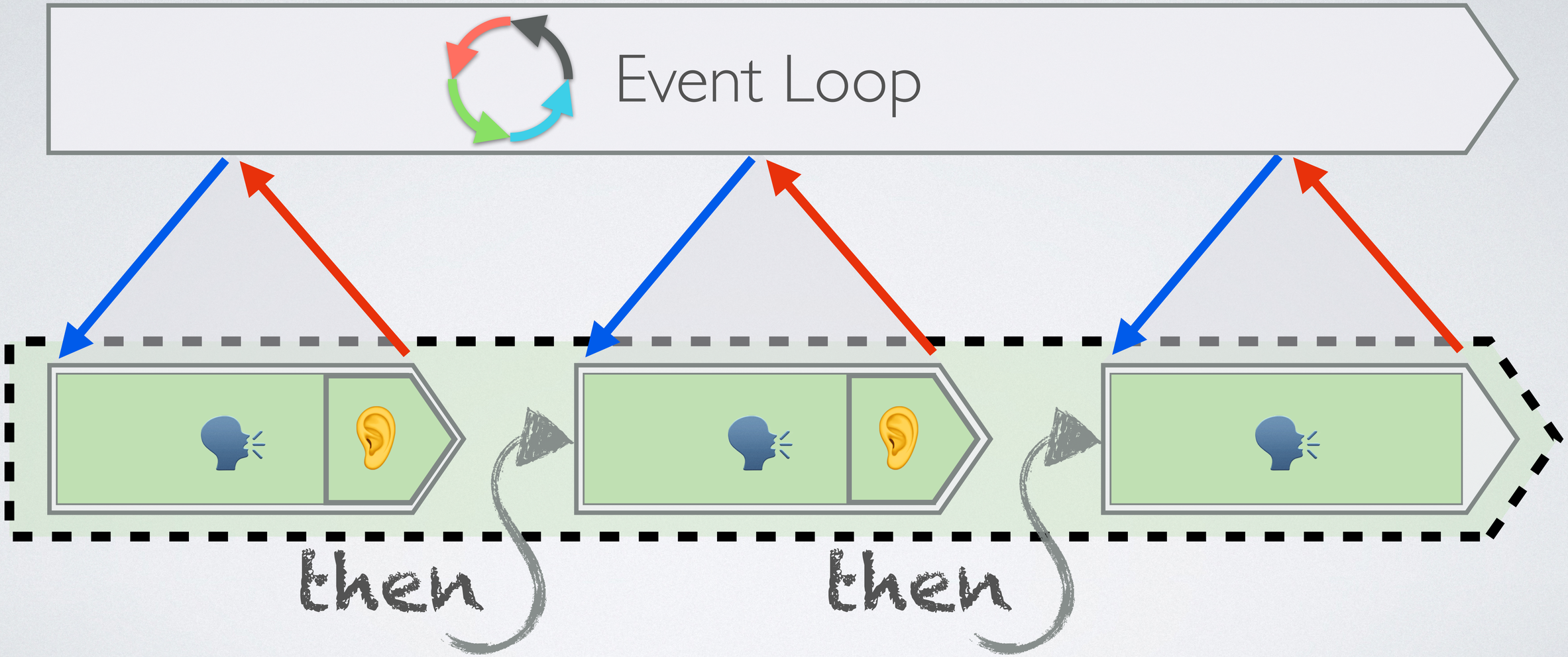
# Asynchronous

```
function talk(string $question1, string $question2)
{
    /** @var Promise $promise */
    $promise = askQuestion($question1);
    // !? echo $response;

    /** @var Promise $promise */
    $promise = askQuestion($question2);
    // !? echo $response;
}
```

# Promises A+

*Thenable* Promises


Event Loop
then
then

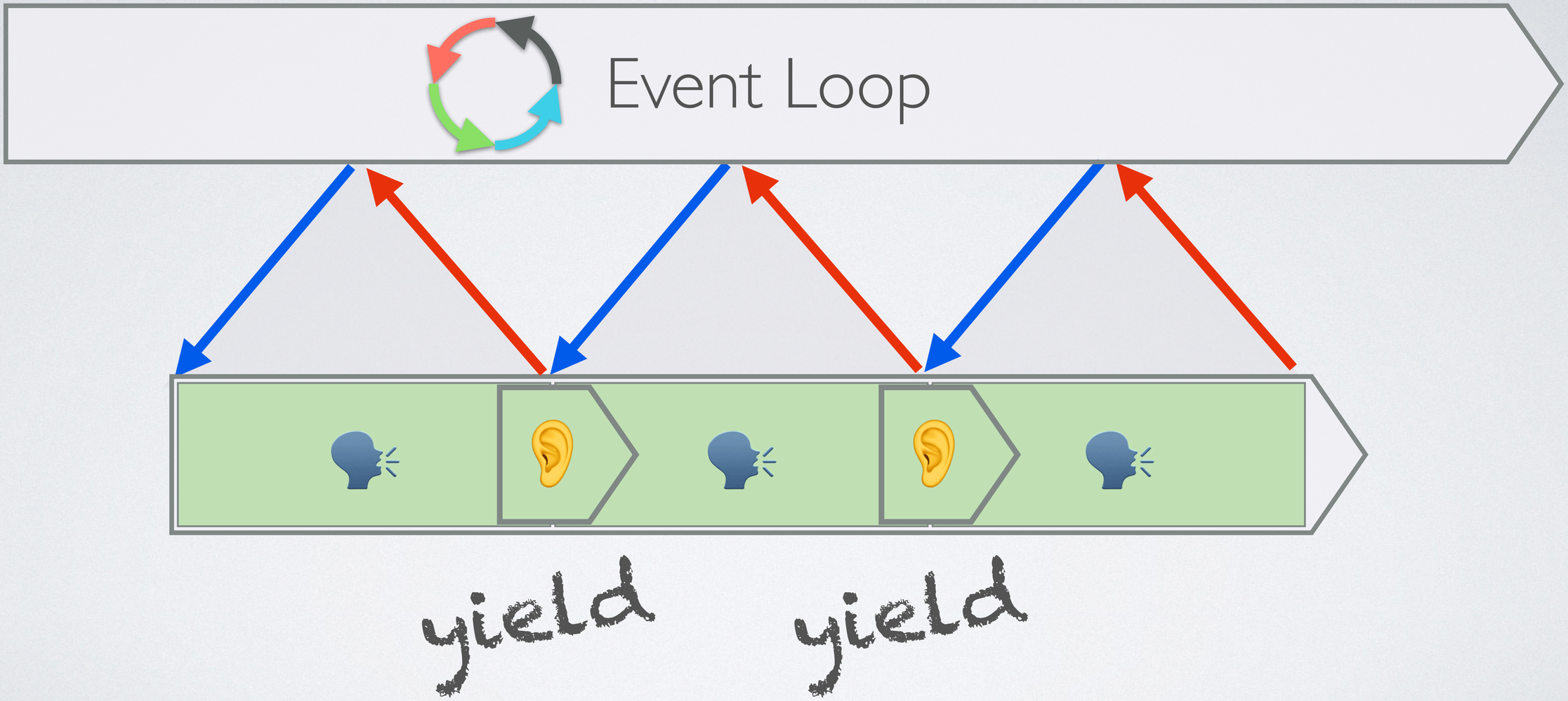
```php
function talk(string $question1, string $question2)
{
    $promise = askQuestion($question1);
    $promise->then(
        function(string $response) use($question2) {
            echo $response;

            return askQuestion($question2);
        }
    )->then(
        function(string $response) {
            echo $response;
        }
    );
}
```

# 🔥Callback Hell🔥

```
$promise
    ->then(function ($x) {
        return $x + 1;
    })
    ->then(function ($x) {
        throw new \Exception($x + 1);
    })
    ->otherwise(function (\Exception $x) {
        return $x->getMessage() + 1;
    })
    ->then(function ($x) {
        echo 'Mixed '.$x;
    });
```

# *Generator* Promises


Event Loop
yield
yield

# Synchronous

```
function talk(string $question1, string $question2)
{

    /** @var string $response */
    $response = askQuestion($question1);
    echo $response;


    /** @var string $response */
    $response = askQuestion($question2);
    echo $response;
}
```

# Asynchronous

```
function talk(string $question1, string $question2)
{

    /** @var string $response */
    $response = yield askQuestion($question1);
    echo $response;


    /** @var string $response */
    $response = yield askQuestion($question2);
    echo $response;
}
```

# Asynchronous

```
function talk(string $question1, string $question2)
{
    $promise = askQuestion($question1);
    /** @var string $response */
    $response = yield $promise;
    echo $response;

    $promise = askQuestion($question2);
    /** @var string $response */
    $response = yield $promise;
    echo $response;
}
```

To asynchronously *wait* the value of a **promise**, use **`yield`**.

**Asynchronous Function:**

a **generator** yielding only *promises*.

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@b_viguier

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# Choose your Event Loop

# reactphp/react

👍 Community

😩 *Thenable* Promises

# amphp/amp

👍 Generators

🤔 Coupling ?

# m6web/tornado

👍 Generators

😘 Interfaces / Adapters

🤔 M6Web

# Tea for Two

Let’s code it!

# Discussing with a friend

```
function talk(string $question1, string $question2)
: \Generator
{
    /** @var string $response */
    $response = yield askQuestion($question1);
    echo $response;

    /** @var string $response */
    $response = yield askQuestion($question2);
    echo $response;
}
```

# Breathing

```
function breath(EventLoop $eventLoop, int $count)
: \Generator
{
    while (--$count >= 0) {
        echo "Breathing\n";
        yield $eventLoop->idle();
    }
}
```

# Drinking Tea

```
function tMax(EventLoop $eventLoop, int $maximum)
: \Generator
{
    do {
        yield $eventLoop->idle();
        $current = rand(20, 40);
    } while ($current > $maximum);

    return $current;
}
```

# Drinking Tea

```
function drink(EventLoop $eventLoop): \Generator
{
    $generator = tMax($eventLoop, 35);
    $promise = $eventLoop->async($generator);
    $temperature = yield $promise;

    echo "Drinking [$temperature °]\n";

    yield $eventLoop->delay(1000/*ms*/);
}
```

# Drinking Tea

```
function drink(EventLoop $eventLoop): \Generator
{
    $generator = tMax($eventLoop, 35);
    $promise = $eventLoop->async($generator);
    $temperature = yield $promise;

    echo "Drinking [$temperature °]\n";

    yield $eventLoop->delay(1000/*ms*/);
}
```

# Drinking Tea

```
function drink(EventLoop $eventLoop): \Generator
{
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    $temperature = yield $promise;

    echo "Drinking [$temperature °]\n";

    yield $eventLoop->delay(1000/*ms*/);
}
```

# Drinking Tea

```
function drink(EventLoop $eventLoop): \Generator
{
    $generator = tMax($eventLoop, 35);
    $promise = $eventLoop->async($generator);
    $temperature = yield $promise;

    echo "Drinking [$temperature °]\n";

    yield $eventLoop->delay(1000/*ms*/);
}
```

# Wait for it…

```
$concurrentPromise = $eventLoop->promiseAll(

    $eventLoop->async( breath($eventLoop, 10)      ),
    $eventLoop->async( discuss('Where?', ‘What?') ),
    $eventLoop->async( drink($eventLoop)           )

);

$eventLoop->wait($concurrentPromise);
```

# Wait for it…

```
$concurrentPromise = $eventLoop->promiseAll(

    $eventLoop->async( breath($eventLoop, 10)      ),
    $eventLoop->async( discuss('Where?', ‘What?') ),
    $eventLoop->async( drink($eventLoop)           )

);

$eventLoop->wait($concurrentPromise);
```

# Wait for it…

```
$concurrentPromise = $eventLoop->promiseAll(

    $eventLoop->async( breath($eventLoop, 10)      ),
    $eventLoop->async( discuss('Where?', ‘What?') ),
    $eventLoop->async( drink($eventLoop)           )

);

$eventLoop->wait($concurrentPromise);
```

# So...

Asynchronous Programming

**doesn’t** require…

# ~~Http Server~~

# ~~Threads~~

JavaScript™

Asynchronous Programming

**requires**…

# Event Loop

# Interruptible Tasks

# **Generators**: Powerful tool for Asynchronous Programming

# PRACTICE

# One year of asynchronous PHP in production

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**Tomorrow**, 13:00

# Why and how to use generators for asynchronous programming

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@b_viguier

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# Thanks !

```
$answer = yield $you->ask($me);
```

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@b_viguier

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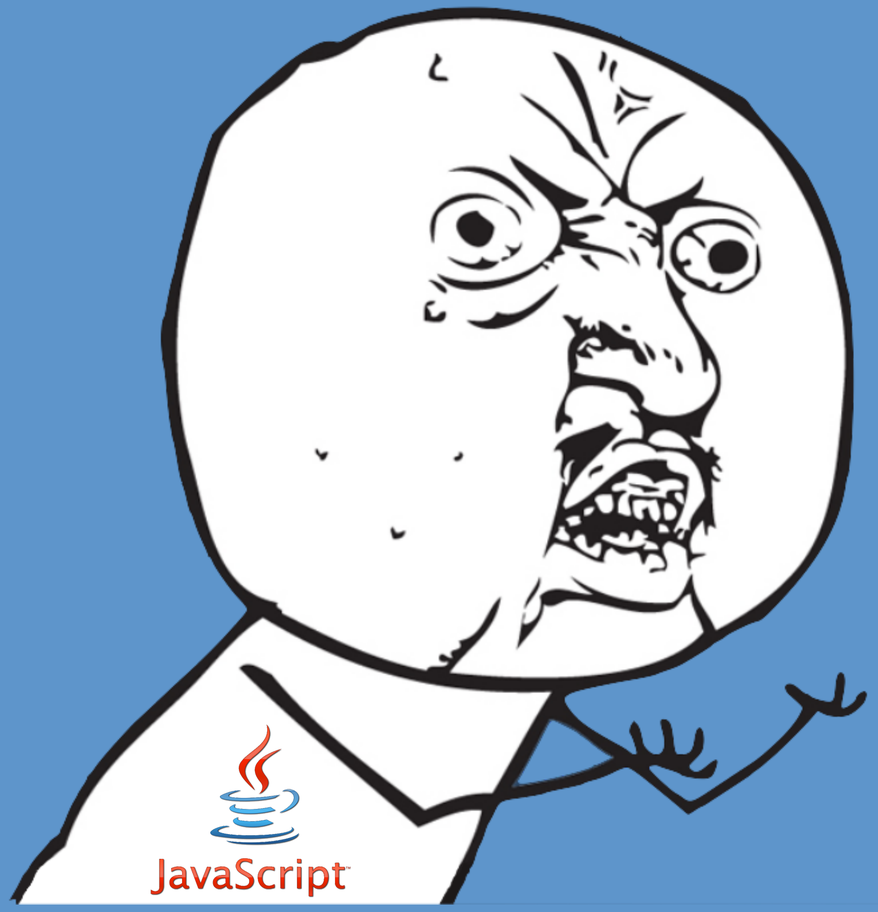
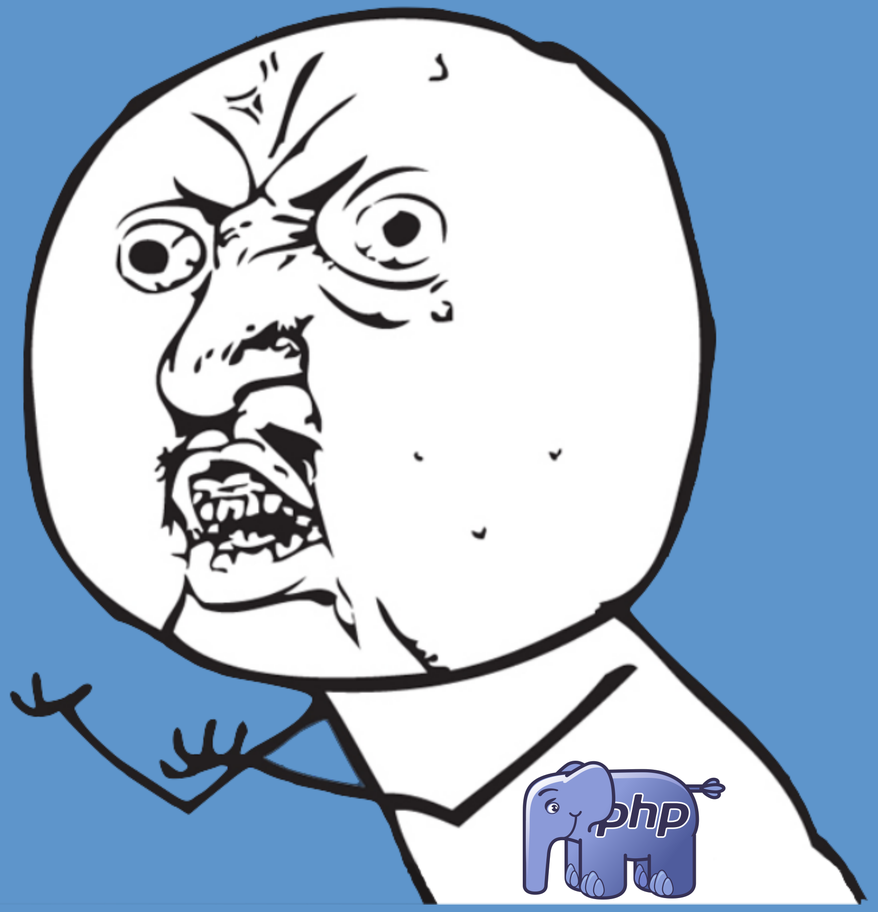



# PHP DEV

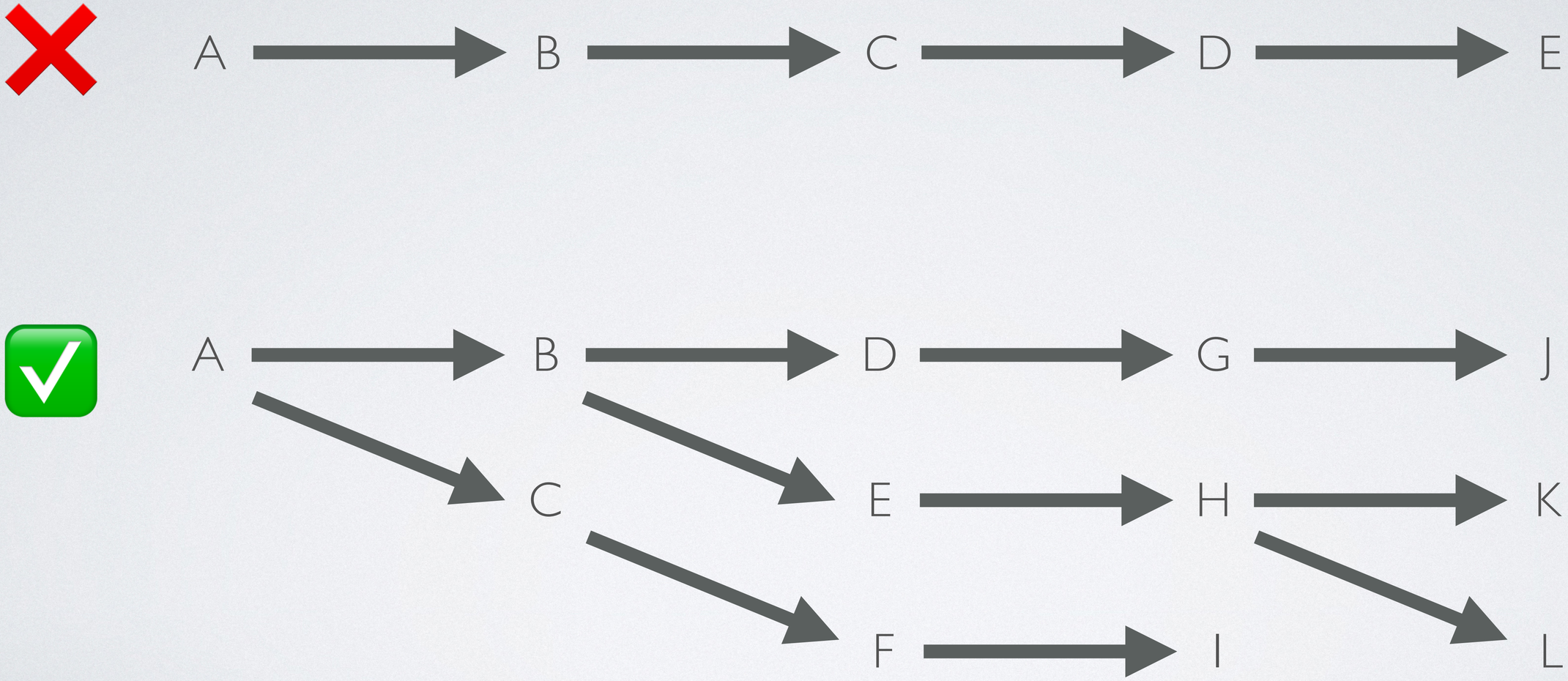
# Y U NO USE JAVASCRIPT

# PHP DEV

# Y U NO USE PHP



# Finding the good use case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